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INVESTIGATING MULTI-AGE SCHOOL PROFESSIONAL LEARNING COMMUNITY, TEACHERS' PERCEPTIONS, AND CLASSROOM PRACTICES

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ABSTRACT

INVESTIGATING MULTI-AGE SCHOOL PROFESSIONAL LEARNING COMMUNITY, TEACHERS' PERCEPTIONS, AND CLASSROOM PRACTICES

Rong Hu

The research aimed to provide a complete understanding of characteristics, facilitators, and challenges in implementing professional learning communities in multi-age schools. This study utilized a mixed-methods multiple case study design. Participants in this study were teachers from two private K-8 multi-age schools. The characteristics of professional learning communities and their influence on school quality and student performance were identified. Results confirmed that experiences in professional learning communities increased teacher involvement in all six domains, especially in collective responsibility, reflective dialogue, and peer collaboration. Results indicated that professional learning communities explained significant variance in teacher-perceived school quality measured by academic expectations, communication, and engagement. The sustainability of a successful professional learning community is vital to school quality. The insight gained from this study revealed several factors that enhance the development of professional learning communities in multi-age schools. The first theme, school structural conditions, included subcategories such as time, space, technology and instructional materials, communication systems, district support, and school size as facilitators of professional learning communities in multi-age schools. The second theme, school human and social resources included parental involvement and support, openness to innovation/improvement, professional development, and supportive and caring

relationships between students and teachers. The third theme was shared and supportive leadership which included roles of principal and teacher leader role. Results from this study demonstrated that lack of time, technology, supplies, instructional materials, and parent support were the top challenges in teaching and implementing professional learning communities in multi-age schools. This study offered suggestions for school leaders looking to make practical and authentic changes to improve professional development during school transformation.

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CHAPTER 1 INTRODUCTION

Multi-age classrooms have been discussed in the literature in many contexts (Aina, 2001; Cozza, 2017; Kasten & Lolli, 1998; Lolli, 1998; Stuart et al., 2007). In a multi-age classroom, students from two or more age groups are purposefully combined to form a learning community for students to learn and cooperate (Aina, 2001). Many researchers have investigated the effectiveness of multi-age programs (Hoffman, 2003; Pardini, 2005; Song et al., 2009; Veenman, 1996). In a multi-age class, students are taught and assessed according to their needs and developmental stages rather than their age or grade designation. Many terms refer to "multi-age classroom" education, including multi-age, multi-grade, and mixed-age classrooms. In this study, the term "multi-age" is used.

Multi-age teachers often use cooperative learning groups, peer tutoring, or peer assistance. It is important to know that multi-age instruction may not be suited for all teachers (J. L. Broome, 2009; Grant & Johnson, 1996; Kasten & Lolli, 1998). Teachers suited for multi-age classrooms typically philosophically advocate child-centered approaches to education, cooperative learning, and differentiated instruction (R. H. Anderson & Pavan, 1993; J. L. Broome, 2009; Kasten & Lolli, 1998). Research has shown that professional learning communities positively affect student academic achievement, teacher effectiveness, school culture, and leadership development (Skerrett & Williamson, 2015). However, multi-age schools face significant challenges in providing teachers with effective professional development, including the lack of resources and few qualified staff to support professional development efforts.

This study examined the development of Professional Learning Communities (PLCs) in multi-age schools. First, the characteristics of professional learning communities and their influence on school quality and student performance were identified. Then, teacher-perceived facilitators and challenges in implementing professional learning communities were explored. A mixed-methodology multiple case study (Al-Hamdan & Anthony, 2010; Creswell, 2012; Landau, 2014; Lomas, 2016) was used for this study.

This study has important implications for both researchers and practitioners. First, this study explored longitudinally what multi-age classroom teachers experienced as members of a professional learning community in a three-year Multi-Age Community (MAC) program. This study systematically evaluated how schools can benefit from implementing professional learning communities during the transformation to a multi-age classroom setting. Second, from a practice standpoint, this study is relevant to policymakers, district administrators, school leaders, and teachers. This study identified the characteristics of effective PLCs and suggested that PLC can influence school quality and student performance, especially with better peer collaboration and focus on student learning. Moreover, these findings can help school leaders to build more effective PLCs to help teachers to cope with the challenges they face in multi-age classrooms.

Statement of the Problem

Declining Enrollment and Multi-age Classrooms

From 2010 to 2020, New York's school enrollment in grades K to 12 decreased by 7% (Bauer, 2021). Two hundred fifty-eight districts in New York experienced an enrollment decline of 10% to 19.9%, and 81 school districts underwent declines of 20%

or even more (Bauer, 2021). The Ripley Central School District in Western New York State had more than 500 students in 1994 and only had 137 students in 2019, a percentage decrease of about 73% (Post-Standard, 2019). Students in Alabama schools decreased by more than 10,000 from 2019 to 2020 (Y. Lee, 2021).

About 75% of NYC public schools enrolled fewer students in 2022. According to a Chalkbeat analysis, overall enrollment in grades K-12 in New York City public schools dropped 5.6% (roughly 821,000 students) in 2022. Nearly 23% of schools saw 10% or more enrollment declines. New York City enrollment in grades K-8 fell 7% (Zimmerman & Wilburn, 2022).

From 2010 to 2020, 1,400 schools closed or consolidated (19.7%). Catholic school enrollment has declined by 21.3% since 2010 (National Catholic Educational Association, 2022). Averagely, 100 Catholic schools close or consolidate each year.

Some schools have adopted multi-age classrooms to deal with enrollment issues and use the advantages of multi-age classrooms to help students learn (Proehl et al., 2013). For example, Proehl et al. (2013) examined an urban Catholic school's transition to multi-age classrooms when it faced dropped student enrollment. Results showed that the transition did not significantly impact student learning, such as absences, tardiness, or academic performance. Social, emotional, and developmental benefits were perceived, such as fewer disciplinary incidents, more respect for their classmates, and more shared responsibility, and higher level of leadership.

COVID-19 Pandemic and Multi-age Education

The COVID-19 pandemic introduced new educational challenges for students, teachers, and parents (Maněnová et al., 2021). Fullan & Quinn (2020) stated that the

pandemic "*revealed the fault lines in traditional educational systems*." Azorín & Fullan (2022) suggested schools to "*define new models of education and develop collaborative learning cultures that prepare students from childhood to be supported by their peers, to solve problems together, and to network and exchange knowledge in an increasingly interconnected world."*

Multi-age classroom values children's emotional and social development. K. Harrison (2018) conducted a phenomenological study in three multi-age classrooms in a private suburban school. The study examined multi-age classrooms' affective, social, and pedagogical paradigms. Results revealed that multi-age classrooms had affective and social advantages.

Multi-age classroom encourages cooperation, promotes leadership and confidence, and creates caring learning communities for students. Multi-age classrooms provide the groundwork for a student's affective development, which then improves a student's moral autonomy and intellectual development. Multi-age classroom programs and successful practices can benefit students, schools, and parents (Powers et al., 2020) and play an important role in the post-pandemic period.

Rural Schools and Education Equality

A key barrier to rural schools is the lack of funding (Y. Lee, 2021). The Coronavirus Disease (COVID-19) Pandemic further exasperated funding issues as schools struggled with limited online learning technologies and coronavirus resources. Students in rural areas had to look for internet access or drive to school far from home (Y. Lee, 2021). Students' barriers to reliable learning decreased rural school enrollment. Rural enrollment decline is a worrisome tendency for people concerned about education

equality (Post-Standard, 2019). Multi-age education was adapted in some rural schools because "*it is an economical way to deliver education in less heavily populated areas*" (Blum & Diwan, 2007; Pardini, 2005; Smit et al., 2015).

School of Choice and Multi-age Classrooms

Multi-age classrooms exist in many school systems, including public schools (Ong et al., 2000; Spratt, 1986; Walsh, 1989), private schools (Cozza, 2017; Harrison, 2018; Many & Henderson, 2005; Somma, 2017; Zabolotney, 1983), charter schools (S. Miller, 2017), Montessori schools (Bagby et al., 2022; Davenport et al., 2019; Gentaz & Sylvie, 2022; Kazi et al., 2018; McDurham, 2011; Salazar, 2013), and other school forms (Maddocks et al., 2011; McDonald, 2022).

Multi-age classroom programs have been implemented to ease financial constraints and for educational and pedagogy purposes. The school reform of today focuses on schools of choice. Multi-age classrooms integrate the school-of-choice agenda by including individualized, personalized, and differentiated learning (Cozza, 2017). Multi-age classrooms target individual student need and prompt problem-solving, communication, and high-level thinking.

Professional Learning Communities for Teachers in Multi-age Schools

Many studies have been conducted to offer insight into the effectiveness of multi-age programs (Hoffman, 2003; Pardini, 2005; Song et al., 2009; Veenman, 1996). Multi-age classroom education is a possible strategy to deal with declining enrollment (Proehl et al., 2013; Saqlain, 2015; Veenman, 1995). It is cost effective and can help provide equitable education for schools especially small schools or schools in rural areas. Multi-

age classroom programs pay attention to students' emotion and social development and provide education in a caring community.

Although there are resources and training related to professional learning communities, it is not easy to find an effective implementation for multi-age schools. There is always a need to find methods to help teachers in multi-age schools (Cozza, 2017; Espinosa & Chen, 2001; Newman, 2019). Extensive continuous multi-age professional development is crucial for the success of multi-age classroom programs (Baukol, 2011; Graham, 1998; Gutiérrez et al., 2022; Penney, 2005).

Purpose of the Study

This study aims to explore the characteristics and development of successful professional learning communities in multi-age schools. Emphasis is placed on providing details of teachers' experiences and perceptions of transitioning into a multi-age classroom program with the development of a professional learning community.

First, this study examines characteristics of professional learning community practices in multi-age schools and their potential influence on school quality and student performance. Characteristics of professional learning communities, such as collective responsibility, peer collaboration, and focus on student learning, benefit teacher growth and student learning. However, little is known about specific characteristics of professional learning communities in multi-age school settings and the outcomes of such innovative environments. This research seeks to understand how teachers in multi-age school settings experience professional learning communities in becoming adept at teaching multi-age classes to address the gap in understanding PLCs' characteristics and outcomes in multi-age schools. Second, this study explores factors facilitating the

professional learning community in multi-age schools. Third, challenges in implementing professional learning communities in multi-age schools are investigated.

Theoretical/Conceptual Framework

A theoretical framework guides a study by describing the main concepts, ideas, and beliefs. The theoretical framework that guided this research includes the Multi-Age Community (MAC) and professional learning communities (Figure 1).

Figure 1

Theoretical Framework

Multi-Age Community (MAC)

Multi-Age Community (MAC) is a professional learning community framework that integrates students, teachers, educational leaders, and strategies for effective teaching and learning in multi-age classrooms (Cozza, 2017). MAC focuses on important organizing, culture-building, learning, and assessment elements. MAC integrates strategies including modeling, sharing ideas, observing, and reflecting on practices to ensure teacher improvement and student learning.

MAC aims to "*target individual needs, develop problem solvers, communicators, and high-level thinkers"* (Cozza, 2017). Effective instructional practices are embedded in MAC, including differentiated instruction, interdisciplinary studies, fluid grouping, project-based learning, learning centers, personalized learning, blended learning, and formative assessment strategies.

Professional Learning Communities

Teachers are important change agents and sources of innovation (K. D. Anderson, 2004; C. Brown et al., 2021; Nguyen et al., 2019). Providing a supportive and engaging environment is critical for teachers to transition into education reforms successfully.

A professional learning community refers to a "*community of instructional practice*" (Dufour et al., 2006; Supovitz, 2002). This study utilized the PLC framework of Landau (2014) to provide structures for data analysis process. This study's framework of professional learning communities consists of six operational characteristics: collective responsibility, reflective dialogue, deprivatized practice, shared sense of purpose, peer collaboration, and focus on student learning (Landau, 2014).

Significance of the Study

The PLC literature has largely considered characteristics, models, factors, and outcomes in traditional school settings. This study contributed to this literature by enriching the current knowledge of professional learning communities in innovative multi-age school settings. This study examined the characteristics of professional learning communities in multi-age school settings. In addition to collecting and analyzing data regarding successful professional learning community implementation and characteristics, this study also described structures and resources that yield effective

professional learning communities in hopes that these could be replicated in other multi-age schools.

Much of the extant research has inquired into teachers' experiences of a single semester in a professional learning community. This study explored longitudinally how multi-age classroom teachers experienced and achieved in a three-year Multi-Age Community (MAC) program.

From a practice standpoint, this study is relevant and timely for policymakers, district administrators, school leaders, and teachers in multi-age schools. This study provided examples of effective PLCs influencing school quality and student academic achievements. This study also discussed PLC practices in multi-age schools, which can help school leaders build more effective PLCs to help teachers cope with their challenges in multi-age classrooms.

The study is significant in enriching and broadening the current research on professional learning communities, providing examples of professional learning communities in multi-age schools, and developing recommendations for practices and successful implementations. The contributions of this study are of interest to scholars in professional learning communities as well as to administrators, school leaders, and teachers in multi-age schools. The findings of this study can better inform educational leaders on how best to implement and support effective PLC practices focusing on teacher growth and student learning in multi-age schools.

Connection with Social Justice and Vincentian Mission in Education

This research is related to the Mission of St. John's University in the following ways:

- This research helps to provide equal learning opportunities for students in rural areas. Due to the limitations of the economy, many rural schools are combined or closed. Some schools choose multi-age classroom models to provide meaningful education to students.
- This research brings more social justice to the area of education. Instructions in multi-age classrooms value every student's learning, including those who might be quicker or slower in their age group. All the students have opportunities to learn at their own pace regardless of the limitation of age groups. This research helps students learn by helping teachers in professional learning communities in multi-age schools.
- This research provides strategies and examples on flexible and beneficial choice for educational system improvement for diverse learners. We are facing an ear full of diversity. Traditional one-fits-all graded classrooms are facing many challenges. One of the things that we learned from the pandemic is that we need to build resilient learning systems. Practices and successful implementations of professional learning communities can help teach diverse students.
- This research sheds light on the practice of PLCs and teacher professional development in multi-age schools, which is of interest to policymakers and educators worldwide.

Research Design and Research Questions

A mixed methods design multiple case study is chosen for this study. The mixed methods approach is selected because quantitative and qualitative research approaches

can provide a deeper and richer understanding (Al-Hamdan & Anthony, 2010; Creswell, 2012; Venkatesh et al., 2013). The mixed methods multiple case study uses qualitative data to provide further and detailed information to support, clarify, explain, and extend the results from the quantitative data.

The participants of this study included teachers from two K-8 multi-age schools. These two schools participated in MAC and implemented professional learning communities to improve their multi-age classroom programs.

The following six research questions form the basis of this study:

Question 1. What are the characteristics of professional learning communities in multi-age schools?

Question 2. How does the existence of a professional community impact school quality?

Question 3. How do multi-age classrooms and professional learning community impact students' achievement?

Question 4. What is the evidence for the professional learning community in multi-age schools?

Question 5. What do teachers perceive as facilitators of the professional learning community in multi-age schools?

Question 6. What challenges do teachers have in implementing a professional learning community in multi-age schools?

Hypothesis 1. There will be no significant change in six characteristics, including collective responsibility, reflective dialogue, deprivatized practice, shared sense of

purpose, peer collaboration, and focus on student learning after implementing a professional learning community.

Hypothesis 2. Characteristics of professional learning communities will not significantly account for the variance in school quality.

Definition of Terms

The following terms are used in this study:

Multi-age Classroom

Multi-age classroom is a classroom setting in which students from more than one age group are combined in the same classroom is called a multi-age classroom (Mason & Burns, 1997).

Professional Learning Community

Professional Learning Community (PLC) is a collaborative approach to professional development in which educators meet regularly, share expertise from their teaching experiences, and work collaboratively in problem-solving to improve teaching and increase student performance (Dufour et al., 2006; Lomos et al., 2011).

Multi-Age Community

Multi-Age Community (MAC) is a multi-age community where educational leaders and teachers collaborate on planning lessons, developing assessments, and designing curricula to improve student learning in multi-age classrooms (Cozza, 2017).

Collective Responsibility

Collective Responsibility refers to teachers' willingness to take responsibility for student learning and school improvement (V. E. Lee & Smith, 1996a).

Reflective Dialogue

Reflective Dialogue refers to the conversations that teachers have with colleagues on instructional practice, pedagogy, and student learning (M. Lee & Louis, 2019; Lomos et al., 2011; Louis & Kruse, 1995; Louis & Marks, 1998).

Deprivatized Practice

Deprivatized Practice refers to the frequency with which teachers openly engage in their practice and support one another and the frequency teachers observe peer's teaching and give meaningful feedback (M. Lee & Louis, 2019; Louis & Marks, 1998).

Shared Sense of Purpose

Shared Sense of Purpose is a consensus among teachers and administrators about school mission, goals, values, and discipline policy (Louis & Marks, 1998).

Peer Collaboration

Peer Collaboration refers to activities that teachers work collaboratively to design instructional programs and improve their school for student learning (Lomos et al., 2011).

Focus on Student Learning

Focus on Student Learning refers to that teachers share beliefs and values that all students can be academically successful, and the whole school should focus on student learning and provide supportive learning environments that address student academic performance (Bryk et al., 1997; Louis & Kruse, 1995; Louis & Marks, 1998).

Teacher Leaders

Teacher Leaders are teachers who "*lead within and beyond the classroom, identify with and contribute to a community of teacher learners and leaders, and influence others towards improved educational practice; and accept responsibility for achieving the outcomes of that leadership*" (Katzenmeyer & Moller, 2009).

CHAPTER 2 REVIEW OF RELATED RESEARCH

Introduction

The purpose of this study is to explore, analyze, and describe the characteristics of PLCs and the impact of PLCs on school quality and student performance during schools' transitioning from a single-grade classroom to a multi-age classroom setting. Emphasis is placed on providing details of teachers' perceptions of transitioning into a multi-age classroom design with the development of a professional learning community. This chapter provides a review of the literature relating to multi-age classrooms and professional learning community.

Theoretical Framework

Two theoretical frameworks guided this research, including the Multi-Age Community (MAC) and Professional Learning Community (PLC), as shown in Table 1.

Table 1

Themes in Theoretical Framework

MAC Practices	***Professional Learning Community***
Building a caring learning community	Collective responsibility
	Reflective dialogue
	Deprivatized practice
Multi-age organizational practice	Shared sense of purpose
Collaborative inquiry	Peer collaboration
Multi-age classroom instructional components and strategies	Focus on student learning
Multi-age classroom assessments	
Experiences in multi-age classrooms	Facilitators of PLCs
Challenges in multi-age classrooms	Challenges to PLCs

This chapter examines the literature on multi-age classrooms and then move to professional learning communities.

Literature Review on Multi-age Classrooms

The dominant classroom structure in schools in the United States is a single-grade classroom. However, unlike the single-grade classroom, a multi-age classroom contains students from two or more age groups or grade levels to form learning communities for students to learn and cooperate (Mariano & Kirby, 2009).

The educational purpose of multi-age schools is child-centered education, focusing on a developmentally appropriate practice in a more caring and natural learning environment (Grant et al., 1996; B. A. Miller, 2001). In multi-age classrooms, students are taught in a mixed-age group as a whole class highlighting individual learning through a developmentally appropriate curriculum (Lloyd, 1999). Students in multi-age classes are kept with the same teacher for two or more years.

Multi-age classes are generally formed for educational or pedagogy purposes or administrative and economic reasons. A multi-age classroom differs from a combination or split-grade classroom, usually created because of a decline in enrollment and the need to cut down the staff (Grant, 1996). Multi-age classrooms may not be suited for all teachers (Grant & Johnson, 1996; Kasten & Lolli, 1998). Teachers competent for multi-age classrooms usually philosophically endorse child-centered education, cooperative learning, and differentiated instruction (R. H. Anderson & Pavan, 1993; Kasten & Lolli, 1998).

Patterns of Empirical Research on Multi-age Classrooms

Since the early 1990s, scholarly interest in multi-age classrooms has increased. Systematic Quantitative Literature Review (SQLR) methodology (Nguyen et al., 2019; Pickering & Byrne, 2013; Ronksley-Pavia et al., 2019) is used to explore patterns in

multi-age classrooms literature. This review of the literature on multi-age classrooms conducted a review process used by Nguyen et al. (2019).

In order to review the literature on multi-age classrooms, searches were conducted across five popular databases: *ProQuest*, *EBSCOhost*, *ERIC*, *JSTOR*, and *ScienceDirect*. The inclusion criteria are that the articles must have been published within the past 27 years (1995-2021), and qualitative, quantitative, or mixed methods were used (Ronksley-Pavia et al., 2019).

Keywords entered in the search databases were "multi-age," "multiage," "multi-grade," and "multigrade." The time frame was set from January 1995 to December 2021. First, the titles and abstracts were skimmed. Next, publications that were not relevant were removed. This preliminary search uncovered 316 articles that were downloaded for reading. Then the full texts of all 316 articles were scanned to examine whether these publications fit to multi-age education. Finally, 95 articles were reviewed.

Sixty-three articles (66.32%) used a qualitative method, 16 articles (16.84%) employed a quantitative method, and 16 articles (16.84%) used mixed methods research design. Only a minimal increase in quantitative research was seen across the three review periods. However, there was a big increase in the number and the portion of mixed-methods design studies across three review periods, especially in the third period (2013-2021). Although the number of studies using quantitative and mixed methods has increased during the review period (1992-2012), qualitative research remains the most popular method in multi-age education (66.32% of the publications).

There are 39 articles (41%) about multi-age classrooms in Northern America (mostly the USA), followed by Africa, Asia, and Europe. The number of research articles

about multi-age classrooms in Africa is 12 (12.6%). A group of 18 (18.9%) and 14 (14.7%) were about multi-age classrooms in Asia and Europe, respectively. There is a sharp increase in Africa, Asia, and Europe, especially in Africa. The phenomena showed an increasing interest in multi-age classroom programs in schools from these three areas. Conversely, there is a decrease in research articles on multi-age education in Northern America. Most research articles about Northern America's multi-age education were done in the first period (1995–2003) since there was a peak in Northern America in the 1990s (Pardini, 2005). Multi-age classroom programs peaked in 1990 since Kentucky, Mississippi, and Oregon mandated multi-age classrooms at their primary schools (Gutloff, 1995). Kentucky mandated multi-age classroom programs in elementary schools and issued the Education Reform Act in 1990 to deal with failing school systems (Pardini, 2005). In 1995, the Michigan Department of Education reported that one in five districts in Michigan implemented multi-age classrooms (Song et al., 2009). More than 50% of the districts started or continually developed their multi-age programs in 1998 (Fox, 1998). However, in 2000, the Michigan Department of Education stopped advocating for multi-age programs. A reason for discontinuing multi-age programs was the argument that they were incompatible with grade-level curricula and annual standardized testing (Song et al., 2009). In the past decade, some schools have closed their multi-age classrooms "*due to the grade-level standards and testing requirements imposed by the No Child Left Behind Act and most states' accountability laws*" (Song et al., 2009). Although the number of multi-age schools has reduced, many educators still value the multi-age philosophy and its benefits for students. Song et al. (2009) suggested

that multi-age programs can be a viable alternative for underserved or low-performance students.

The implication of the region pattern showed that there is more and more interest in multi-age schools worldwide. Although the interest in multi-age programs decreased in Northern America, there is still an undiminished interest worldwide.

Advantages of Multi-age Classrooms

Research has shown that students benefit academically, emotionally, and socially in a multi-age classroom (Aina, 2001; Heins et al., 2000; Ong et al., 2000). Pratt (1986) reported that multi-age classrooms provided students with socially and psychologically healthy learning environments.

Aina (2001) conducted a qualitative study to identify teacher, student, and parent perceptions about a multi-age program. Aina (2001) reported that in multi-age classrooms, students could progress at their own pace, students feel less competitive than their peers in traditional single-grade classrooms, and students have more caring relationships with other classmates and the teacher.

McClellan & Kinsey (1997) explored the social and cognitive effects of students in multi-age versus single-age classrooms. The investigation used a teacher rating scale to measure students' social behavior in multi-age and single-age classrooms. Findings suggested that students in multi-age classrooms were rated significantly less aggressive and more prosocial than students in single-age classrooms. In addition, follow-up ratings showed significant positive social and cognitive effects were kept for students who participated in multi-age classrooms and then enrolled in single-age classrooms.

Ronksley-Pavia et al. (2019) conducted a systematic quantitative literature review of empirical studies on multi-age education in small school settings. Thirty-four articles published between 1997 and 2017 were examined. Curriculum and teaching practices were explored to identify the main advantages and disadvantages of multi-age classroom programs in small schools. First, the difference between multi-grade classes and multi-age classes was discussed. Then, curriculum approaches were described, including prescribed, parallel, spiral, outcomes-based, integrated, and other curriculums. Finally, pedagogical practices and roles of teachers were discussed. Ronksley-Pavia et al. (2019) suggested that there was general agreement that students in multi-age classrooms benefit more on social and emotional development than their peers in traditional single-grade classrooms; however, there was no general agreement about the benefits of students' academic progress which appears to be related to the quality of teaching.

Multi-age classrooms benefit both older children and younger children. In a multi-age classroom, younger children have more opportunities to participate and contribute to more challenging learning tasks and activities. Older children have more opportunities to practice leadership and self-regulatory behavior. There is more social responsibility and sensitivity to others in multi-age groups than single-age groups (Chase & Doan, 1994). Katz (1995) discussed the benefits of the mixed-age grouping, which include the opportunity to nurture, ways of learning, social participation, and intellectual benefits. Katz found that younger children had expectations of "*instructive, leadership, helpful, and sympathizing*" roles for older children, and older children had "*the need for help and instruction expectations*" for younger children. Results showed that in a mixed-age group, older children "*spontaneously facilitated other children's behavior*" (Katz, 1995).

However, in a single-age group, more bullying behavior was reported (Katz, 1995). Katz (1995) also showed that older children's self-regulatory behavior improved when they were asked to remind younger ones of class rules.

Research showed that multi-age classrooms benefit students in their academic performance. Ong et al. (2000) compared students' reading, writing, and mathematics achievement in comparable multi-age and single-age classrooms in three districts. Ong et al. (2000) showed that Non-Title I students in multi-age classrooms were achieving more highly than non-Title I students in single-age classrooms, but no evidence of benefits showed for Title I students and other traditionally lower-achieving students.

Paven (1992) reviewed 64 research studies on multi-age schools between 1968 and 1990 and reported that 58% of the students in multi-age classrooms achieve higher academic performance than their peers in single-grade classrooms. In addition, 33% achieved similarly to their peers, and only 9% performed worse. Pavan (1992) noted that underachieving students benefited from learning in multi-age classrooms. Pavan (1992) also reported that students in multi-age classrooms were more likely "*to have positive self-concepts, high self-esteem, and good attitudes toward school*."

Veenman (1995) found that students in multi-age classrooms did not learn more or less than students in single-age classrooms, but students in multi-age classrooms scored higher on attitudes towards school, personal adjustment, and self-concept than students in single-age classrooms. Veenman (1996) listed several explanations for the conclusion that there is no difference in student performance between multi-age and single-grade classes.

Disadvantages of Multi-age Classrooms

Multi-age education has existed for a long time. It has a peak interest in the USA in the 1990s. Many schools implemented multi-age classroom programs. However, conclusions about the benefits of multi-age classrooms are mixed. Some research showed that multi-age education benefited students in academic, social, and mental areas. On the other hand, some researchers believed that multi-age classrooms were good for social and mental development but not for students' academic progress. Some researchers suggested that mixed results, especially the academic benefits of multi-age education, were caused by the specific implementation of multi-age classrooms.

Mason & Burns (1996) argued that multi-age classes had a small negative influence on students' performance and potentially negatively impacted teacher motivations. Veenman (1996) replied to the finding of Mason & Burns (1996) and found little evidence for the assumption that the teaching quality in multi-age classrooms was lower than in single-grade classes. Slaton et al. (1997) suggested that the forced assignments for teachers and students in multi-age classrooms might negatively affect academics.

Lloyd (1999) believed that the lack of a unanimous way of groupings in multi-age classrooms could cause difficulties for a researcher to compare the academic impact of multi-age programs. Mariano & Kirby (2009) believed that inconsistent definitions of different types of multi-age groupings primarily cause mixed results on the effects of multi-age classes. Song et al. (2009) suggested that high-quality research on the effects of multi-age classroom programs was "*needed via a randomized control trial or a quasi-*

experimental study to validate the existing body of research" about academic performance.

Practices and Beliefs

Hoffman (2003) conducted a case study to examine the instructional and organizational practices in multi-age classrooms. Four multi-age classroom teachers participated in his research. Interviews and classroom observations were collected. Four beliefs were revealed: differentiated instruction, social collaboration, flexible grouping, and student interest. Team teaching and the role of the teacher as a facilitator also surfaced in the data.

Song et al. (2009) suggested that parent education and teacher preparation were important for multi-age schools. Effective multi-age schools usually plan, inform parents, prepare teachers, and offer extensive, ongoing professional development for teachers. Song et al. (2009) found that parents who preferred to have their children learn in multi-age classrooms were parents who were involved more in school life.

Naparan & Alinsug (2021) examined the classroom strategies of ten multi-age teachers from six multi-age schools in the Philippines. Data was collected through semi-structured one-on-one interviews. The results revealed good multi-age classroom strategies, including classroom management, collaborative learning, differentiated instruction, teaching to real-life situations, technology use, and the teacher's flexibility.

Collie et al. (2015) reported their findings in multi-age classrooms in Palisades School District, a public school district in Pennsylvania, United States. The findings were based on five years (2009 through 2014). Parent perceptions, teacher perceptions, and student perceptions were collected and analyzed.

First, parent perceptions were collected. Sixty-nine respondents were received from an online parent survey. Among the 40 parents who had a child in a multi-age classroom, 43% reported a positive attitude toward school. However, 33% of parents were concerned that coursework was too easy in the second year. 27.5% of parents felt the multi-age classroom program did not work. The parents addressed the importance of being allowed to choose between traditional or multi-age classrooms. Only 38% of the parents felt they received appropriate information from the school about the multi-age classroom program.

Second, perceptions about the multi-age classroom program were also collected from six teachers. All teachers stated it was "*difficult to have flexible groups between grade levels due to the curriculum, assessment schedule, and standards-based report cards*" (Collie et al., 2015). In addition, all teachers reported that it would be impossible to finish teaching in a multi-age classroom without the help of a teaching assistant. On the other hand, teachers reported the success of the multi-age classroom program as a family atmosphere and the ability of students to take on leadership roles. Half teachers felt that the multi-age classroom program was well accepted. However, teachers felt overwhelmed because of the following reasons:

- lack of interaction between younger and older students
- time constraints for collaboration and planning
- difficulty in creating meaningful center work
- difficult in classroom management because of noise and distractions
- difficulty in managing two testing schedules

Third, student perceptions were collected. Thirty-three students who had multi-age classroom experience were interviewed. Twenty-two students reported a positive student/teacher relationship. Thirteen reported more positive attitudes toward the school than in a traditional classroom. Nineteen students felt no drawback in achievement. Thirty students would like to recommend a multi-age classroom to a younger sibling because of more individualized learning and more opportunity to learn from other students and get help (Collie et al., 2015).

Bailey et al. (2016) explored parents' and teachers' perceptions during transitioning to a multi-age classroom setting in two elementary schools. Parent support of the multi-age program was found, while teachers were significantly more neutral than the parents on issues including family-school relationships, class size stability, teacher assignment stability, and students' ability in the multi-age classroom.

Factors in Implementing Multi-age Classroom Programs

In order to make multi-age classroom programs more effective, there are a few factors that need to be considered.

Miller (1991) reviewed studies of multi-grade classrooms in Canada, Finland, the U.S.A., and eight developing countries. Miller (1991) listed six key factors affecting successful teaching in multi-age education: classroom organization, class management, instructional organization, curriculum, instructional delivery and grouping, self-directed learning, and peer tutoring. Miller (2001) suggested leadership, strong teacher commitment to student learning, and parent support were prerequisites for successful multi-age classroom programs.

Heins et al. (2000) summarized the factors as the following: the use of the process approach to learning; teacher as facilitator; learning activities such as project-based learning and interdisciplinary instruction; learning environment to encourage active, hands-on experience; cooperative learning and peer tutoring; flexible grouping; and adequate planning.

Aina (2001) pointed out some concerns about multi-age classrooms, such as parents' and communities' lack of adequate information and understanding of the multi-age classroom program, teachers' lack of adequate training, and the need for more preparation time and materials.

Espinosa and Chen (2001) conducted a longitudinal study about technology and multi-age classroom using mixed methods. Twenty-three classroom teachers from K-5 grades participated in the study. Data was collected from classroom observations, interviews, surveys, and journals. Results showed that after two years, 100% of the teachers had positive feelings about multi-age education. However, by the end of year three, 22% of the teachers expressed negative feelings and concerns when they dealt with students with different and broader developmental levels. Espinosa and Chen (2001) suggested continuous support and practical assistance for teachers.

Saqlain (2015) pointed out several challenges for multi-age teachers, including inadequate training, lack of time for teaching and planning, prescribed curriculum and assessment, social and cultural isolation, lack of community understanding, and rural school settings with inadequate resources. Saqlain (2015) suggested that proper professional development training, learning material, and community support could address some of these challenges.

Vithanapathirana (2006) pointed out the importance of curriculum adaptation for multi-age education based on an action research project with teachers in multi-age schools in rural areas in Sri Lanka. Vithanapathirana (2006) suggested the organization of content across grades, implementation of a competency-based curriculum, and informal assessment methods. Pridmore (2007) suggested that teachers, especially in many developing countries, need more support adapting curricula for multi-age programs. A five-step process for curriculum planners was presented.

Literature Review on Professional Learning Communities

A Professional Learning Community is a process in which educators meet regularly, share ideas, and work collaboratively to improve teaching practice and student performance (DuFour et al., 2010; Lomos et al., 2011).

PLC Characteristics

Although little is known about the characteristics of professional learning communities in multi-age schools, there is a growing consensus in the literature of features that are necessary for effective professional learning communities (Hipp & Huffman, 2003; Hord, 2008; Hord & Sommers, 2007; Leithwood et al., 2006; Stoll et al., 2006).

Several studies identify critical elements of PLCs (Bryk et al., 1999; Kruse, 2001; Kruse & Louis, 1995; V. E. Lee & Smith, 1996b; Louis et al., 1996; Louis & Marks, 1998). Kruse and Louis (1995) described five critical elements of a strong professional learning community, including a) reflective dialogue; b) deprivatization of practice; c) collective focus on student learning; d) collaboration; and e) shared norms and values. Some researchers have included other elements. For example, Lee and Smith (1996b)

conceptualize PLCs as collective responsibility, cooperation, and control over classroom and school conditions. The Professional Community Index (Louis & Marks, 1998) measures a professional learning community as a sum of five components: (a) shared sense of purpose; (b) collaborative activity; (c) collective focus on student learning; (d) deprivatized practice; and, (e) reflective dialogue. Bryk et al. (1999) proposed six components of PLCs, including (a) reflective dialogue, (b) deprivatized practice, (c) staff collaboration, (d) focus on student learning, (e) collective responsibility for school operations and improvement, and (f) teacher socialization. Leithwood et al. (2006) summarized five variables and indicators that led to an effective professional learning community: (a) shared sense of purpose; (b) collaborative activity; (c) collective focus on student learning; (d) deprivatized practice; and (e) reflective dialogue. Stoll et al. (2006) gave a comprehensive literature review on the professional learning community and listed five key characteristics of PLC, which included: (a) shared values and vision; (b) collective responsibility; (c) reflective professional inquiry; (d) collaboration; and (e) group and individual learning. Dufour et al. (2008) outlined six essential elements of a successful PLC, which include (a) shared mission, vision, values, and goals; (b) collaborative teams focused on learning; (c) collective inquiry into best practices and current reality; (d) action orientation and experimentation; (e) commitment to continuous improvement; and, (f) results orientation. Hord (2009) described a professional learning community as consisting of six dimensions that include (a) shared beliefs, values, and vision; (b) shared and supportive leadership; (c) supportive structural conditions, such as time, place, and resources; (d) supportive relational conditions, such as respect, caring, and trust; (e) collective intentional learning; and (f) peer shared personal practice.

Zhang and Pang (2016) conducted a mixed method in studying the characteristics of professional learning communities in Chinese schools. In Chinese schools, teacher collaboration has existed for decades in the form of Teaching Research Groups, Lesson Preparation Groups, and Grade Groups. Teachers in the same group share an office and are scheduled to have enough time to work together. Although there are similar features with PLCs in Western schools, Chinese educational systems and cultural factors influence specific characteristics and practices. A questionnaire survey with 59 items was administered to 175 teachers in seven diverse schools in Shanghai, followed by semi-structured interviews with 14 selected voluntary teachers. These schools included five elementary schools and two secondary schools with varied sizes. Some of the schools were in urban areas, and some of them were in rural areas. Qualitative data were coded to identify themes by two researchers coding separately and then to arrive at an agreement on the coding. Zhang and Pang (2016) found that PLCs in China have the characteristics of collaborative learning, professional competency, facilitative leadership, structural support, and cultural barriers. These five characteristics were explained by three factors: the school system, social culture, and teacher recognition. It is crucial to address the cultural barriers, and administrators should provide incentives to encourage different views of teachers. School structures should be optimized to give more power and responsibility to teachers. This mix-method research article shows how institutional and sociocultural factors can influence the practice of PLCs. This article relates to this research because it shows an example of how to use mixed methods to investigate the characteristics of PLCs.

Based on previous research, six effective PLC characteristics are used in this study (Landau, 2014): Collective Responsibility, Reflective Dialogue, Deprivatized Practice, Shared Sense of Purpose, Peer Collaboration, and Focus on Student Learning.

PLC Impact on Teacher Performance and Student Achievement

PLC has been implemented in many countries to improve teacher and student performance. Research in different educational contexts suggests that PLCs significantly contribute to school reforms, teachers' professional growth, and student achievements (Bloom, 2012; Landau, 2014; Zhang & Pang, 2016).

Bloom (2012) conducted a mixed-method study to explore social studies teachers' professional learning community experience in a middle school in Long Island, New York. Results showed that teachers' experience participating in the professional learning community positively affected their instructional and professional practices.

Brown (2015) conducted a mixed-method study to examine the relationship between professional learning communities and teacher efficacy. Results indicated that PLCs significantly impact teachers' sense of efficacy. In addition, teachers perceived that teacher collaboration, building confidence, and student achievement contributed to their sense of efficacy.

Landau (2014) examined the characteristics of the professional community in New York City public schools and the impact of PLC on student performance and teacher practices using a mixed-method research design. Three hundred fifty-three participants from 60 NYC schools responded to the Teacher Community Survey. Descriptive statistics were used to examine the extent of the professional communities. Multiple bivariate correlations were used to determine the relationship between factors of PLC.

Multiple hierarchical regression analyses were conducted to determine the impact of PLC on student performance. Qualitative data, including focus groups and observations, were collected from two schools to gain more explanations and perceptions of the PLC.

Landau (2014) found a relatively high level of professional learning community characteristics in five of six areas. Significant correlations among PLC characteristics were also identified. Deprivatized practice and a collective sense of responsibility significantly impacted student performance. The rationale for using the article is that it supports the research topic. Landau (2014) showed how PLC characteristics were examined and how PLC affected student performance. Furthermore, Landau (2014) showed how to use quantitative and qualitative data to gain insights into PLC and its impact. Although this research did not directly focus on multi-age schools, Landau (2014) provided thoughtful research in NYC public school settings.

Hawkins (2015) conducted a qualitative study to examine the effects of a professional learning community on collaboration to improve teaching in an elementary school in Georgia, U.S.A. Key findings showed that teachers perceived PLC as fundamental in professional development and organizational change (Hawkins, 2015).

Brereton (2018) conducted quantitative research to explore global trends in relationships between social capital and teacher self-efficacy in 31 countries (Australia, Finland, Denmark, Japan, Mexico, Sweden, and others). Results indicated a significant and positive relationship between PLCs and teacher self-efficacy. Furthermore, findings suggested that PLC may be a sustainable model to promote the collective capacity of teachers.

Stollar (2014) conducted mixed-method research in a Pennsylvania school district to examine teachers' experiences of PLC and the influence of PLC on teaching and learning. Results confirmed that teachers perceived PLCs to impact teaching effectiveness and student learning positively.

Terrell (2015) conducted a study to examine the influence of PLC on Grade 4 mathematics and language arts literacy achievement in an urban New Jersey district. Data was collected from 1,479 students. Results supported "*the benefit of PLCs as capacity-building, an efficacy-supporting structure that improves student achievement*."

Raue (2017) examined the influence of PLC on students' academic achievements in reading and mathematics. Results showed that PLC had a significantly positive effect on student performance.

Ruland (2015) used a qualitative case study to examine teachers' experience in PLCs. Results showed that institutional and cultural factors positively affect teacher collaboration in the professional learning community. PLC improved teacher support, teacher empowerment, teacher capacity, teacher self-efficacy, teacher support for students, and the relationships between teachers and students. Furthermore, the results confirmed the importance of administrative support and guidance to implement PLC successfully.

Facilitators and Barriers of PLCs

PLCs play an important role in improving teacher practices and student learning. Research suggests that PLCs require certain factors to ensure successful implementation, such as time, place, school structure, and trust (Ali, 2004; Howard, 2022; Louis et al., 1996; Louis & Marks, 1998). School level (elementary, middle, high), school social

organization, and school structural conditions may interfere with or facilitate the successful implementation of PLCs. School human and social resources may improve PLCs. Teachers' backgrounds (gender, years of experience, and positions) may also impact PLC development. This section examined facilitators of and barriers to effective PLCs.

Kruse and Louis (1993) attempted to blend the literature on professionalism with the literature on community and summarized that several school structural conditions and human and social resources were necessary to build successful professional communities. For example, structure conditions such as time, physical proximity, teacher empowerment and autonomy, communication, and interdependence among teachers (such as team teaching and integrated lesson study) influence the success or failure of PLCs. In addition, other human and social resources support or encumber PLCs, including openness to improvement, trust and respect, cognitive and skill base, supportive leadership, and socialization (Kruse & Louis, 1993).

Louis et al. (1996) concluded that structural conditions significantly affect PLCs, including staffing complexity, scheduled planning time, and teacher empowerment. However, a significant impact of school size on PLCs was not found. Furthermore, human and social resources (supportive principal, respect, openness to innovation, feedback from parents and colleagues, and focused professional development) greatly impacted the success or failure of a PLC. Louis et al. (1996) also found a difference in PLCs between school levels. Generally, elementary schools had a stronger PLC than secondary schools or high schools.

Louis and Marks (1998) conducted a mixed-method study to examine the impact of the professional learning community on student performance. In addition, the relationship of PLC to the social and technical organization of the classroom was also evaluated. Results showed that both PLC and social support positively correlated with student performance. Louis and Marks (1998) also found PLC to be the most characteristic in elementary schools and less characteristic in high schools.

Crow and Pounder (2000) studied interdisciplinary teacher teams in a middle school. Results showed that several factors seemed critical for PLCs, including organizational context (time, principal, supportive leadership), design features (size, team structure, autonomy, member expertise), and interpersonal processes.

Howard (2022) conducted an explanatory sequential mixed-method study to examine the relationship between school type and supportive conditions-structural. Facilitators and barriers to PLCs were also examined. Results indicated three themes and six subthemes as facilitators of PLCs, including supportive conditions-structural (collaborative space, proximity to colleagues, collaboration structures, collaboration via technology); shared personal practice (observe and mentor colleagues); collective learning and application (study and work collaboratively). In addition, two themes were identified as barriers to the professional learning community, including supportive conditions-structural (the layout of the building) and supportive conditions-relational (teacher buy-in and different team members to a grade level each year).

Ali (2004) conducted multi-site case studies to explore the motivational factors of teachers engaging in professional development and important organizational and structural features of professional development. Twenty-nine teachers (including multi-

age classroom teachers and single-grade teachers), three principals, and one director of instruction in three different school settings (rural, suburban, and urban) participated in the study. Results indicated that teachers engaged in professional learning due to intrinsic motivation (pedagogical knowledge, technology skills, classroom management, content knowledge, and personal interest) and extrinsic motivation (salary advancement, licensure requirements, school reform, and school improvement professional development). Results also suggested that teachers preferred workshops and peer-staff development as a professional development format instead of conferences or presentations because active learning and peer engagement were preferred.

Gray et al. (2014) studied the impact of school structures, collegial trust, trust in principal, and collective efficacy in professional learning communities. Data were collected from 1,713 teachers from 67 schools in a large southeastern school district in the USA. The results of bivariate correlation analysis showed that PLC development was positively correlated with enabling school structure, collective efficacy, and trust in colleagues. PLC was negatively correlated with school level, indicating that PLC development was higher in elementary schools. The results of hierarchical regression analysis showed that the structural factor has more effect than the relational factor.

Gray et al. (2014) showed how organizational and relational factors could affect the development of professional learning communities. The authors suggested that school leaders could provide leadership opportunities and shared decision-making to support PLC development. This article relates to this research because it provides a specific example of how to study correlations and regression relationships for PLCs.

Owen (2014) provides insight from three schools in Australia. This article examines the characteristics and developmental stages of PLC establishment in innovative schools. Owen (2014) aimed to answer two questions: How were PLC characteristics evident in the development of PLC in innovative school contexts, and what were the learning impacts? This research used a case study approach with three schools. Data sources include school documentation, interviews, and focus groups. Fifty-eight teachers in elementary and secondary schools responded to a PLC survey. The PLC survey included 15 items on PLC characteristics such as shared vision, collaboration, data focus, leadership, reflective dialogue, and collective focus on student learning. Ten semi-structured interviews and two focus groups were employed. Data showed that PLC characteristics were evident in different developmental stages of PLC. The results showed that teacher learning is evidenced through PLC processes, including planning together and team teaching. Except for the pedagogical changes, there were more improvements, including higher student attendance and engagement. It also suggested that providing planning time would strengthen PLC development. The role of principal in building school culture and providing support for teachers was also highlighted. The rationale for selecting the article is that it supports the research topic. This article showed how PLCs were developed in innovative contexts, including organizational and pedagogical restructuring transformations. The article provided examples and evidence to help the development of PLC in innovative contexts.

Carpenter (2015) conducted a qualitative study at three secondary schools to identify the relationship between the supportive and shared leadership structure and school culture. Three administrators and 12 science teachers were selected. Data sources

included interviews, observations, archival records, and artifacts related to implementing professional community practice. Carpenter (2015) found that shared leadership is crucial to effective professional learning communities. Shared leadership provides the venue for shared values and vision and can further help with student growth and school improvement. Carpenter (2015) also confirmed the negative impact of the lack of shared leadership as a toxic culture which might exacerbate staff isolation and decrease teacher moral and job satisfaction. The findings from Carpenter (2015) suggested that school leaders must provide supportive and shared leadership to build effective professional learning communities. The reason for using the article is that it supports the research topic.

Ning et al. (2015) conducted a study in Singapore schools, including primary and secondary schools, to identify the relationship between team value orientations, team collegiality, and team collaboration. Ning et al. (2015) focused on effective collaborative practices within teacher-learning teams instead of the whole school or department PLCs. An online questionnaire survey was used with instructions and explanatory notes. Respondents were collected from 952 teachers in 207 learning teams from 95 schools. Results indicated that team collectivism had a positive impact on team collegiality. In addition, team collegiality was a positive predictor for team collaboration. Ning et al. (2015) showed that team collectivism positively and moderately affected team collegiality. Ning et al. (2015) provided a better understanding of improving team cultural capital to achieve better collaboration. This article supports the research topic and extends the understanding of PLCs by investigating effective factors with teacher-learning teams.

Raue (2017) spanned seven data collection periods between 1998 and 2007 in K-8 to explore factors that affect the impact of PLCs on student achievement. Raue (2017) stated, "*Barriers to teacher learning are barriers to student learning. One longstanding barrier is the physical and social isolation of teachers from their colleagues*". As a promising reform effort, PLCs emphasize the importance of collaborative culture, which breaks isolation.

Curtis (2017) conducted a comparative case study to examine the relational characteristics, facilitating factors, or barriers to shared personal practice within PLC in two Texas high schools. Results indicated that building strong relationships and emphasizing collective creativity were strong predictors of sharing personal practice. However, the results also suggested that "*the copious tasks of teaching and negative perceptions of being observed by colleagues hindered consistent sharing of personal practice.*"

Hollingsworth (2021) conducted a quantitative study on the impact of school level on professional learning communities in traditional public schools. Participants included K-12 schools in North Carolina. Results suggested that the PLC practices were perceived to be the same in different levels of schools.

School leadership has long been suggested as one of the critical factors for successful PLCs. Supportive leadership, especially the principal, is key to the success of a professional learning community (W. F. Smith & Andrews, 1989; Teague & Anfara, 2012). W. F. Smith and Andrews (1989) categorized the principal's roles into four dimensions: a resource provider, an instructional resource, a communicator, and a visible presence.

Hord and Hirsh (2009) emphasized approaches that principals used to facilitate strong PLCs. Duling (2012) conducted a multi-site case study to examine the most meaningful principal behaviors to support PLCs. Duling concluded that the principal's knowledge and involvement in curriculum, instruction, assessment, and organizational culture were important to support PLCs.

Younker (2021) conducted a qualitative case study to examine if school culture and professional relationships played a role in the sustainability of professional learning communities. Results indicated that school administrators "*supported teacher autonomy, promoted a collaborative culture, and held teachers accountable for mandated professional learning community participation*."

Méndez (2016) conducted an autoethnographic study to explore the relationship between the principal's leadership behaviors, vision, and systemic planning and the development of professional learning communities over four years of PLCs at an urban elementary school in New Jersey. Findings showed a strong relationship between principals' leadership practices and the development of professional learning communities.

Flowers (2019) conducted mixed-method research to examine the role of district leadership in implementing and developing professional learning communities. A school district of approximately 14,000 students and a high school of 2,219 students participated in the study. Results indicated leadership and culture were critical to school improvement and PLC development. Zende (2002) conducted a quantitative study to explore how science professional development impacts K-6 teacher growth and student learning outcomes. Two hundred-five teachers participated in the study. Twelve teachers (5.9%)

teach in multi-age classrooms. Results indicated that districts needed to "*continue to design teacher leadership situations that implement long-term professional development, build capacity for shared decision making, create a supportive environment for leaders, and incorporate assessments.*" Results also suggested that teachers could not support further curriculum improvement efforts without logistical and financial support. Principals needed to play a more active role in implementing the curriculum.

Teachers in rural schools face more barriers when participating in professional development, including "*isolation, funding issues, distance, and lack of temporary replacements*" (Baker, 2011). Technology methods can be used to help, such as online professional learning communities. The Rural School Educator Effectiveness Collaborative created two state-wide Online Professional Learning Communities for rural teachers. However, only 0.723% of the possible 1100 eligible educators chose to participate. Baker (2011) conducted a mixed-method study to examine why rural teachers chose not to join online PLCs. Results revealed three main barriers: incentives, convenience, skills, reluctance to share writing online, the lack of time, and convenient Internet access in rural areas.

PLCs in Multi-age Schools

Teachers in multi-age classrooms face many difficulties, such as classroom management, teaching students in different age groups together, difficulty in planning and execution, lack of cooperation, limited resources, increased workload, and lack of guidance (Kalender & Erdem, 2021). Although the challenges and difficulties that multi-age classroom teachers have, high-quality professional development opportunities are very few.

Effective implementation of a successful multi-age classroom program needs knowledge about child development, skills, attitudes, and an understanding of multi-age instruction strategies and integrated curriculum (Gaustad, 1992). Teachers in multi-age classrooms need professional knowledge to provide a quality education for the diverse range of students in their multi-age classrooms, such as "*the skills of learner grouping, organization and routines, curriculum mapping, differentiating the curriculum, multi-level assessment, planning, and time management*" (Taole, 2017). Extensive continuous multi-age professional development is crucial for the success of multi-age classroom programs (Baukol, 2011; Graham, 1998; Gutiérrez et al., 2022; Penney, 2005).

Collaborative action is essential to teachers' work in multi-age schools (Lakkala et al., 2021). Stein (1998) conducted a case study to explore the leadership strategies for developing effective professional learning communities in three elementary schools. One of the three schools created multi-age classrooms and prompted teachers to open up to sharing their practices as one way of deprivatized practice.

O'Reilly (2002) conducted an ethnographic study to explore the relationship between a group of teachers and a principal in a multi-age school and the individual and group conceptualizations of the professional school community over time. Results revealed that "*the conceptualizations of community existing among and between teachers and a principal, and the changes that can occur over time are both social and collaboratively created*."

J. Broome (2016) presented the results of a national survey collected from 223 arts teachers working in multi-age classrooms to identify their professional development needs. Results indicated that most participants preferred professional development

workshops "*related to organizational strategies, collaboration with colleagues, assessment, integrated curriculum, collaborative student work, research, and thematic instruction"* (J. Broome, 2016).

Durbin (2014) conducted a qualitative multiple-case study to explore pedagogies, practices, and attitudes among K-8 teachers on mobile technology. Six multi-age classroom teachers in a charter school located in Alaska participated in the study. Results showed that PLCs could be used to overcome challenges and support teachers using mobile technology. In addition, the setting, formats, and scheduling of professional learning communities were also revealed from the survey results.

Gallant (2009) conducted a qualitative study to explore the main issues kindergarten teachers face. 229 Michigan kindergarten teachers participated in the study, and 13% reported multi-age groupings that included kindergarten. Results revealed issues related to working conditions, including instructional time, class size, the need for additional adult support in the classroom, and the availability of materials. Results also indicated issues related to literacy instruction, including decreasing autonomy to make curricular decisions, tension caused by curricular change, readiness level of students, and the need for parental involvement. Teachers expressed a need for professional development in which "*they could spend time exclusively with other kindergarten teachers to share best instructional practices*," have group discussions and collaborate. Scates (2014) conducted action research to examine the usefulness of the Star Early Literacy (SEL) formative assessment. Results indicated that SEL positively impacted teaching and learning in multi-age classrooms. Results also revealed the need for professional development in using formative assessment in multi-age classrooms

Osborne (1996) conducted an ethnographic study to explore critical attributes, strategies, training, and obstacles while implementing multi-age classroom programs. Osborne (1996) also discussed the advantages and disadvantages of the program for both teachers and students. Results indicated that critical attributes of multi-age classroom programs included developmentally appropriate practices, continuous progress, authentic assessment, team teaching, and varied instructional strategies such as integrated thematic teaching and whole language.

Cozza's (2017) *The Multi-Age Learning Community in Action* presented a framework of PLC named MAC in multi-age schools and outlined specific methods and strategies for school leaders and teachers in building a multi-age model. Cozza (2017) also highlighted the role of principals and teacher leaders in building a successful professional learning community.

Greenway et al. (2013) conducted a qualitative study to examine special education teachers' perceptions of evidence-based practice and decision-making and factors (school policy, training, professional development, and others) that shape their interpretations and actions. The study included nine teachers from multi-age classrooms (K-2, 3-5 grade). Results indicated that teachers' decision-making was complex and affected by multiple factors, including organizational constraints, the value of research, and available tools and resources. Research also showed that team teaching was beneficial to teachers in multi-age classrooms.

Conclusion

Many studies have been conducted to offer insight into the effectiveness of multi-age programs (Hoffman, 2003; Pardini, 2005; Song et al., 2009; Veenman, 1996).

Extensive continuous multi-age professional development is crucial for the success of multi-age classroom programs (Baukol, 2011; Graham, 1998; Gutiérrez et al., 2022; Penney, 2005). PLCs significantly contribute to school reforms, teacher effectiveness, student achievements, school culture, and leadership development (Bloom, 2012; Brereton, 2018; Brown, 2015; Hawkins, 2015; Landau, 2014; Skerrett & Williamson, 2015). Several studies identify critical elements of PLCs (Bryk et al., 1999; Dufour, 2008; Hord, 2009; Kruse, 2001; Kruse & Louis, 1995; Landau, 2014; Lee & Smith, 1996b; Louis et al., 1996; Louis & Marks, 1998). In addition, PLCs require certain factors to ensure successful implementation, such as time, place, school structure, and trust (Ali, 2004; Gray et al., 2014; Howard, 2022; Louis et al., 1996; Louis & Marks, 1998; Owen, 2014).

CHAPTER 3 METHOD

Introduction

This mixed methods multiple case study examines the critical characteristics of a successful professional learning community, factors necessary for the successful implementation of the PLC, and challenges encountered during implementation in K-8 multi-age classrooms.

The study sought to answer the following six research questions:

Question 1. What are the characteristics of professional learning communities in multi-age schools?

Question 2. How does the existence of a professional community impact school quality?

Question 3. How do multi-age classrooms and professional learning community impact students' achievement?

Question 4. What is the evidence for the professional learning community in multi-age schools?

Question 5. What do teachers perceive as facilitators of the professional learning community in multi-age schools?

Question 6. What challenges do teachers have in implementing a professional learning community in multi-age schools?

Hypothesis 1. There will be no significant change in six characteristics, including collective responsibility, reflective dialogue, deprivatized practice, shared sense of purpose, peer collaboration, and focus on student learning after implementing a professional learning community.

Hypothesis 2. Characteristics of professional learning communities will not significantly account for the variance in school quality.

This study used quantitative and qualitative data from an established three-year grant project, Multi-Age Community (MAC) (Cozza, 2017). The MAC project was a research study designed to implement a multi-age professional learning community in schools in the Northeast of the United States and to improve educational programs for K-8 schools. The MAC project involved obtaining information from several quantitative and qualitative sources and using them to identify effective strategies for improving teaching and learning in multi-age classrooms. The researcher was enrolled in the program and collected the data with other researchers.

First, this chapter will outline the research design and rationale for the study. Second, the site and participants of the study will be described. Third, data collection and data analysis methods will be explained. Finally, the researcher role and research ethics will be addressed.

Research Design and Rationale

This study utilized a mixed-methods multiple case study design. The mixed method approach was chosen for this study to gain a deeper understanding of the characteristics of professional learning communities in multi-age schools, the impact of the development of professional learning communities on school quality and student learning, factors that facilitate the implementation of PLC, and challenges during the implementation of PLC.

A multiple case study design was used as the qualitative research method for this study. A case study is "*an in-depth exploration of a bounded system (e.g., activity, event,*

process, or individuals) based on extensive data collection" (Creswell, 2012, p. 465). This study qualifies as a multiple case study because it examined the PLCs in two multi-age schools.

Multiple quantitative and qualitative data sources were included and analyzed for the study. Surveys, student Terra Nova scores, professional learning community continuum rubrics, focus groups, teacher reflection journals, and PLC meeting agendas/minutes were included in the data collection. A rationale for this design is that "*one data collection form supplies strengths to offset the weaknesses of the other form and that a more complete understanding of a research problem results from collecting both quantitative and qualitative data*" (Creswell, 2012, p. 540). Qualitative data such as in-depth focus groups and journals strengthen quantitative data about teacher perceptions in implementing a professional learning community. The advantage of this design is that "*quantitative data provide for generalizability, whereas qualitative data offer information about the context or setting*" (Creswell, 2012, p. 542).

Quantitative data was collected through surveys to examine PLC characteristics and school quality. Survey research is "*procedures in quantitative research in which investigators administer a survey to a sample or to the entire population to describe the attitudes, opinions, behaviors, or characteristics of the population*" (Creswell, 2012, p. 376). The Multiage Professional Learning Community Survey (MPLCS) and the Professional Learning Community Continuum Rubric (PLCCR) were collected to evaluate PLC characteristics and development. The Teacher School Attitude Survey (TSAS) was used to examine teachers perceived school quality on academic expectations, communication, and engagement. Student Terra Nova scores were collected to examine

the impact of the multi-age classroom and professional learning community on students' achievement.

Table 2

Research Questions and Data Collection & Analysis Summary

Research Questions	***Data Collection***	***Data Analysis***
Question 1. What are the characteristics of professional learning communities in multi-age schools?	PLC rubric (Aug. 2013, June 2014, Aug. 2014, and Feb. 2015) PLC survey (Aug. 2013, June 2014, Aug. 2014, and Feb. 2015)	SPSS-Descriptive statistics One-Way ANOVA Welch's t-test
Question 2. How does the existence of a professional community impact school quality?	PLC survey (Aug. 2013, June 2014, Aug. 2014, and Feb. 2015) Teacher School Attitude Survey (Aug. 2013, June 2014, Aug. 2014, and Feb. 2015)	Pearson r Correlation analysis Regression analysis Path model
Question 3. How do multi-age classrooms and professional learning community impact students' achievement?	Students Terra Nova Reports on 3/11/2013, 3/10/2014, 03/07/2016	SPSS-Descriptive statistics
Question 4. What is the evidence for the professional learning community in multi-age schools?	Teacher School Attitude Survey Teacher Journals Focus Group. PLC Meeting Agenda/Minutes	Coding for Themes Triangulation of Data
Question 5. What do teachers perceive as facilitators of the professional learning community in multi-age schools?	Teacher School Attitude Survey Teacher Journals Focus Group PLC Meeting Agenda/Minutes	Coding for Themes Triangulation of Data
Question 6. What challenges do teachers have in implementing a professional learning community in multi-age schools?	Teacher School Attitude Survey Teacher Journals Focus Group PLC Meeting Agenda/Minutes	Coding for Themes Triangulation of Data

The Multiage Professional Learning Community Survey (MPLCS) (Cozza, 2017) and the Professional Learning Community Continuum Rubric (PLCCR) addressed research question one. The Multiage Professional Learning Community Survey and the Teacher School Attitude Survey (TSAS) addressed research question two. Terra Nova

Test Scores were used to evaluate student achievement to answer research question three. Finally, qualitative data such as journals and focus groups were used to gain teachers' perceptions of implementing and participating in PLCs to answer research questions four, five, and six.

Data from the Multiage Professional Learning Community Survey, the Professional Learning Community Continuum Rubric, and the Teacher School Attitude Survey were analyzed using descriptive statistics (Creswell, 2012). The Terra Nova Test Scores of students were also analyzed using descriptive statistics. A one-way analysis of variance (ANOVA) and Welch's ANOVA test were used to compare the PLC characteristics to analyze the impact of PLC in multi-age schools. Pearson *r* correlation and regression analysis were used to determine the impact of PLC on teacher-perceived school quality. Table 2 summarizes the research questions, data collection, and analysis methods.

Site and Population

Site Description

School A is a private PK-8 school in the Northeast of the United States. The demographics for School A consisted of 50% Hispanic and black students, 32% white students, 16% Asian or Pacific Islander students, and 2% other students. The school had 172 students in 2013, with a student-to-teacher ratio of 11:1.

School B is a private K-8 school in the Northeast of the United States. The demographics for School B consisted of 90% Hispanic and black students. The school had 137 students in 2013, with a student-to-teacher ratio of 13:1.

Population Description

The target population for this study was teachers in multi-age schools. In particular, this population included staff from Schools A and B. Purposeful sampling was used to choose the participants of this study. In purposeful sampling, "*researchers intentionally select individuals and sites to learn or understand the central phenomenon*" (Creswell, 2012, p. 206). School A and School B were multi-age schools in the Northeast of the United States. Sampling PLC participants at School A and School B provided an opportunity to explore the research questions of this study. Twenty-eight participants, 25 females and three males, from schools A and B, were chosen. Participants included pre-kindergarten through eighth-grade teachers.

Table 3

Demographic Information (N=28).

Demographic Variable	*Categories*	*Frequency*	*Percent*
School	School A	15	53.6%
	School B	13	46.4%
Position	Principal	2	7.1%
	Classroom Teacher	23	82.1%
	Other	3	10.7%
Gender	Male	3	10.7%
	Female	25	89.3%
Participation in Teaming/Collaborative efforts/Professional Learning Community	Yes	19	67.9%
	No	9	32.1%

The demographic data of participants was collected, including the following: position; grade(s) taught; years of experience in current school; years of experience in other schools; gender; participation in any teaming, collaborative efforts, and/or

professional learning communities; years of experience in any teaming, collaborative efforts, and/or professional learning communities. Twenty-three participants were classroom teachers, two were principals, and three were in other positions (see Table 3). The teachers indicated an average of 8.95 (SD=11.06) years of experience in their current school and 8.64 (SD=11.77) years teaching in other schools. In addition, 67.9 percent of the teachers indicated previous experience in a professional learning community. The average years involved in teaming / collaborative efforts / professional learning community is 4.77 (SD=7.60) (see Table 4).

Table 4

Experience Information (N=28).

Variable	*Range*	*Mean*	*SD*
Experience in School	0-41 years	8.95	11.06
Experience in Other Schools	0-47 years	8.64	11.77
Years involved in Teaming/Collaborative efforts/Professional Learning Community	0-35 years	4.77	7.60

Site Access

The Institutional Review Board (IRB) approval was obtained from St. John's University. IRB approval was obtained and updated for the three-year MAC project led by Dr. Cozza, which was started in August 2013. The researchers of MAC also sought permission to conduct the study in the district. In order to conduct a research study within the district, a letter was submitted, and approval was obtained from the Deputy Superintendent. The Deputy Superintendent was also invited to attend the PLC meetings at school sites to discuss issues related to implementing professional learning communities to improve instructional practice.

Research Methods

A consent letter on St. John's University letterhead was distributed to all the participants. This letter explained the multi-age professional learning community and listed all the activities teachers and administrators needed to participate in and the data needed to be collected. Participants signed the consent letter and returned it to the MAC research team before the data collection. All participants were actively participating in PLCs. Quantitative and qualitative data were collected and analyzed.

Quantitative Data Collection and Analysis

The following sections will describe instruments, data collection, and data analysis for quantitative research questions.

Instruments for Quantitative Data. Quantitative data was collected using surveys and student Terra Nova test scores.

The Multiage Professional Learning Community Survey (MPLCS) comprises six subscales containing 27 items (Cozza, 2017, pp. 178–180). These items determine which aspects of professional communities are perceived to be occurring within the school. These items are rated on a 5-point Likert scale, asking participants to indicate their perceptions of characteristics associated with professional learning communities in their school. Previous research showed the instrument items' validity (Landau, 2014; Louis et al., 2010; Louis & Marks, 1998; Sebring et al., 1995; Supovitz, 2002). The Multiage Professional Learning Community Survey was given four times during the implementation of the MAC PLC in August 2013, June 2014, August 2014, and February 2015. Table 5 listed the administration time of the Multiage Professional Learning Community Survey and the number of participants in School A and School B.

Table 5

Data Collection Time (2013–2015)

Instruments	*Aug. 2013*		*June 2014*		*Aug. 2014*		*Feb. 2015*	
	School	*Respondents*	*School*	*Respondents*	*School*	*Respondents*	*School*	*Respondents*
MPLCS	A	10	A	3	A	6	A	8
	B	8	B	5	B	3	B	4
PLCCR	A	10	A	0	A	6	A	0
	B	8	B	0	B	3	B	0
TSAS	A	0	A	3	A	6	A	8
	B	0	B	5	B	3	B	4

The Professional Learning Community Continuum Rubric (PLCCR) (Cozza, 2017, p. 177) assesses the implementation of the PLC process, which is adapted from the work of DuFour et al. (Dufour et al., 2006). It provides a breakdown of crucial elements (overall PLC development, mission, shared vision, shared values, goals, collaborative culture (teachers working together), collaborative culture (administrator/teacher relations), parent partnerships, action research, continuous improvement, and a focus on results). Participants were asked to assess the development of their school's professional learning community: Pre-Initiation Stage, Initiation Stage, Developing Stage, and Sustaining Stage. The Professional Learning Community Continuum Rubric was given in August 2013 and 2014 as shown in Table 5.

The Teacher School Attitude Survey (TSAS) consisted of a 5-point Likert scale and open-ended questions. The survey contained 29 statements adapted from New York City School Survey (*NYC School Survey*, n.d.). 18 Likert scale statements indicate perceptions of school quality and evaluate the three key areas of interest: Academic Expectations (items 1-7), Communication (items 8-10), and Engagement (items 11-18).

In addition, there are also 11 open-ended questions to provide data for further analysis for qualitative research to look at the participants' overall perceptions. The Teacher School Attitude Survey measures the school quality in the abovementioned areas in teachers' perceptions. Table 5 lists the administration time and the number of participants of the Teacher School Attitude Survey.

The Terra Nova is a standardized test that provides objective information about student performance in various areas, including reading, language, mathematics, social studies, and science (TerraNova3, n.d.). The Terra Nova is administered to K-12 students. Test results can be compared with the national norm group. Test results can also be compared over time intervals, which indicates growth for an individual or group of students.

Table 6

Terra Nova Reports Collected at Different Test Dates (2013–2016)

Grade	*3/11/2013*				*3/10/2014*				*03/07/2016*		
KG	A	15	B	16	A	8	B	19		B	0
G1	A	9	B	14	A	9	B	19		B	13
G2	A	19	B	11	A	7	B	11		B	6
G3	A	10	B	0	A	15	B	15		B	9
G4	A	10	B	13	A	8	B	0		B	5
G5	A	13	B	13	A	9	B	11		B	4
G6	A	8	B	11	A	13	B	11		B	9
G7	A	17	B	13	A	9	B	12		B	9
G8	A	0	B	14	A	0	B	12		B	8
Total	**A**	**101**	**B**	**105**	**A**	**78**	**B**	**110**		**B**	**63**

Quantitative Data Collection. Surveys were distributed to teachers who joined the Multi-Age Community (MAC), which aimed to prepare and train teachers and

administrators for multi-age classroom components and instructional strategies from 2013 to 2016. Some of the teachers completed the surveys more than one time. Table 5 lists the data collection time and the number of collected responses. Terra Nova score reports were collected from schools A and B. Table 6 listed Terra Nova reports collection time.

Quantitative Data Analysis. Quantitative data were analyzed using IBM SPSS Statistics, version 28.

Question 1. What are the characteristics of professional learning communities in multi-age schools?

In order to answer the first research question, descriptive statistics indicating the mean and standard deviation for each of the 27 items were determined. Second, the six characteristics of professional learning communities in multi-age schools were explored by calculating the average of items in each of the six subscales: collective responsibility, reflective dialogue, deprivatized practice, shared sense of purpose, peer collaboration, and focus on student learning. Third, the one-way analysis of variance (ANOVA) was used to determine whether there were any statistically significant differences between the means of PLC characteristics before and after the implementation of the PLC. Finally, descriptive statistics were also analyzed on the responses collected from the Professional Learning Community Continuum Rubric to assess the development of the PLC.

Question 2. How does the existence of a professional community impact school quality?

In order to answer the second research question regarding whether the existence of a professional community impact school quality, multiple approaches were used. First,

the correlation between PLC characteristics and school quality was explored. Second, teachers perceived school quality, including academic expectations, communication, and engagement, was regressed on the six characteristics of the professional learning community. The independent variables are the six characteristics of PLCs, as listed in Table 7. The dependent variables are the teacher-perceived school quality measures, as listed in Table 8. Third, a path model of PLC characteristics to school quality was built.

Table 7

Independent Variables (IVs)

Variable	***Qualitative/ Quantitative***	***Operationalization***	***Range***
Collective responsibility	Quantitative	Measured by taking the average of Item 1-7 on a 5-point Likert-type scale	1-5
Reflective dialogue	Quantitative	Measured by taking the average of Item 8-11 on a 5-point Likert-type scale	1-5
Deprivatized practice	Quantitative	Measured by taking the average of Item 12-15 on a 5-point Likert-type scale	1-5
Shared sense of purpose	Quantitative	Measured by taking the average of Item 16-18 on a 5-point Likert-type scale	1-5
Peer collaboration	Quantitative	Measured by taking the average of Item 19-22 on a 5-point Likert-type scale	1-5
Focus on student learning	Quantitative	Measured by taking the average of Item 23-27 on a 5-point Likert-type scale	1-5

Table 8

Dependent Variables (DVs)

Variable	***Qualitative/ Quantitative***	***Operationalization***	***Range***
Academic expectations	Quantitative	Measured by taking the average of Item 1-7 on a 5-point Likert-type scale	1-5
Communication	Quantitative	Measured by taking the average of Item 8-10 on a 5-point Likert-type scale	1-5
Engagement	Quantitative	Measured by taking the average of Item 11-18 on a 5-point Likert-type scale	1-5

Question 3. How do multi-age classrooms and professional learning community impact students' achievement?

In order to analyze the effects of the multi-age classroom program and the professional learning community, students' Terra Nova scores in School A and School B were collected from 2013 to 2016. Comparisons and descriptive analysis were conducted to answer the third research question.

Validity and Reliability in Quantitative Research. Validity is defined as the extent to which a concept is accurately measured. Reliability is defined as the extent to which an instrument consistently has the same results if used in the same situation (Heale & Twycross, 2015). The validity of the instrument items in the Multiage Professional Learning Community Survey was demonstrated in previous research (Landau, 2014; Louis et al., 2010; Louis & Marks, 1998; Sebring et al., 1995; Supovitz, 2002). The survey items, Cronbach's alpha, and the source of the items have been tested in previous research, which indicated a Cronbach's alpha between 0.74 to 0.94 (Landau, 2014, p. 52).

The Teacher School Attitude Survey is adapted from the NYC School Survey. Reliability determines the extent to which the measures remain consistent in different conditions. For example, do two teachers from different grades who feel the same about the school quality respond to the survey items similarly? Validity refers to how well a measure represents the intended idea. The reliability of the NYC School Survey was measured by calculating Cronbach's alpha separately for each of the survey's domain scores and each group of respondents (students, parents, and teachers) (Rockoff & Speroni, 2008). Very high levels of reliability, with a Cronbach's alpha higher than 0.9,

were found. The reliability and validity of the NYC School Survey were assessed in a few other studies (Nathanson, Cole, et al., 2013; Nathanson, McCormick, et al., 2013).

Qualitative Data Collection and Analysis

A multiple case study design was used as the qualitative method in the mixed-method design, analyzing data from surveys, focus groups, reflective journals, and PLC meeting agendas/minutes. Qualitative data addressed the fourth, fifth, and sixth research questions.

Instruments for Qualitative Data. Qualitative data were collected through open-ended responses from the Teacher School Attitude Survey, focus groups, journals, and PLC meeting agendas/minutes. The data collection methods are described below.

Focus groups were conducted during a three-day MAC PLC Academy in the summers of 2013 to 2015. During each MAC PLC Academy, the focus group met three times for approximately 45 minutes each. At the meeting, the participants in the study shared information and gave feedback based on four prompts. In addition, the session was audio-taped and transcribed, and field notes were taken.

The following questions were asked during the focus group sessions (Cozza, 2017):

- FGQ1. *Do you feel comfortable with the multi-age planning process based on what you have learned in the Academy?*
- FGQ2. *What strengths do you believe your school has that will influence program implementation based on what you have learned so far?*
- FGQ3. *What resources do you think you will need to successfully implement the program based on what you have learned so far?*

- FGQ4. *What are some challenges that might surface during program implementation? What challenges do you believe you will face in implementing a PLC?*

The teachers were asked to keep a reflection journal. These journal entries assessed teachers' ongoing activities, feelings, and reactions as they began implementing MAC PLC. Teachers kept journals of their progress as they implemented multi-age teaching and learning in their classrooms.

Reflective journals from participants were gathered once per month from 2013 to 2016. One benefit of using self-completed journals was that it gave the participants enough time to reflect deeply on each question (J. A. Smith et al., 2009). The following questions were asked during reflective journal tasks (Cozza, 2017, pp. 174, 207):

- JQ1. *What strategies have you integrated to your classroom from the Summer Academy*?
- JQ2. *Describe the success you have in the classroom*.
- JQ3. *Show evidence of the success.*
- JQ4. *What are some challenges you have in the classroom?*
- JQ5. *How can the MAC (Multi-Age Classroom) team assist you?*
- JQ6. *How do you perceive your role as a teacher leader (think of your expertise, coaching ideas and the multi-age program)? (For teacher leaders)*

Once per month, a multi-age program coach and researchers met participants (teachers, the principal, and a board member). The research team talked with participants about their experiences and percepts in MAC. The PLC meeting agenda/minutes were

documented to provide information to assist in answering research questions four, five, and six.

Qualitative Data Collection. Qualitative data was collected through journals, open-ended responses in the Teacher School Attitude Survey, focus groups, and PLC meeting agendas/minutes. Data collection occurred from August 2013 to April 2016.

Part of the data was collected during the MAC PLC Summer Academy which was offered to teachers and administrators during the summer to provide instructional strategies for multi-age schools. Focus group data was collected during the MAC PLC Summer Academy. Other types of the data was collected at the targeted schools, which included journals and PLC meeting agendas/minutes.

Qualitative Data Interpretation and Analysis. Qualitative data analysis was completed by coding open-ended responses in the Teacher School Attitude Survey, teacher journals, focus groups, and PLC meeting agendas/minutes. First, the researcher read through qualitative data from both schools. Then, after identifying evidence from the coded data, the researcher selected data that is determined to be salient examples representative of teacher experiences and perceptions. Both deductive and inductive coding were used (Bingham & Witkowsky, 2022; Linneberg & Korsgaard, 2019; Vanover et al., 2021). A five-cycle process was adapted from Bingham & Witkowsky (2022) and Vanover et al. (2021) to analyze the qualitative data. In the first cycle, attribute codes (Miles et al., 2013) were developed to create an organizational schema. Then, attribute codes were applied to categorize qualitative data (e.g., "focus group," "journal"), location (e.g., "School A," "School B"), participants, and time. The second cycle created categories of interest based on research questions and theoretical

framework. Then the data was sorted into categories according to the topic codes. In the third cycle, open coding was conducted to identify emerging topics or concepts in open codes. In the fourth cycle, themes were identified, and findings were determined to answer the research questions. Finally, in the fifth cycle, findings were explained deeper using theory and literature.

Trustworthiness in Qualitative Research. The trustworthiness of the research must be considered. Quantitative and qualitative criteria for assessing research quality and rigor were listed in previous research (Anfara et al., 2002; Houghton et al., 2013; Penley, 2018; Williams & Kimmons, 2022). In order to ensure the trustworthiness of the study, the study used the triangulation of multiple methods and data sources, including surveys, journals, focus groups, and PLC meeting agendas/minutes. Triangulation helps the researcher improve trustworthiness by ensuring that findings are not simply the results of a single method, source, or researcher bias (Patton, 2002).

To establish credibility**,** the researcher used prolonged engagement in the field (Williams & Kimmons, 2022), peer debriefing (Williams & Kimmons, 2022), and triangulation. The researcher immersed herself in the schools of the study for nine months (September 2015 to June 2016). Other researchers in the MAC project immersed themselves in the sites for three years (2013-2016) from the transformation to multi-age schools and experienced the complete development of the professional learning communities. Trust with the participants was built during the MAC Summer Academy and school visits. Through prolonged engagement in the field, the researchers had a deeper understanding of the professional learning community in action and teachers' practices and perceptions. Rich data was collected through scientifically proven methods.

Peer debriefing was also conducted to enhance the credibility of the research. A disinterested peer was invited to ask probing questions. The researcher answered questions and made proper modifications to make results understandable to people outside the research context.

To establish transferability, the researcher conducted thick description and purposive sampling. Thick Description (Drew, 2022; Ponterotto, 2006) involves writing detailed narratives explaining situations and their cultural context. Ponterotto (2006) outlined five characteristics that make up a thick description, including describing and interpreting social actions within the context, capturing thoughts and emotions, assigning motivations and intentions, providing truthlike statements, and promoting a thick interpretation of social actions. Thick descriptive data was based on direct journal quotations, focus group discussions, and PLC meeting agendas/minutes. The thick descriptive data increased transferability by allowing readers to determine how the study's findings were relevant to other contexts, including their own. Furthermore, purposive sampling was used to select participants.

The researcher used multiple techniques to establish dependability, including creating an audit trail, code-recode strategy, peer examination, and triangulation. Audit Trail (Williams & Kimmons, 2022) was maintained, including field notes and reports, to describe how the study was conducted in schools and how the data collected was analyzed, including coding. Documents were carefully tracked and kept during the analysis and coding process. In addition, a code-recode strategy was used to enhance the study's dependability. The data were coded, and the analysis was left for a while. After that, the researcher re-coded the data and compared the two sets of coded data. Finally,

the data analysis was shared with peer reviewers to gain consensus on the understanding of the data.

Confirmability refers to the degree to which others can confirm or replicate the study's findings (Trochim, 2006). Additionally, confirmability indicates how the data support the research results and establishes whether the researcher has bias during the study (Penley, 2018). The study is designed to confirm findings that allow the researcher to be attentive to validity issues by using a collection of the triangulation of data (Tashakkori & Teddlie, 2003) and reflexivity (Alvesson & Sköldberg, 2009). A reflexive journal was written to record the researcher's thoughts, reflections, and decision-making, and the moment of self-awareness occurred when the researcher was a research assistant in the MAC project. The process of listening to the participants made the researcher reflect on her own experience as a teacher. The researcher completed her master's degree in TESOL (Teaching English to Speakers of Other Languages). The researcher has experience teaching multi-age English Language Learners who were put in the same classroom. Her teaching and educational experience helped the researcher deeply understand teachers' perceptions and practices in multi-age schools. Reflexivity helped the researcher to be conscious of the steps. The reflections on the decisions helped the researcher be aware of biases.

Researcher Role and Research Ethics

The researcher is a professional in education research areas. The researcher did not teach in the participating schools. The researcher also considered the subjectivity of the participants and the personal biases they might bring to the research. The researcher explored the background of the participants. Data from multiple participants were

analyzed to reduce personal biases. The researcher used multiple data sources and methods. The researcher examined information from multiple data sources to reduce potential bias. The researcher thoroughly evaluated and investigated the subjectivity of data used to preserve credibility (Bowen, 2009; O′Leary, 2017).

Qualitative researchers face ethical challenges, including anonymity, confidentiality, informed consent, and researchers' potential impact on the participant (Sanjari et al., 2014). Therefore, ethics was carefully considered during the data collection and analysis (Creswell, 2012).

A formal research proposal for the MAC project was written. Approval for the MAC project was obtained from St. John's University and the district. The IRB application and informed consent documents were kept for the MAC project. These documents clearly described the purpose of the MAC project and the data collection protocols. The school principal aided in the scheduling of school visits, classroom observations, and interviews with teachers. The researchers communicated the purpose of the MAC project and the participants' role as interviewees in each focus group session. The consent letter was sent to each participant and was signed by each participant.

Additionally, the researcher completed the "Research Ethics Training Curriculum for Community Representatives" training course from SJU. The study's purpose, methodology, and scope are clearly described in this dissertation. This study adopted guidelines in research with adults: *do no harm, respect participants, do not lie, treat people fairly, gain informed consent, allow the right to withdraw* (Simons, 2009).

The researcher strictly maintains the confidentiality of all data. Names of the participants or names of the schools were not included in the study. The participants were

coded anonymously. A name was not attached to the audio-taped focus group sessions, survey responses, journals, or PLC meeting agendas/minutes. The researcher keeps information stored in a secure laptop. Only the researcher can access the laptop, and the data will be disposed of in two years.

CHAPTER 4 RESULTS

This study focuses on understanding the development and implementation of professional learning communities in K-8 multi-age settings. The researcher used a mixed-methods multiple case study design to analyze data from surveys, student test scores, focus groups, reflective journals, and PLC meeting agendas/minutes. The findings of the study are presented in this chapter.

Sites

School A and School B were private PK-8 schools located in a low socio-economic neighborhood in the Northeast of the United States. School A had a diverse population of 50% Hispanic and black students, 32% white students, and 18% other students. The demographics for School B consisted of 90% Hispanic and black students. The school had 137 students in 2013, with a student-to-teacher ratio of 13:1.

Data Analysis

Before data analysis, survey data were screened for missing values and outliers. In the responses collected from the Multiage Professional Learning Community Survey, nine missing data were found among the 47 responses from 28 participants, which happened to the answers to the following questions: Q10, Q13, Q14, Q15, Q17, Q19, Q21, once and Q23 twice. Overall, the rate of missing data in the Multiage Professional Learning Community Survey is 0.7%. (9/ (47*28) =0.007). Researchers can "*substitute up to 15% of the missing data with scores without altering the overall statistical findings*" (Creswell, 2012, p. 182). When calculating the subsets of PLC characteristics, the highest missing rate is 6.25% (1/16) which happens at calculating Peer Collaboration for School

A on responses collected in August 2014. The missing values were substituted using the most frequent answer from the participant's school at the time of data collection.

For the Multiage Professional Learning Community Survey and the Teacher School Attitude Survey, only responses from teachers (n=39) were used in the quantitative analysis. Staff at other positions, such as principal, had a different experience from teachers. For example, for Q12 in the Multiage Professional Learning Community Survey '*How often do you typically visit other teachers' classrooms to observe instruction?*', the principal of School A answered 'daily', which is rated as 5. However, all teachers in School A answered, 'less than once a month', which is rated as 1.

Reliability evidence was calculated by conducting Cronbach's Alpha analysis using IBM SPSS Statistics, version 28. The following subscales were analyzed: Collective Responsibility (items 1-7), Reflective Dialogue (items 8-11), Deprivatized Practice (items 12-15), Shared Sense of Purpose (items 16-18), Peer Collaboration (items 19-22), and Focus on Student Learning (items 23-27).

Table 9

Reliability Analysis of the Main Constructs of the Study

Dimension	# Of Items	Reliability from literature	Reliability based on the current study
Collective Responsibility	7	.94	.878
Reflective Dialogue	4	.83	.866
Deprivatized Practice	4	.80	.619
Shared Sense of Purpose	3	.74	.741
Peer Collaboration	4	.74	.703
Focus on Student Learning	5	Not reported	.897

The acceptable reliability level of the measures was a minimum Cronbach alpha equal to 0.70 or above, as Nunnally (1978) suggested. Results of Cronbach's Alpha

confirmed that scores received for five dimensions were reliable except for Deprivatized Practice, as shown in Table 9.

Table 10

Survey Questions for Deprivatized Practice in Literature and This Study

Question	***Survey Question in literature***	***Survey Question in this study***
Q12	How often in this school year have you visited other teachers' classrooms to observe instruction?	How often do you typically visit other teachers' classrooms to observe instruction?
Q13	How often in this school year have you received meaningful feedback on your performance from colleagues?	How often do you typically receive meaningful feedback on your performance from colleagues?
Q14	How often in this school year have you had colleagues observe your classroom?	How often do you typically have other colleagues observe your classroom?
Q15	How often in this school year have you invited someone in to help teacher your class(es)?	How often do you typically invite someone to help teach your classes?

Items in the dimension of Deprivatized Practice in literature and this study were listed in Table 10. Response values for each question on a 5-point scale were also listed in Table 11. In literature (Landau, 2014; M. Lee & Louis, 2019), Deprivatized Practice was measured by four items ($\alpha = .80$) such as "*How often in this school year have you visited other teachers' classrooms to observe instruction*?" High values (i.e., five is "10 times or more") indicate that teachers have deprivatized practices very frequently. In this study, Deprivatized Practice was measured at a much higher value. For example, for the question "*How often do you typically visit other teachers' classrooms to observe instruction*", a low value such as 2 (2 or 3 times a month) can be more than 20 in a school year which is a '5' in literature. Items in the Deprivatized Practice dimension might need to be revised to increase reliability in future research.

Table 11

Response Values for Deprivatized Practice in Literature and This Study

Response Value	***Question Response Option in literature***	***Question Response Option in this study***
1	Never	Less than once a month
2	1-2 times	2 or 3 times a month
3	3-4 times	once or twice a week
4	5-9 times	almost daily
5	10 times or more	daily

Quantitative Findings

Question 1 – PLC Characteristics and Development

Question 1. What are the characteristics of professional learning communities in multi-age schools?

Hypothesis 1. There will be no significant change in six characteristics, including collective responsibility, reflective dialogue, deprivatized practice, shared sense of purpose, peer collaboration, and focus on student learning after implementing a professional learning community.

Results from the Multiage Professional Learning Community Survey. The Multiage Professional Learning Community Survey comprises six subscales containing 27 items (Cozza, 2017). These items are rated on a 5-point Likert scale, asking participants to indicate their perceptions of characteristics associated with professional learning communities. The Multiage Professional Learning Community Survey was administrated four times from 2013 to 2015.

In order to answer the first research question, descriptive statistics on item level were determined. The results showed a descriptive overview of the professional learning community characteristics in School A (Table 12), School B (Table 13), and both schools

(Table 14). A higher score represented a more positive response. The top three responses are highlighted in blue. A lower score represented a more negative response. The lowest three responses are highlighted in green.

Table 12

Descriptive Statistics for Individual Responses from School A (N=23).

Item	*Mean (SD) (201308, n=9)*	*Mean (SD) (201406, n=2)*	*Mean (SD) (201408, n=4)*	*Mean (SD) (201502, n=8)*
Q1	4.67 (0.50)	3.50 (0.71)	4.75 (0.50)	4.50 (0.53)
Q2	4.00 (1.22)	4.50 (0.71)	4.25 (0.50)	4.25 (0.71)
Q3	3.89 (1.05)	4.50 (0.71)	4.00 (0.82)	4.38 (0.52)
Q4	3.33 (1.00)	4.50 (0.71)	4.00 (0.82)	4.00 (0.93)
Q5	4.11 (0.93)	4.50 (0.71)	4.25 (0.96)	4.25 (0.46)
Q6	4.22 (1.09)	4.50 (0.71)	4.00 (0.82)	3.25 (1.04)
Q7	4.33 (1.00)	4.50 (0.71)	4.00 (0.82)	4.50 (0.53)
Q8	3.00 (0.71)	1.50 (0.71)	3.00 (0.82)	3.13 (1.25)
Q9	1.22 (0.44)	1.00 (0.00)	1.25 (0.50)	1.88 (0.83)
Q10	1.67 (0.71)	2.00 (0.00)	1.75 (0.96)	1.75 (0.89)
Q11	1.44 (0.53)	1.00 (0.00)	1.50 (0.58)	2.13 (1.13)
Q12	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Q13	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.25 (0.46)
Q14	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Q15	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.25 (0.71)
Q16	3.56 (0.53)	3.50 (0.71)	3.50 (0.58)	3.63 (0.92)
Q17	3.11 (1.27)	3.00 (1.41)	2.75 (0.96)	3.63 (0.92)
Q18	3.22 (0.83)	3.50 (0.71)	3.50 (1.00)	4.25 (0.71)
Q19	3.22 (0.97)	4.00 (0.00)	4.00 (0.00)	3.75 (1.04)
Q20	3.44 (0.53)	3.50 (0.71)	3.75 (0.50)	3.50 (0.93)
Q21	4.00 (0.00)	3.00 (0.00)	3.75 (0.96)	3.63 (1.19)
Q22	4.00 (0.50)	4.00 (0.00)	4.00 (0.00)	4.13 (0.35)
Q23	4.11 (0.60)	4.00 (0.00)	4.00 (0.00)	4.25 (0.46)
Q24	3.78 (0.97)	4.50 (0.71)	4.00 (0.82)	4.25 (0.71)
Q25	3.89 (0.78)	4.50 (0.71)	3.75 (1.26)	4.13 (0.64)
Q26	3.67 (1.12)	4.50 (0.71)	4.25 (0.50)	4.50 (0.53)
Q27	4.00 (0.71)	4.50 (0.71)	4.25 (0.50)	4.63 (0.52)

- *Note:* highest, lowest

From the results collected at the beginning of the implementation of the PLC in August 2013 as shown in Table 12 to Table 14, items with mean scores near or below 2.5 were 9,10,11,12, 13, 14, and 15 from the subscale of Reflective Dialogue and

deprivatized practice. Overall, participants indicated relatively low levels of a professional learning community. Participants perceived that PLC practices happened to a relatively low degree in August 2013.

Table 13

Descriptive Statistics for Individual Responses from School B (N=16).

Item	*Mean (SD) (201308, n=6)*	*Mean (SD) (201406, n=5)*	*Mean (SD) (201408, n=2)*	*Mean (SD) (201502, n=3)*
Q1	4.00 (1.10)	4.60 (0.55)	5.00 (0.00)	5.00 (0.00)
Q2	4.50 (0.55)	4.80 (0.45)	5.00 (0.00)	5.00 (0.00)
Q3	4.00 (0.00)	4.80 (0.45)	5.00 (0.00)	5.00 (0.00)
Q4	4.17 (0.41)	4.80 (0.45)	5.00 (0.00)	5.00 (0.00)
Q5	4.50 (0.55)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)
Q6	3.83 (0.75)	4.80 (0.45)	5.00 (0.00)	5.00 (0.00)
Q7	4.50 (0.55)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)
Q8	2.83 (1.17)	4.40 (0.89)	5.00 (0.00)	3.33 (0.58)
Q9	2.00 (1.26)	3.20 (1.10)	3.00 (0.00)	3.00 (0.00)
Q10	2.00 (0.89)	3.00 (0.71)	4.00 (0.00)	3.33 (0.58)
Q11	2.17 (1.17)	3.20 (0.84)	3.00 (0.00)	3.33 (0.58)
Q12	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Q13	1.83 (1.33)	2.40 (1.34)	1.50 (0.71)	2.00 (1.73)
Q14	1.33 (0.82)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Q15	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	2.00 (1.00)
Q16	3.50 (0.84)	4.40 (0.89)	5.00 (0.00)	4.33 (0.58)
Q17	3.50 (1.05)	4.20 (0.84)	4.50 (0.71)	3.67 (1.15)
Q18	4.17 (0.75)	3.60 (1.14)	4.50 (0.71)	4.67 (0.58)
Q19	4.00 (0.63)	4.20 (0.84)	3.50 (0.71)	5.00 (0.00)
Q20	2.50 (1.05)	4.00 (0.71)	3.50 (0.71)	4.33 (0.58)
Q21	2.67 (1.03)	4.20 (0.84)	4.00 (0.00)	4.67 (0.58)
Q22	4.33 (0.52)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)
Q23	4.00 (0.89)	4.80 (0.45)	4.50 (0.71)	4.33 (0.58)
Q24	4.50 (0.55)	4.80 (0.45)	4.50 (0.71)	4.67 (0.58)
Q25	4.17 (0.75)	4.60 (0.55)	4.50 (0.71)	4.33 (1.15)
Q26	4.00 (0.63)	4.40 (0.89)	5.00 (0.00)	4.67 (0.58)
Q27	4.00 (0.63)	4.20 (1.30)	4.50 (0.71)	4.67 (0.58)

- *Note:* highest, lowest

From the results of August 2013 in Table 14, the three items with the highest mean scores were those relating to collective responsibility (Q1, Q5, Q7). The items with

the lowest mean scores were those relating to reflective dialogue (Q9, Q10, Q11) and deprivatized practices (Q12, Q13, Q14, Q15).

Table 14

Descriptive Statistics for Individual Responses from Both Schools (N=39).

Item	*Mean (SD) (201308, n=15)*	*Mean (SD) (201406, n=7)*	*Mean (SD) (201408, n=6)*	*Mean (SD) (201502, n=11)*
Q1	4.40 (0.83)	4.29 (0.76)	4.83 (0.41)	4.64 (0.50)
Q2	4.20 (1.01)	4.71 (0.49)	4.50 (0.55)	4.45 (0.69)
Q3	3.93 (0.80)	4.71 (0.49)	4.33 (0.82)	4.55 (0.52)
Q4	3.67 (0.90)	4.71 (0.49)	4.33 (0.82)	4.27 (0.90)
Q5	4.27 (0.80)	4.86 (0.38)	4.50 (0.84)	4.45 (0.52)
Q6	4.07 (0.96)	4.71 (0.49)	4.33 (0.82)	3.73 (1.19)
Q7	4.40 (0.83)	4.86 (0.38)	4.33 (0.82)	4.64 (0.50)
Q8	2.93 (0.88)	3.57 (1.62)	3.67 (1.21)	3.18 (1.08)
Q9	1.53 (0.92)	2.57 (1.40)	1.83 (0.98)	2.18 (0.87)
Q10	1.80 (0.77)	2.71 (0.76)	2.50 (1.38)	2.18 (1.08)
Q11	1.73 (0.88)	2.57 (1.27)	2.00 (0.89)	2.45 (1.13)
Q12	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Q13	1.33 (0.90)	2.00 (1.29)	1.17 (0.41)	1.45 (0.93)
Q14	1.13 (0.52)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Q15	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.45 (0.82)
Q16	3.53 (0.64)	4.14 (0.90)	4.00 (0.89)	3.82 (0.87)
Q17	3.27 (1.16)	3.86 (1.07)	3.33 (1.21)	3.64 (0.92)
Q18	3.60 (0.91)	3.57 (0.98)	3.83 (0.98)	4.36 (0.67)
Q19	3.53 (0.92)	4.14 (0.69)	3.83 (0.41)	4.09 (1.04)
Q20	3.07 (0.88)	3.86 (0.69)	3.67 (0.52)	3.73 (0.90)
Q21	3.47 (0.92)	3.86 (0.90)	3.83 (0.75)	3.91 (1.14)
Q22	4.13 (0.52)	4.71 (0.49)	4.33 (0.52)	4.36 (0.50)
Q23	4.07 (0.70)	4.57 (0.53)	4.17 (0.41)	4.27 (0.47)
Q24	4.07 (0.88)	4.71 (0.49)	4.17 (0.75)	4.36 (0.67)
Q25	4.00 (0.76)	4.57 (0.53)	4.00 (1.10)	4.18 (0.75)
Q26	3.80 (0.94)	4.43 (0.79)	4.50 (0.55)	4.55 (0.52)
Q27	4.00 (0.65)	4.29 (1.11)	4.33 (0.52)	4.64 (0.50)

- *Note:* highest, lowest

Q12, Q14, and Q15 also had the least variability. Teachers generally perceived that deprivatized practice was not a common professional learning community practice in their school.

- Q9: 10 out of 15 participants (67%) responded that they typically have conversations with colleagues about developing a new curriculum less than once a month, rated as 1 which is the lowest.
- Q12: 15 out of 15 participants (100%) responded that they typically visited other teachers' classrooms to observe instruction less than once a month, rated as 1 which is the lowest.
- Q13: 13 out of 15 participants (87%) responded that they typically received meaningful feedback on their performance from colleagues less than once a month, rated as 1 which is the lowest.
- Q14: 14 out of 15 participants (93%) responded that they typically had colleagues observe their classroom less than once a month, rated as 1 which is the lowest.
- Q15: 15 out of 15 participants (100%) responded that they typically invited someone to help teach their classes less than once a month, rated as 1 which is the lowest.

As shown in Table 14, from the results in February 2015, the items that had the highest mean scores were those in collective responsibility (Q1, Q2, Q3, Q5, Q7) and (Q26, Q27) in focus on student learning. Items (Q1, Q2, Q3, Q5, Q7) in collective responsibility and (Q26, Q27) in focus on student learning not only had the highest level of teacher involvement but also had low to medium variability indicating that collective responsibility and focus on student learning is a common professional community practice currently occurring. The items with the lowest level of teacher involvement were (Q9, Q10, Q11) relating to reflective dialogue and deprivatized practices (Q12, Q13, Q14, Q15). Q12 and Q14 had the least variability of 0.00, indicating unanimous consensus among teachers that deprivatized practice occurred rarely.

Table 15 shows the biggest change in mean scores on item levels in School A between August 2013 and February 2015. (Q3, Q4, Q6) relating to engaging in collective responsibility, (Q9, Q11) relating to reflective dialogue, (Q17, Q18) relating to shared sense of purpose, Q19 relating to peer collaboration, and (Q26, Q27) in focus on student learning showed the biggest change. The mean score of Item 18 changed by 1.03, indicating that PLC improved the closeness between teachers and administration on school discipline policy. Item 6 had a negative change of -0.97, indicating that teachers felt less responsible for helping each other to do his/her best.

Table 15

Biggest Change on Item Level (School A).

Item	***Mean (SD) (201308, n=9)***	***Mean (SD) (201502, n=8)***	***Difference***
Q3	3.89	4.38	0.49
Q4	3.33	4.00	0.67
Q6	4.22	3.25	-0.97
Q9	1.22	1.88	0.65
Q11	1.44	2.13	0.68
Q17	3.11	3.63	0.51
Q18	3.22	4.25	1.03
Q19	3.22	3.75	0.53
Q26	3.67	4.50	0.83
Q27	4.00	4.63	0.62

Table 16 shows the biggest change in mean scores on item levels in School B between August 2013 and February 2015. (Q1, Q3, Q6) relating to engaging in collective responsibility, (Q9, Q10, Q11) relating to reflective dialogue, Q15 relating to deprivatized practice, and (Q19, Q20, Q21) relating to peer collaboration showed the biggest change. Item 21 had the biggest change of 2.00, indicating that PLC improved

peer collaboration among teachers, especially relating to teachers' efforts to coordinate their teaching with instruction at other grade levels.

Table 16

Biggest Change on Item Level (School B).

Item	*Mean (SD) (201308, n=6)*	*Mean (SD) (201502, n=3)*	*Difference*
Q1	4.00	5.00	1.00
Q3	4.00	5.00	1.00
Q6	3.83	5.00	1.17
Q9	2.00	3.00	1.00
Q10	2.00	3.33	1.33
Q11	2.17	3.33	1.17
Q15	1.00	2.00	1.00
Q19	4.00	5.00	1.00
Q20	2.50	4.33	1.83
Q21	2.67	4.67	2.00

Table 17 shows the descriptive statistics for PLC characteristics of School A on the measure level. From the results collected at the beginning of the implementation of the PLC in August 2013, the participants indicated overall high levels of collective responsibility (questions 1-7) and lower levels of reflective dialogue (8-11) and deprivatized practices (12-15). In addition, the staff was closely aligned (low variability) in their perceptions of deprivatized practices. The results in February 2015 showed an increase in all six characteristics.

Figure 2 shows the characteristics of the professional learning community in School A. The highest level of teacher involvement was found in collective responsibility and focus on student learning.

Table 17

Descriptive Statistics for PLC Characteristics of School A (N=23).

Item	*Mean (SD) (201308, n=9)*	*Mean (SD) (201406, n=2)*	*Mean (SD) (201408, n=4)*	*Mean (SD) (201502, n=8)*	*Difference: Mean (201502) - Mean (201308)*
Collective Responsibility	4.08 (0.76)	4.36 (0.71)	4.18 (0.60)	4.16 (0.54)	0.08
Reflective Dialogue	1.83 (0.43)	1.38 (0.18)	1.88 (0.25)	2.22 (0.84)	0.39
Deprivatized Practice	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.13 (0.19)	0.13
Shared Sense of Purpose	3.30 (0.77)	3.33 (0.94)	3.25 (0.74)	3.83 (0.69)	0.54
Peer Collaboration	3.67 (0.22)	3.63 (0.18)	3.88 (0.32)	3.75 (0.60)	0.08
Focus on Student Learning	3.89 (0.76)	4.40 (0.57)	4.05 (0.57)	4.35 (0.44)	0.46

Figure 2

Characteristics of the Professional Learning Community (School A)

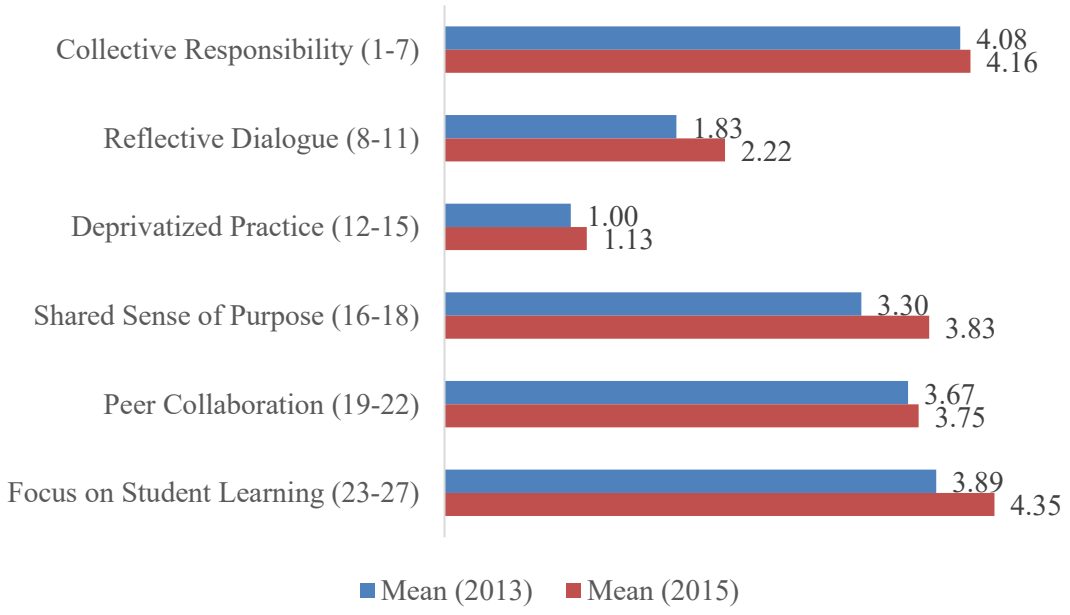


Table 18 shows the descriptive statistics for PLC characteristics of School B on the measure level. From the results collected at the beginning of the implementation of the PLC in August 2013, the participants indicated overall high levels of collective responsibility (questions 1-7) and focus on student learning (23-27) and lower levels of reflective dialogue (8-11) and deprivatized practices (12-15). In addition, the staff was closely aligned (low variability) in their perceptions of collective responsibility. The results in February 2015 showed an increase in all six characteristics.

Figure 3 shows the characteristics of the professional learning community in School B. The highest level of teacher involvement was found in collective responsibility and peer collaboration.

Table 18

Descriptive Statistics for PLC Characteristics of School B (N=16).

Measure	***Mean (SD) (201308, n=6)***	***Mean (SD) (201406, n=5)***	***Mean (SD) (201408, n=2)***	***Mean (SD) (201502, n=3)***	***Difference: Mean (201502) - Mean (201308)***
Collective Responsibility	4.21 (0.20)	4.83 (0.26)	5.00 (0.00)	5.00 (0.00)	0.79
Reflective Dialogue	2.25 (1.04)	3.45 (0.48)	3.75 (0.00)	3.25 (0.00)	1.00
Deprivatized Practice	1.29 (0.51)	1.35 (0.34)	1.13 (0.18)	1.50 (0.50)	0.21
Shared Sense of Purpose	3.72 (0.68)	4.00 (0.94)	4.67 (0.00)	4.22 (0.69)	0.50
Peer Collaboration	3.38 (0.65)	4.35 (0.45)	4.00 (0.35)	4.75 (0.25)	1.38
Focus on Student Learning	4.13 (0.62)	4.56 (0.64)	4.60 (0.57)	4.53 (0.64)	0.40

Table 19 shows the descriptive statistics for PLC characteristics of both schools on the measure level. Overall, the participants indicated higher levels of collective

responsibility and focus on student learning, and lower levels of reflective dialogue and deprivatized practices. In addition, the staff is closely aligned (low variability) in its perceptions of questions related to deprivatized practices. The increase in all six characteristics was obvious for both schools.

Figure 3

Characteristics of the Professional Learning Community (School B)

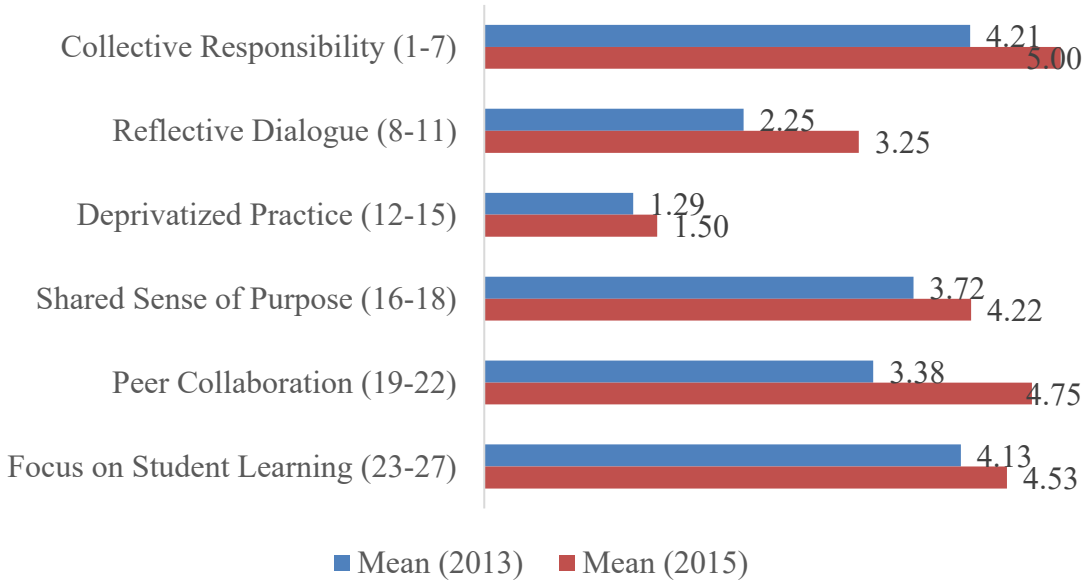


Table 19

Descriptive Statistics for PLC Characteristics in Both Schools (N=39).

Measure	***Mean (SD) (201308, n=15)***	***Mean (SD) (201406, n=7)***	***Mean (SD) (201408, n=6)***	***Mean (SD) (201502, n=11)***
Collective Responsibility	4.13 (0.59)	4.69 (0.42)	4.45 (0.63)	4.39 (0.60)
Reflective Dialogue	2.00 (0.73)	2.86 (1.09)	2.50 (0.99)	2.50 (0.85)
Deprivatized Practice	1.12 (0.34)	1.25 (0.32)	1.04 (0.10)	1.23 (0.33)
Shared Sense of Purpose	3.47 (0.74)	3.81 (0.92)	3.72 (0.93)	3.94 (0.68)
Peer Collaboration	3.55 (0.45)	4.14 (0.52)	3.92 (0.30)	4.02 (0.69)
Focus on Student Learning	3.99 (0.69)	4.51 (0.58)	4.23 (0.59)	4.40 (0.47)

The descriptive statistics for PLC characteristics increased between August 2013 and February 2015. The data in Table 20 represents the pre and post-surveys taken in August 2013 and again in February 2015 after 18 months of PLC implementation in the five domains of a PLC, including Collective Responsibility, Reflective Dialogue, Shared Sense of Purpose, Peer Collaboration, and Focus on Student Learning. The results of the PLC pre- and post-surveys indicated an increase in the means in all the five domains of the PLC. In addition, three areas of the five domains were scored between 4.0 and 5.0, indicating that the participants rated highly in these areas. In particular, the post-survey revealed higher means in the areas of Collective Responsibility (M=4.39), Peer Collaboration (M=4.02), and Focus on Student Learning (M=4.40), indicating that, on average, participants perceived these three characteristics of the PLC.

Table 20

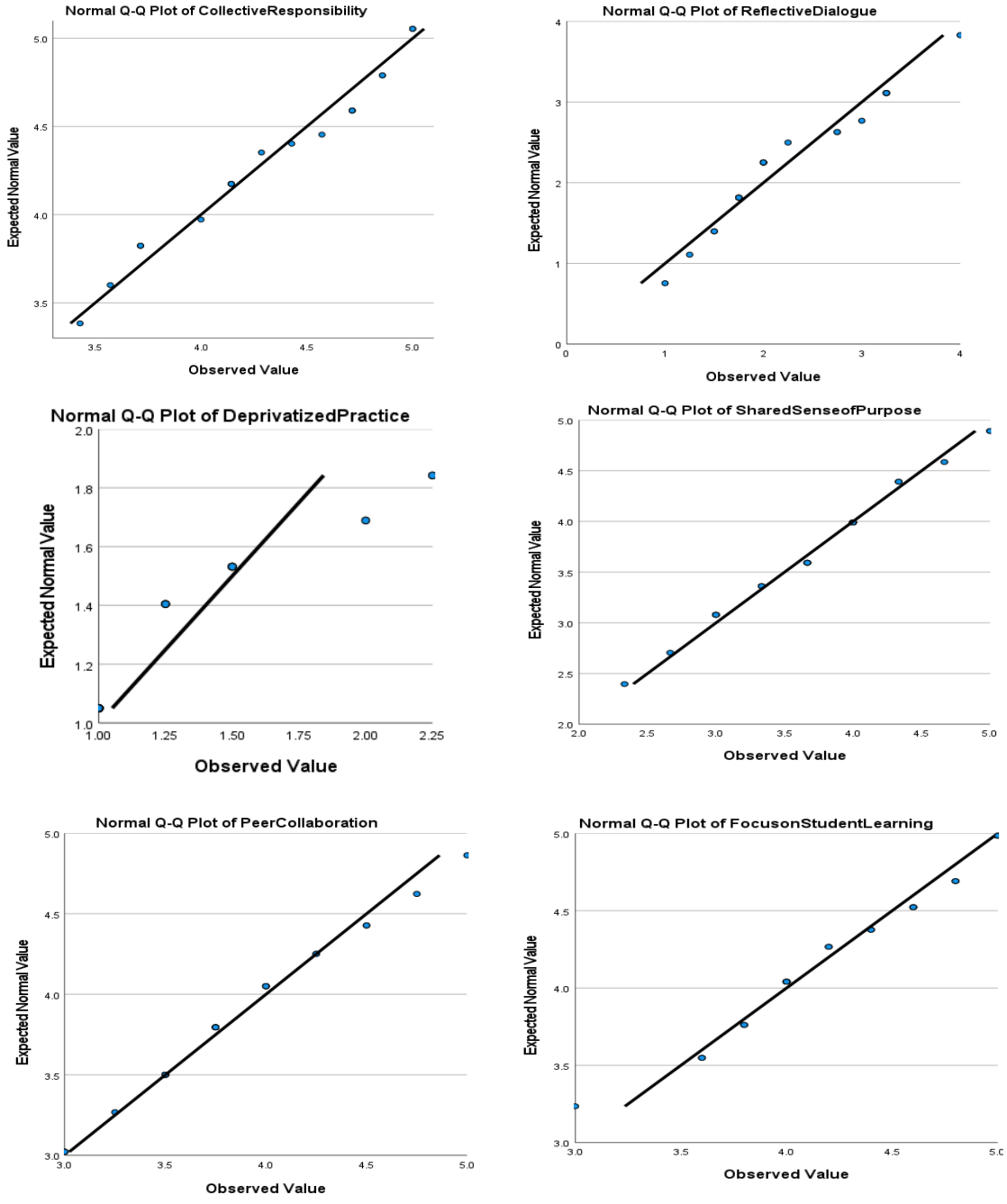
PLC Pre- and Post-Survey T-test Results (Both Schools)

	Pre-Survey (201308)			*Post Survey (2015028)*						
Measure	*M*	*SD*	*N*	*M*	*SD*	*N*	*Statistic*	*df1*	*df2*	*Sig.*
Collective Responsibility	4.27	0.38	13	4.39	0.60	11	0.301	1	16.376	0.590
Reflective Dialogue	2.12	0.72	13	2.50	0.85	11	1.442	1	22	0.243
Shared Sense of Purpose	3.56	0.67	13	3.94	0.68	11	1.838	1	22	0.189
Peer Collaboration	3.65	0.28	13	4.02	0.69	11	2.736	1	12.753	0.123
Focus on Student Learning	4.15	0.57	13	4.40	0.47	11	1.304	1	22	0.266

Before conducting a t-test to determine whether the change was significant, the normality assumption for the t-test was checked. Q-Q Plots were generated for the six PLC characteristics in August 2013 and February 2015. The standard Q-Q plots of February 2015 for Collective Responsibility (CR), Reflective Dialogue (RD), Deprivatized Practice (DP), Shared Sense of Purpose (SSP), Peer Collaboration (PC), and Focus on Student Learning (FSL) are shown in Figure 4.

Figure 4

Normal Q-Q Plots CR, RD, DP, SSP, PC, and FSL



The data points for CR, RD, SSP, PC, and FSL are close to the main diagonal line in the Q-Q plot. In conjunction with its skewness and kurtosis values and an inspection of its histogram, we can conclude that CR, RD, SSP, PC, and FSL are distributed

approximately normally. In contrast, many of the coordinate data points for DP depart quite far from the main diagonal line in the Q-Q plot. In conjunction with its skewness and kurtosis values and an inspection of its histogram, we can conclude that DP is distributed quite differently from normal and, thus, fails to meet the normality assumption for the t-test. After the data cleaning, responses from two participants in August 2013 were not included in the t-test.

Table 21

PLC Pre- and Post-Survey T-test Results (School A)

	Pre-Survey (201308)			*Post Survey (2015028)*						
Measure	*M*	*SD*	*N*	*M*	*SD*	*N*	*Statistic*	*df1*	*df2*	*Sig.*
Collective Responsibility	4.29	0.48	8	4.16	0.54	8	0.240	1	14	0.632
Reflective Dialogue	1.91	0.40	8	2.22	0.84	8	0.904	1	10.018	0.364
Shared Sense of Purpose	3.46	0.64	8	3.83	0.69	8	1.268	1	14	0.279
Peer Collaboration	3.69	0.22	8	3.75	0.60	8	0.077	1	8.889	0.788
Focus on Student Learning	4.05	0.63	8	4.35	0.44	8	1.223	1	14	0.287

For School A, not all the data passed the variance homogeneity test. Reflective Dialogue and Peer Collaboration did not pass the variance homogeneity test. Welch's test was conducted for the two domains. The results from One Way ANOVA for CR, SSP, and FSL and the results from Welch's test for RD and PC were reported in Table 21.

The results of the PLC pre- and post-surveys of School A indicated an increase in the means in four domains of the PLC. In addition, two areas of the five domains were scored between 4.0 and 5.0, indicating that the participants rated highly in these areas. The post-survey revealed higher means in Collective Responsibility (M=4.16) and Focus on Student Learning (M=4.35), indicating that, on average, participants obviously perceived two characteristics of the PLC. A one-way analysis of variance (ANOVA) and Welch's test were conducted to determine if there were any statistically significant

differences between the means of the five characteristics of PLC in August 2013 and again after 18 months of PLC implementation in February 2015. There was no significant difference in the scores for the five domains of the PLC in School A.

Table 22

PLC Pre- and Post-Survey T-test Results (School B)

	Pre-Survey (201308)			*Post Survey (2015028)*						
Measure	*M*	*SD*	*N*	*M*	*SD*	*N*	*F*	*df1*	*df2*	*Sig.*
Collective Responsibility	4.26	0.19	5	5.00	0.00	3	44.735	1	6	0.001*
Reflective Dialogue	2.45	1.02	5	3.25	0.00	3	1.725	1	6	0.237
Shared Sense of Purpose	3.73	0.76	5	4.22	0.69	3	0.821	1	6	0.400
Peer Collaboration	3.60	0.38	5	4.75	0.25	3	21.254	1	6	0.004*
Focus on Student Learning	4.32	0.46	5	4.53	0.64	3	0.306	1	6	0.600

* Significant at p<.05

For School B, the data passed the test for homogeneity of variance. The result from One Way ANOVA are reported in Table 22. The results of the PLC pre- and post-surveys of School B indicated an increase in the means in all five domains of the PLC. In addition, four areas of the five domains were scored between 4.0 and 5.0, indicating that the participants rated highly in these areas. In particular, the post-survey revealed higher means in the areas of Collective Responsibility (M=5.00), Shared Sense of Purpose (M=4.22), Peer Collaboration (M=4.75), and Focus on Student Learning (M=4.53), indicating that on average, participants perceived these characteristics of the PLC obviously. A one-way analysis of variance (ANOVA) was conducted to determine if there were any statistically significant differences between the means of the five characteristics of PLC in August 2013 and again after 18 months of PLC implementation in February 2015. A statistically significant difference was found in scores for the characteristics of Collective Responsibility (M = 5.00, SD = .00) and Peer Collaboration (M = 4.75, SD = .25). Results suggested that participation in the PLC over 18 months

increased participants' perceptions of Collective Responsibility and Peer Collaboration significantly. The PLC survey questions regarding Collective Responsibility center on the school culture in which teachers consider themselves responsible for school improvement and student growth. The PLC survey questions regarding Peer Collaboration focus on a systematic process in which teachers work collaboratively to improve their teaching practice.

Results from the Professional Learning Community Continuum Rubric. In order to assess the development stages of the MAC PLC, the Professional Learning Community Continuum Rubric was used. It is adapted from the work of DuFour et al. (Dufour et al., 2006). 11 crucial elements of the PLC were evaluated, which included overall PLC development, mission, shared vision, shared values, goals, collaborative culture (teachers working together), collaborative culture (administrator/teacher relations), parent partnerships, action research, continuous improvement, and a focus on results. The development of the PLC is divided into four stages: Pre-Initiation, Initiation, Developing, and Sustaining. Administrators and teachers in Schools A and B were asked to complete the Professional Learning Community Continuum Rubric. Eighteen responses (10 from School A and eight from School B) were collected in August 2013 at the beginning of the implementation of the MAC PLC. After one year of the development of the MAC PLC, nine responses (six from School A and three from School B) were collected.

Figure 5 shows the results from School A. In 2013, 90% of the participants indicated that they were in the pre-initiation stage and the school had not yet begun to address a principle of a PLC. In 2014, 83% felt they were in the developing stage. In this

stage, faculty were beginning to modify their thinking and practices. Structural changes were being made to align with the principle of the PLC.

Mission**:** In 2013, 60% indicated that no effort had been made to engage faculty to identify what they want students to learn as in the pre-initiation stage. In 2014, 100% indicated that the teachers were clear regarding the learning outcome that students were to achieve as in the developing stage. In addition, there were strategies to assess students, monitor for results, and respond to students who were not learning.

Shared vision: In 2013, 60% of the staff indicated they were in the pre-initiation stage. In 2014, 67% felt that members had worked together for school improvement and a shared vision as in the developing stage.

Shared values: In 2013, 60% of the staff indicated they were in the pre-initiation stage. No effort had been made to engage teachers in describing preferred conditions for the school. In 2014, 50% indicated that staff members had made efforts to articulate and promote the attitudes, behaviors, and commitments to advance their school as in the developing stage.

Goals: In 2013, 60% indicated that the PLC was in the pre-initiation stage. Teachers had not articulated the attitudes, behaviors, or commitments to advance the school's mission. In 2014, there seems to be a lack of consistency in the responses to this statement, ranging from perceptions. For example, 33% indicated that while teachers had been involved in writing goals for the schools, the goals were written broadly and hard to measure. As a result, the goals did not influence instructional decision-making. Another 33% indicated that the goals were clearly communicated and consisted of long-term and short-term goals. The remaining 33% indicated they were in the sustaining stage where

goals were clearly linked to the school's vision and all staff members pursued measurable goals.

Collaborative Culture (Teachers Working Together): In 2013, 60% of the staff indicated they were in the initiation stage. In this stage, the teachers did not exchange ideas often, though they had a common curriculum. 30% felt they were still in the pre-initiation stage, and teachers worked in isolation. In 2014, 67% indicated that they were in the initiation stage. 17% indicated they were in the developing stage, and the remaining 17% felt they were in the sustaining stage, in which teachers functioned as a team and worked collaboratively.

Collaborative Culture (Administrator/Teacher Relations): In 2013, 70% felt they were in the pre-initiation stage. Relationships between teachers and administrators are often adversarial. In 2014, 67% indicated that they were in the developing stage. In this stage, administrators had primary responsibility for school improvement, though staff gave input for improvement initiatives.

Parent Partnership: In 2013, 50% indicated they were in the initiation stage, where parents were kept informed of events and situations to obtain parental support. 30% felt that they were in the pre-initiation stage. In this stage, no or little effort is made to cultivate a partnership with parents. In 2014, 67% felt they were in the initiation stage, and the remaining 33% indicated they were in the developing stage.

Action Research: In 2013, the staff was not involved with action research (70%) as in the pre-initiation stage. In 2014, 67% indicated they were in the initiation stage, and the remaining 33% indicated they were in the developing stage.

Figure 5

Comparison of the Professional Learning Community Continuum Rubric (School A)

Continuous Improvement: In 2013, the school was evenly split (40% - 40%) between the pre-initiation stage and the initiation stage. In 2014, half of the participants indicated they were in the initiation stage. Half felt that they were in the developing stage.

Focus on Results: In 2013, 50% indicated the initiation stage. 40% indicated the pre-initiation stage. In the pre-initiation stage, the school did not seek results for individual students. In the initiation stage, results had been identified, though not clearly. Rather than emphasizing student learning, the focus was on the project or task completion. In 2014, 67% felt they were in the developing stage, and the remaining 33% indicated the initiation stage.

Figure 6 shows the results from School B. In 2013, 50% of the participants felt the effort to start the PLC had begun as in the initiation stage, but the effort had not impacted most of the school. In 2014, all the participants felt that they were beginning to modify their thinking and practices as in the developing stage. Structural changes were being made to align with the principle of the PLC.

Mission: In 2013, 62.5% indicated that although the central office had attempted to identify learning outcomes for all grades, it was still not impacting teachers as in the initiation stage. In 2014, all the participants felt that they were in the sustaining stage in which the principle of the PLC was deeply embedded in the school's culture.

Shared vision: In 2014, all the participants felt they were in the developing stage, while this number was 62.5% in 2013.

Shared values: In 2013, there was a lack of consistency in the responses to this statement, ranging from perception. Most teachers (75%) indicated that the PLC was in

the first three stages. However, there was still a gap in reaching the sustaining stage. In 2014, all the participants felt they were in the sustaining stage.

Figure 6

Comparison of the Professional Learning Community Continuum Rubric (School B)

Goals: In 2013, half of the teachers indicated that while teachers had been involved in writing goals for the schools, the goals were written broadly and hard to measure. The goals did not influence instructional decision-making as in the initiation state. 37.5% indicated that the goals were clearly communicated and consisted of long-term and short-term goals as in the developing stage. In 2014, all the participants indicated they were in the sustaining stage where goals were clearly linked to the school's vision and all staff members pursued measurable goals.

Collaborative Culture (Teachers Working Together): In 2013, half of the participants felt teachers functioned in groups and met regularly to finish some tasks as in the developing stage. In 2014, all the participants felt that they were in the sustaining stage in which teachers functioned as a team and they worked collaboratively.

Collaborative Culture (Administrator/Teacher Relations): In 2013, more than 50% of the participants indicated that they were in the developing stage. In 2014, all the participants indicated they were in the sustaining stage. In this stage, staff members were deeply involved in the school's decision-making process.

Parent Partnership: In 2013, 50% indicated a two-way communication with parents and that parental perspectives were solicited on school-wide issues and matters relating directly to their children as in the developing stage. In 2014, all the participants indicated they were in the developing stage.

Action Research: In 2013, half of the participants indicated that they were in the pre-initiation stage. In this stage, many staff members were not involved in action research. 37.5% indicated they were in the initiation stage, and the remaining 12.5% indicated they were in the developing stage. In 2014, all the participants indicated that

teachers had been trained in action research methods and conducted action research to improve their instructional practice as in the sustaining stage.

Continuous Improvement: In 2013, more than half of the participants (62.5%) indicated that they were in the developing stage. In 2014, all the participants indicated that they were in the developing stage.

Focus on results: In 2013, half of the staff indicated they were in the initiation stage. In 2014, all the participants felt that they were in the developing stage. In this stage, data was collected, and results were identified on student outcomes.

Results from the Professional Learning Community Continuum Rubric showed that the MAC PLC in both schools developed satisfactorily from 2013 to 2014.

Question 2 – Impact of PLCs on School Quality

Question 2. How does the existence of a professional community impact school quality?

Hypothesis 2. Characteristics of professional learning communities will not significantly account for the variance in school quality.

In order to answer the second research question regarding whether the existence of a professional community impact school quality, first, the correlation of PLC characteristics and school quality was explored; second, regression analysis of PLC characteristics and school quality was conducted; third, a path model of PLC characteristics to school quality was built.

Correlation of PLC Characteristics and School Quality. In order to determine if a correlation existed between the measures of school quality reported in the Teacher School Attitude Survey (TSAS) and the six characteristics of the PLC reported in the

Multiage Professional Learning Community Survey (MPLCS), a Pearson *r* correlation coefficient was conducted. Responses from MPLCS and TSAS in June 2014, August 2014, and February 2015 (n=24) were used. The statistical analysis was conducted to answer research question two: how does the existence of a professional community impact school quality? Correlation coefficients were conducted for each measure in the TSAS with each characteristic in the PLC to examine the relationship between the PLC and school quality.

Table 23 listed descriptive statistics of PLC characteristics and school quality measured by mean scaled scores.

Table 23

Descriptive Statistics of PLC Characteristics and School Quality (n=24)

Variables	Minimum	Maximum	Mean	Std. Deviation	Variance
1. Collective Responsibility	3.43	5.00	4.49	0.55	0.307
2. Reflective Dialogue	1.00	4.00	2.60	0.93	0.864
3. Deprivatized Practice	1.00	2.00	1.19	0.29	0.083
4. Shared Sense of Purpose	2.33	5.00	3.85	0.79	0.618
5. Peer Collaboration	3.00	5.00	4.03	0.55	0.306
6. Focus on Student Learning	3.40	5.00	4.39	0.52	0.269
7. Academic Expectations	3.14	4.71	3.95	0.49	0.237
8. Communication	2.67	5.00	4.10	0.58	0.340
9. Engagement	2.25	4.88	3.73	0.57	0.324

Table 24 represents the results of the Pearson correlation coefficients between the six characteristics of PLC highlighted in the MPLCS and the three school quality measures perceived by teachers. Results revealed high and statistically significant correlations in most of the areas examined (12 out of 18 correlations). There were no

statistically significant results in the correlation between Deprivatized Practice and all three measures in the TSAS. The other five PLC characteristics have moderate to strong correlations with Communication and Engagement in TSAS.

Table 24

Correlations of PLC Characteristics and School Quality (n=24)

Variables		Academic Expectations	Communication	Engagement
1. Collective Responsibility	Pearson Correlation	0.391	.640**	.668**
	Sig. (2-tailed)	0.059	0.001	0.000
2. Reflective Dialogue	Pearson Correlation	0.304	.448*	.510*
	Sig. (2-tailed)	0.149	0.028	0.011
3. Deprivatized Practice	Pearson Correlation	0.185	0.263	0.271
	Sig. (2-tailed)	0.386	0.215	0.200
4. Shared Sense of Purpose	Pearson Correlation	.771**	.637**	.583**
	Sig. (2-tailed)	0.000	0.001	0.003
5. Peer Collaboration	Pearson Correlation	.569**	.657**	.745**
	Sig. (2-tailed)	0.004	0.000	0.000
6. Focus on Student Learning	Pearson Correlation	1	.740**	.714**
	Sig. (2-tailed)		0.000	0.000

*Note: *. Correlation is significant at the 0.05 level (2-tailed).*
***. Correlation is significant at the 0.01 level (2-tailed).*

- Collective Responsibility has a strong positive correlation (r>0.6) with Communication and Engagement. These correlations are significant at 0.01 level (p<.01).
- Reflective Dialogue has a moderate positive correlation (0.40<r<0.59) with Communication and Engagement. The correlation between Reflective Dialogue and Communication and Engagement is significant at 0.05 (p < .05).

- Shared Sense of Purpose has a strong positive correlation (r>0.6) with Academic Expectations and Communication (p<.01). Shared Sense of Purpose has a moderate positive correlation with Engagement (p<.01).
- Peer Collaboration has a moderate positive correlation (r=0.569) with Academic Expectations (p<.01). Peer Collaboration has a strong positive correlation (r>0.6) with Communication and Engagement (p<.01).
- Focus on Student Learning has a strong positive correlation (r>0.6) with Communication and Engagement. These correlations are significant at 0.01 level (p<.01).

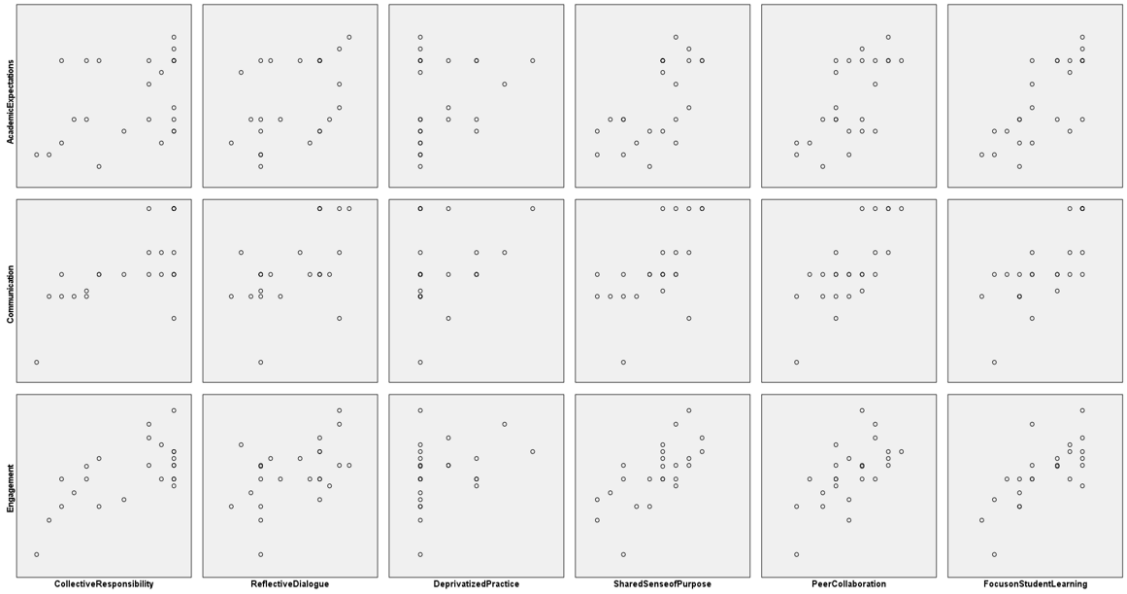
These results indicated a moderate to a strong positive correlation between PLC characteristics and school quality. Overall, there was evidence to support a strong correlation between the school quality measured in the TSAS and the six characteristics of the PLC over the eighteen-month implementation of the PLC.

Regression of PLC Characteristics and School Quality. In order to further examine which of the PLC characteristics make a significant contribution to school quality measured by academic expectations, communication, and engagement, regression analysis was conducted.

Deprivatized Practice was not included because the correlation between Deprivatized Practice and the three measures of school quality is not statistically significant, and the scatterplots of all the three measures (Academic Expectations, Communication, and Engagement) by Deprivatized Practice were not close to linear as shown in Figure 7. The other five PLC characteristics were used in a standard regression analysis to predict academic expectations, communication, and engagement.

Figure 7

Scatter Plots of School Quality Measures by the six PLC Characteristics



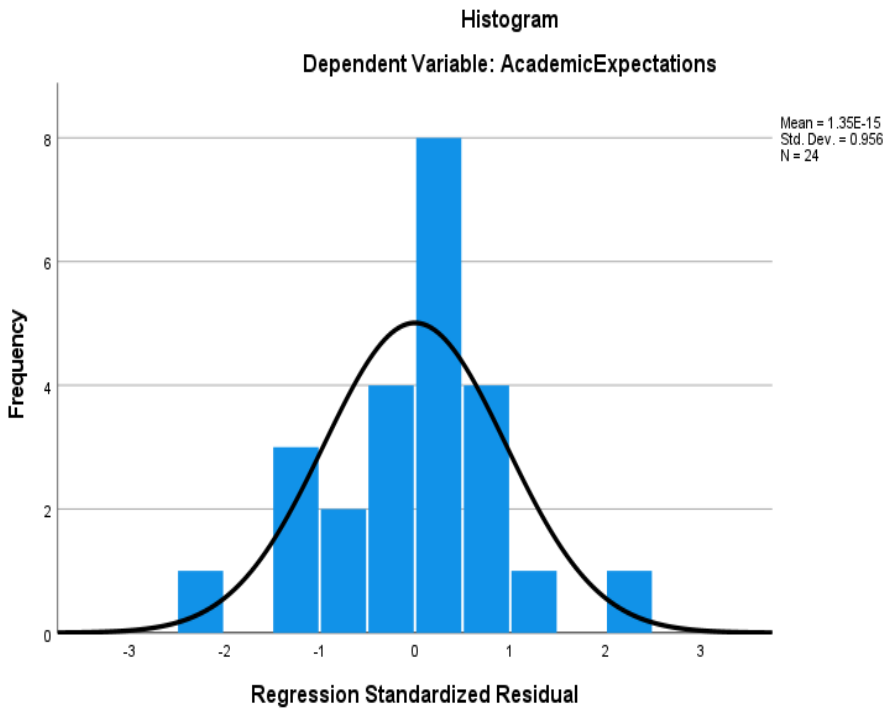
The data met the assumption of non-zero variances (Collective Responsibility, Variance =0.307; Reflective Dialogue, Variance =0.864; Shared Sense of Purpose, Variance =0.618; Peer Collaboration, Variance =0.306; Focus on Student Learning, Variance =0.269; Academic Expectations, Variance =0.237; Communication, Variance =0.340; Engagement, Variance =0.324). In addition, tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (Collective Responsibility, Tolerance = 0.367, VIF = 2.725; Reflective Dialogue, Tolerance =0.438, VIF =2.284; Shared Sense of Purpose, Tolerance =0.277, VIF =3.613; Peer Collaboration, Tolerance =0.493, VIF =2.027; Focus on Student Learning, Tolerance =0.252, VIF =3.966).

Collective Responsibility and Deprivatized Practice were not included in the regression on Academic Expectations because the correlations between these two PLC characteristics and Academic Expectations were not statistically significant. In addition,

the scatterplots of Academic Expectations by Collective Responsibility and Deprivatized Practice were not close to linear, as shown in Figure 7.

Figure 8

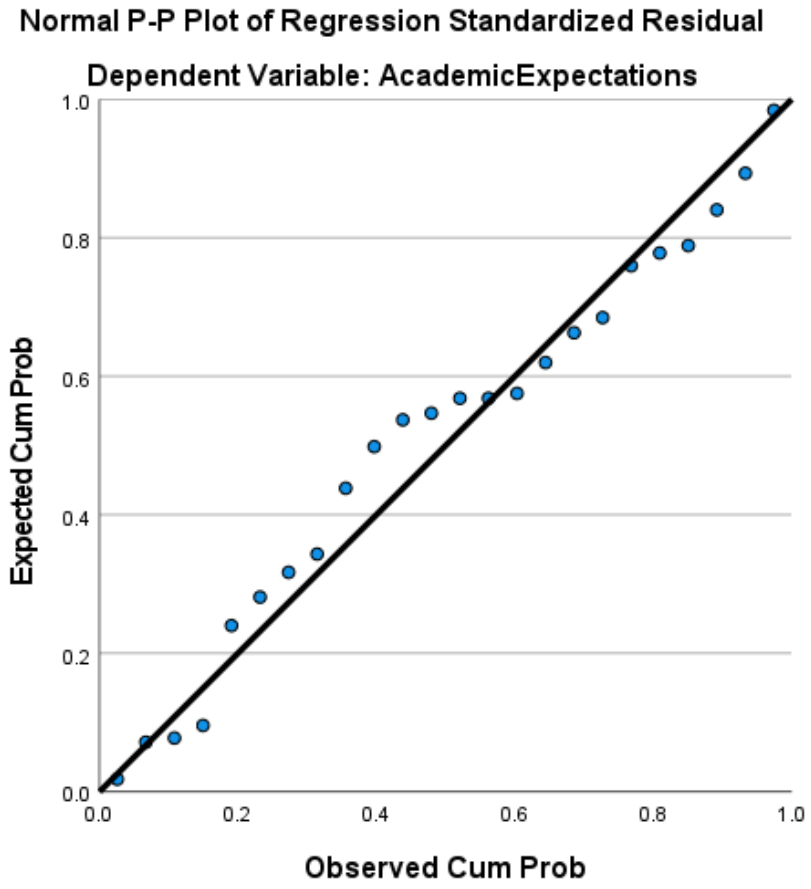
Histogram of Regression Standardized Residual (Academic Expectations)



Before conducting a multiple regression analysis for academic expectations, an analysis of standard residuals was carried out, which showed that the data contained no outliers (Std. Residual Min = -2.094, Std. Residual Max = 2.147, both were smaller than 3 in absolute value). Therefore, the data met the assumption of independent errors (Durbin-Watson value = 1.905). The histogram of standardized residuals (Figure 8) indicated that the data contained approximately normally distributed errors, as did the normal P-P plot of standardized residuals (Figure 9), which showed points that were not completely on the line, but close. The scatterplot of standardized residuals showed that the data met the assumptions of homogeneity of variance and linearity.

Figure 9

Normal P-P Plot of Regression Standardized Residual (Academic Expectations)



Multiple regression with the backward elimination method was conducted to see if Reflective Dialogue, Shared Sense of Purpose, Peer Collaboration, and Focus on Student Learning predicted Academic Expectations. It was found that Peer Collaboration and Focus on Student Learning explained a significant amount of the variance in the value of Academic Expectations. The prediction model on academic expectations was statistically significant, F (2, 21) = 17.872, p < .001, and the independent variables explain 63% (R^2 = 0.630, Adjusted R^2 = 0.595) of the variability of the Academic Expectations. The quality of the prediction of the dependent variable is good (R=. 794).

Table 25

Standard Regression Results on Academic Expectations

Model	*B*	*SE-B*	*β*	*t*	*p*	Pearson *r*	sr^2
(Constant)	0.475	0.584		0.813	0.425		
Peer Collaboration *	0.308	0.142	0.350	2.168	0.042	0.657	0.083
Focus on Student Learning **	0.508	0.151	0.541	3.350	0.003	0.740	0.198

Note. The dependent variable was Academic Expectations. R^2 = .630, Adjusted R^2 = .595. sr^2 is the squared semi-partial correlation. * p< .05, ** p< .01.

The raw and standardized regression coefficients of the predictors, their correlations with academic expectations, and their squared semi-partial correlations are shown in Table 25. Two predictors (Peer Collaboration and Focus on Student Learning) are statistically significant. Peer Collaboration significantly predicts the value of Academic Expectations (β = 0.350, t (21) = 2.168, p < .05). Focus on Student Learning significantly predicts the value of Academic Expectations (β = 0.541, t (21) = 3.350, p < .01). Focus on Student Learning has the strongest relationship with Academic Expectations. The value of Academic expectations was primarily predicted by a higher level of Focus on Student Learning. As can be seen by examining the β weights, Focus on Student Learning made relatively larger contributions to the prediction model. Teachers perceived higher academic expectations as the school focused more on what was best for student learning. With the sizeable correlations between the predictors, the unique variance explained by each of the variables indexed by the squared semi-partial correlations was indicated by $\boldsymbol{sr^2}$ in Table 25. Focus on Student Learning accounts uniquely for 19.8% of the variance of academic expectations (.445*.445=.198 or approximately .20), given the other variable in the model. Therefore, the predicted model was as the following:

Predicted Academic Expectations = 0.475 + 0.308 (PEER COLLABORATION) + 0.508 (FOCUS ON STUDENT LEARNING)

Before conducting a multiple regression analysis for communication, an analysis of standard residuals was carried out, which showed that the data contained no outliers (Std. Residual Min = -1.641, Std. Residual Max = 1.421). Therefore, the data met the assumption of independent errors (Durbin-Watson value = 2.572).

The histogram of standardized residuals (Figure 10) indicated that the data contained approximately normally distributed errors, as did the normal P-P plot of standardized residuals (Figure 11), which showed points that were not completely on the line, but close. The scatterplot of standardized residuals showed that the data met the assumptions of homogeneity of variance and linearity.

Figure 10

Histogram of Regression Standardized Residual (Communication)

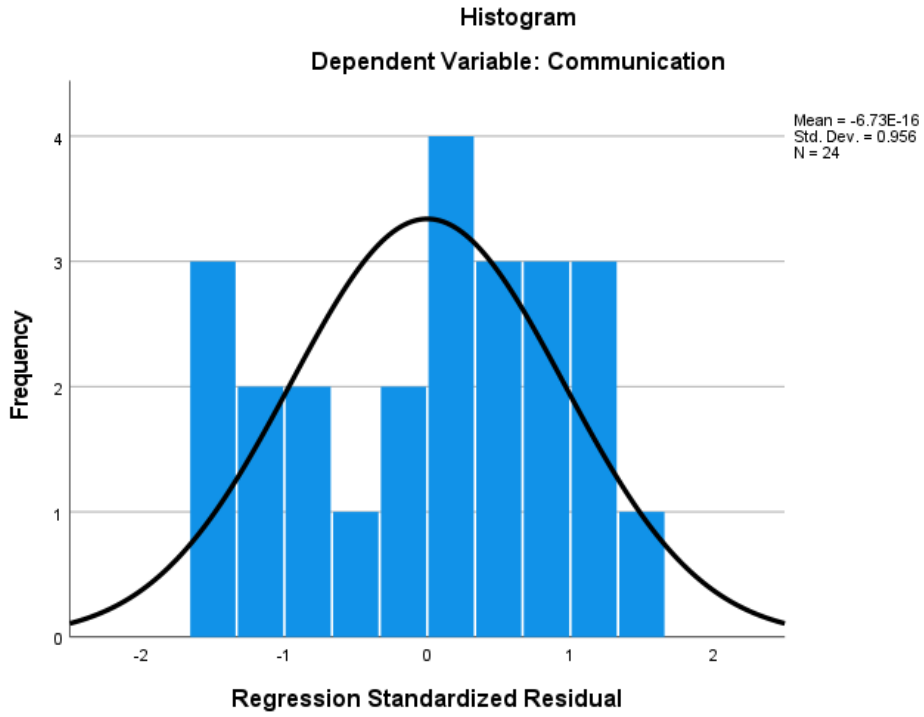
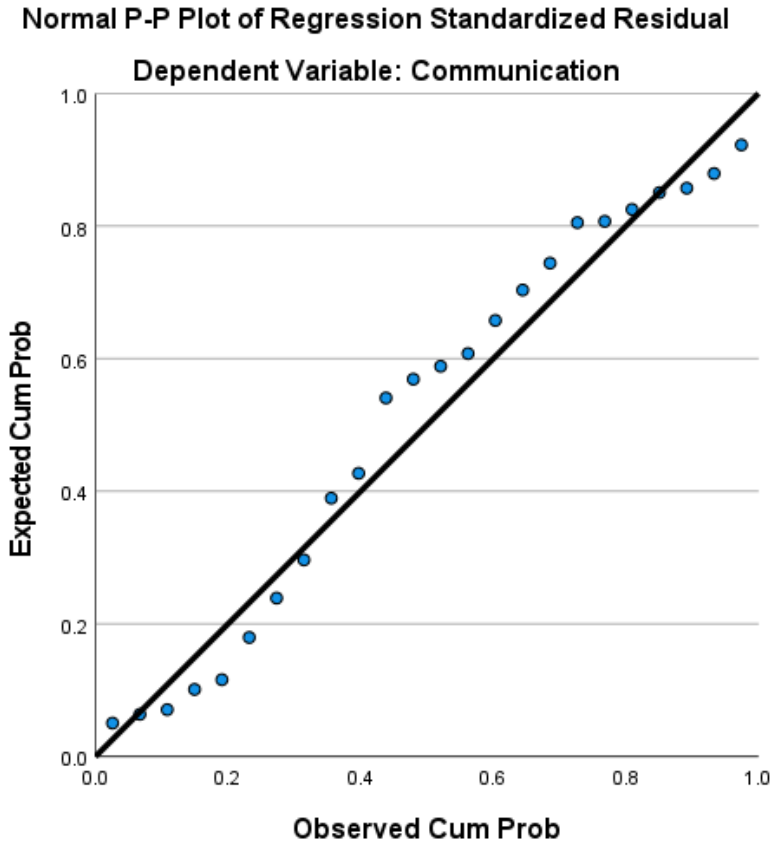


Figure 11

Normal P-P Plot of Regression Standardized Residual (Communication)



Multiple regression with the backward elimination method was conducted to see if Collective Responsibility, Reflective Dialogue, Shared Sense of Purpose, Peer Collaboration, and Focus on Student Learning predicted Communication. It was found that Peer Collaboration and Focus on Student Learning explain a significant amount of the variance in the value of Communication. The prediction model on Communication was statistically significant, F (2, 21) = 22.288, $p < .001$, and the independent variables explain 68% (R^2 = 0.680, Adjusted R^2 = 0.649) of the variability of the dependent variable. Therefore, the quality of the prediction of the dependent variable is good (R=.824).

Table 26

Standard Regression Results on Communication

Model	*B*	*SE-B*	*β*	*t*	*p*	Pearson *r*	sr^2
(Constant)	-0.145	0.650		-0.222	0.826		
Peer Collaboration **	0.528	0.158	0.501	3.340	0.003	0.745	0.170
Focus on Student Learning **	0.482	0.169	0.429	2.856	0.009	0.714	0.124

Note. The dependent variable was Communication. $R^2 = 0.680$, Adjusted $R^2 = 0.649$. sr^2 is the squared semi-partial correlation. * $p < .05$, ** $p < .01$.

The raw and standardized regression coefficients of the predictors, their correlations with academic expectations, and their squared semi-partial correlations are shown in Table 26. Both predictors (Peer Collaboration and Focus on Student Learning) are statistically significant. Communication was primarily predicted by a higher level of Peer Collaboration. Peer Collaboration significantly predicts the value of Communication ($\beta = 0.501$, t (21) = 3.340, $p < .01$). Focus on Student Learning significantly predicts the value of Communication ($\beta = 0.429$, t (21) = 2.856, $p < .01$). Peer Collaboration has the strongest relationship with Communication. As can be seen by examining the β weights, Peer Collaboration made relatively larger contributions to the prediction model. Teachers perceived the school had a better communication environment when the school's PLC had higher peer collaboration characteristics.

With the sizeable correlations between the predictors, the unique variance explained by each of the variables indexed by the squared semi-partial correlations was indicated by $\boldsymbol{sr^2}$ in Table 26. Peer Collaboration accounts uniquely for 17% of the variance of communication (0.412*0.412=0.170 or approximately .17) given the other variables in the model. Focus on Student Learning accounts uniquely for 12.4% of the

variance of communication (0.353 * 0.353 =0.124 or approximately .12), given the other variables in the model. Therefore, the predicted model was as the following:

Predicted Communication = -0.145 + 0.528 (PEER COLLABORATION) + 0.482 (FOCUS ON STUDENT LEARNING)

Before conducting a multiple regression analysis for engagement, an analysis of standard residuals was carried out, which showed that the data contained no outliers (Std. Residual Min = -1.968, Std. Residual Max = 2.031). Therefore, the data met the assumption of independent errors (Durbin-Watson value = 2.287).

The histogram of standardized residuals (Figure 12) indicated that the data contained approximately normally distributed errors, as did the normal P-P plot of standardized residuals (Figure 13), which showed points that were not completely on the line, but close. The scatterplot of standardized residuals showed that the data met the assumptions of homogeneity of variance and linearity.

Figure 12

Histogram of Regression Standardized Residual (Engagement)

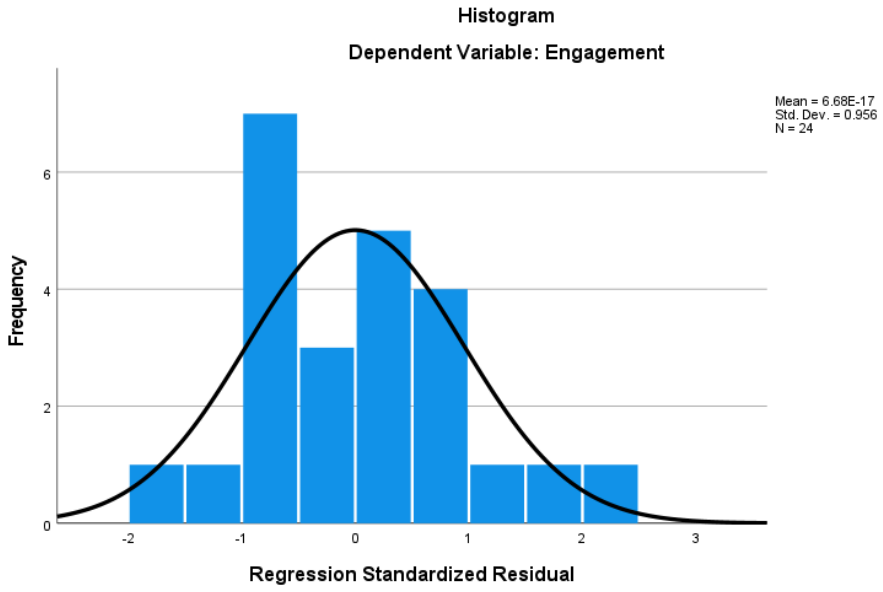
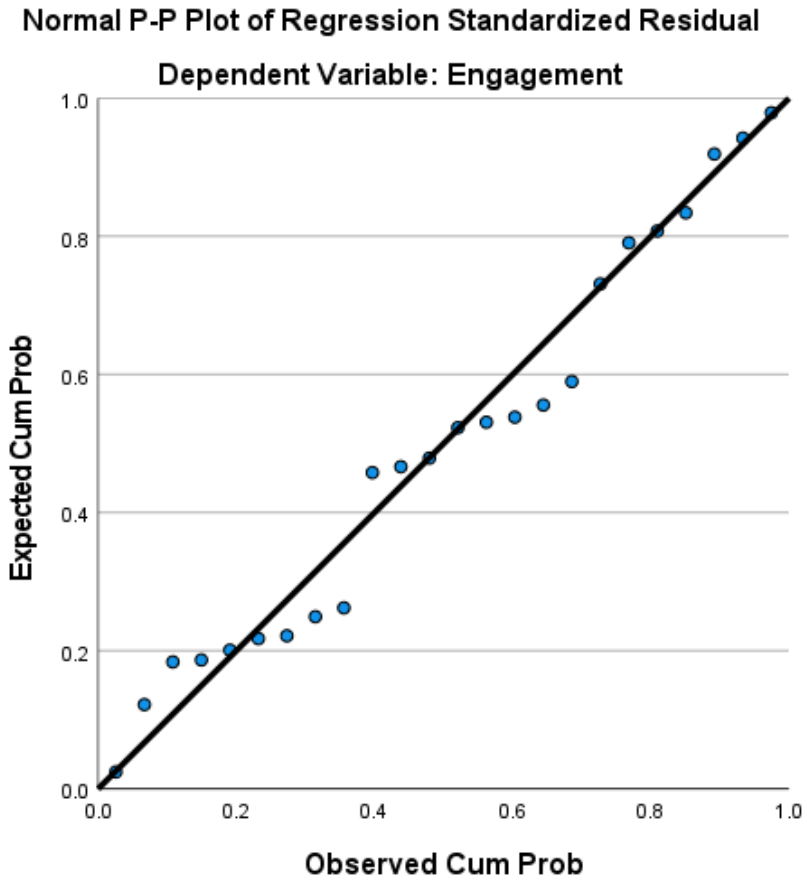


Figure 13

Normal P-P Plot of Regression Standardized Residual (Engagement)



Multiple regression with the backward elimination method was conducted to see if Collective Responsibility, Reflective Dialogue, Shared Sense of Purpose, Peer Collaboration, and Focus on Student Learning predicted Engagement. It was found that Shared Sense of Purpose and Peer Collaboration explained a significant amount of the variance in the value of Engagement. The prediction model on Engagement was statistically significant, F (2, 21) = 16.397, $p < .001$, and the independent variables explain 61.0% (R^2 = 0.610, Adjusted R^2 = 0.572) of the variability of the dependent variable. Therefore, the quality of the prediction of the dependent variable is good (R=.781).

Table 27

Standard Regression Results on Engagement

Model	*B*	*SE-B*	*β*	*t*	*p*	Pearson *r*	sr^2
(Constant)	0.618	0.587		1.053	0.304		
Shared Sense of Purpose **	0.363	0.111	0.501	3.279	0.004	0.689	0.200
Peer Collaboration *	0.425	0.157	0.413	2.701	0.013	0.640	0.136

Note. The dependent variable was Engagement. R^2 = .610, Adjusted R^2 = .572. sr^2 is the squared semi-partial correlation. * p< .05, ** p< .01.

The raw and standardized regression coefficients of the predictors, their correlations with academic expectations, and their squared semi-partial correlations are shown in Table 27. Both predictors (Shared Sense of Purpose and Peer Collaboration) are statistically significant. The dependent variable Engagement was primarily predicted by a higher level of Shared Sense of Purpose. Shared Sense of Purpose significantly predicts the value of Engagement (β = 0.501, t (21) = 3.279, p < .01). Peer Collaboration significantly predicts the value of Engagement (β = 0.413, t (21) = 2.701, p < .05).

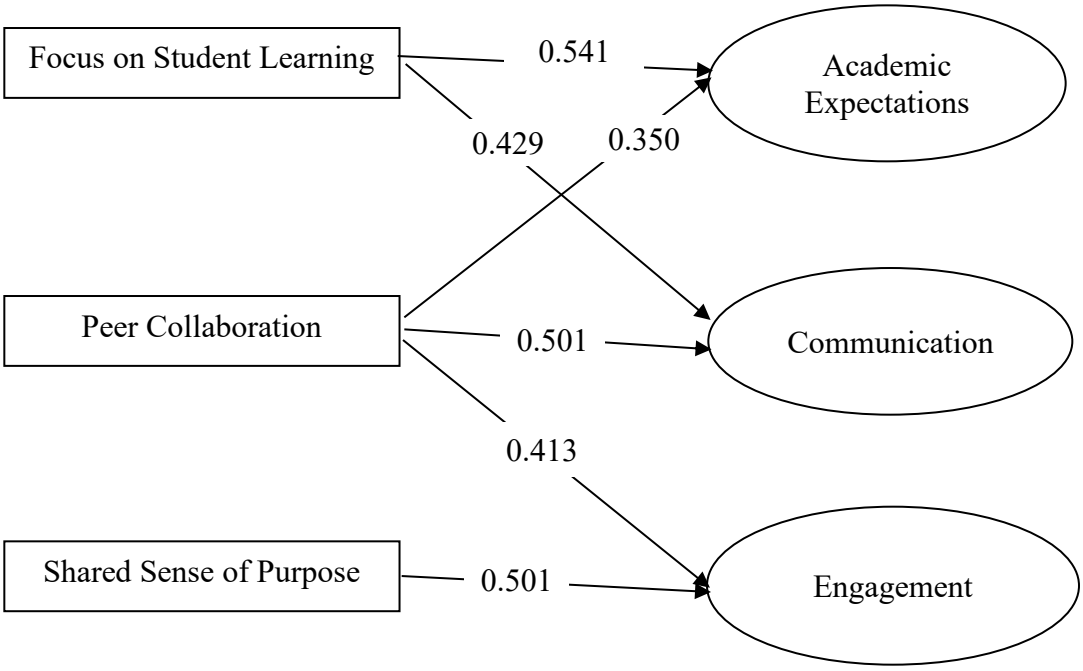
With the sizeable correlations between the predictors, the unique variance explained by each of the variables indexed by the squared semi-partial correlations was indicated by sr^2 in Table 27. Shared Sense of Purpose has the strongest relationship with Engagement. As can be seen by examining the β weights, Shared Sense of Purpose made relatively larger contributions to the prediction model. Shared Sense of Purpose accounts uniquely for 20.0% of the variance of engagement (0.447 * 0.447 = 0.200) given the other variables in the model. Peer Collaboration accounts uniquely for 13.6% of the variance of engagement (0.368 * 0.368 = 0.136 or approximately 0.14) given the other variables in the model. The predicted model was as the following:

Predicted Engagement = 0.618 + 0.363 (SHARED SENSE OF PURPOSE) + 0.425 (PEER COLLABORATION)

Path Model of PLC Characteristics to School Quality. The study examined the potential influences of research-based PLC characteristics on teacher-perceived school quality in multi-age classroom settings. Drawing upon the results identified in the regression analysis, this study used a path model (see Figure 14) that hypothesized key relationships between PLC characteristics and teacher-perceived school quality.

Figure 14

Prediction Model of PLC Characteristics to School Quality



The path model was depicted in Figure 14 with the standardized regression coefficients β (see Table 25, 26, and 27). As displayed in Figure 14, Focus on Student Learning (β=0.541), and Peer Collaboration (β=0.350) were found to have a positive direct effect on academic expectations. All the effects were significant (p< .05). The direct effects of Peer Collaboration and Focus on Student Learning were found to be

positive and significant on communication (β=0.501, and 0.429, respectively, p< .01). The direct effect of Shared Sense of Purpose and Peer Collaboration were found to be positive and significant on engagement (β = 0.501, and 0.413 respectively, p< .05).

Question 3 – Impact of PLCs on Students' Performance

Question 3. How do multi-age classrooms and professional learning community impact students' achievement?

In order to determine how the multi-age classroom program and professional learning community impact students' achievement, the researcher examined students' Terra Nova scores. The Terra Nova test was administered in March 2013 and 2014 for schools A and B. The Terra Nova test was also administered in March 2016 for School B.

The Terra Nova is a norm-referenced standardized test. Therefore, educators can compare results between groups of students. The Terra Nova tests the five areas of reading, language, mathematics, science, and social studies. An Excel spreadsheet was compiled for test scores from the Terra Nova assessments.

The Mean Normal Curve Equivalent scores for grades K to 7 in School A in 2013 and 2014 are shown in Table 28. A difference between the Mean NCE of 2013 and 2014 is calculated. A difference is considered educationally meaningful when the difference score is seven or more Normal Curve Equivalent (NCE) units. When the grade's performance in 2014 is significantly better than that in 2013, the DIFF is shown as "Above." When the grade's performance in 2014 is significantly worse than that in 2013, the DIFF is shown as "Below." The comparison of the Mean Normal Curve Equivalent scores for grades K to 7 in School A are shown in Figure 15 to Figure 22.

Table 28

School A Mean Normal Curve Equivalent Scores (Mean NCE)

Grade	Mean NCE	Reading	Language	Math	Total Score	Science	Social Studies
KG	**2013**	64.9		69.6	68.7		
	2014	66.3		78.8	74.6		
	Difference	1.4		9.2	5.9		
	DIFF			**Above**			
G1	**2013**	71.9		67.0	74.8	68.8	75.1
	2014	71.8		65.0	75.2	68.2	81.1
	Difference	-0.1		-2	0.4	-0.6	6
	DIFF						
G2	**2013**	60.8		66.5	64.5	53.3	57.4
	2014	48.7		46.7	47.4	44.1	60.3
	Difference	-12.1		-19.8	-17.1	-9.2	2.9
	DIFF	**Below**		**Below**	**Below**	**Below**	
G3	**2013**	59.4	56.5	62.5	60.2	61.7	62.3
	2014	65.6	66.1	68.4	68.6	68.5	66.5
	Difference	6.2	9.6	5.9	8.4	6.8	4.2
	DIFF		**Above**		**Above**		
G4	**2013**	59.8	55.1	60.0	58.6	56.3	66.2
	2014	69.9	67.8	58.9	67.0	58.9	68.1
	Difference	10.1	12.7	-1.1	8.4	2.6	1.9
	DIFF	**Above**	**Above**		**Above**		
G5	**2013**	73.2	66.5	71.1	72.5	71.5	66.1
	2014	68.4	61.9	61.4	65.0	61.7	55.0
	Difference	-4.8	-4.6	-9.7	-7.5	-9.8	-11.1
	DIFF			**Below**	**Below**	**Below**	**Below**
G6	**2013**	59.6	65.6	67.5	66.1	63.8	67.4
	2014	66.2	69.6	63.8	68.9	60.8	70.6
	Difference	6.6	4	-3.7	2.8	-3	3.2
	DIFF						
G7	**2013**	62.7	67.3	65.8	67.1	59.1	63.6
	2014	60.7	58.8	63.6	61.9	57.2	61.0
	Difference	-2	-8.5	-2.2	-5.2	-1.9	-2.6
	DIFF		**Below**				

***Total score is Reading, Language, and Math for all levels that contain Language.*

Figure 15

Comparison of Mean NCE of Grade K (School A)

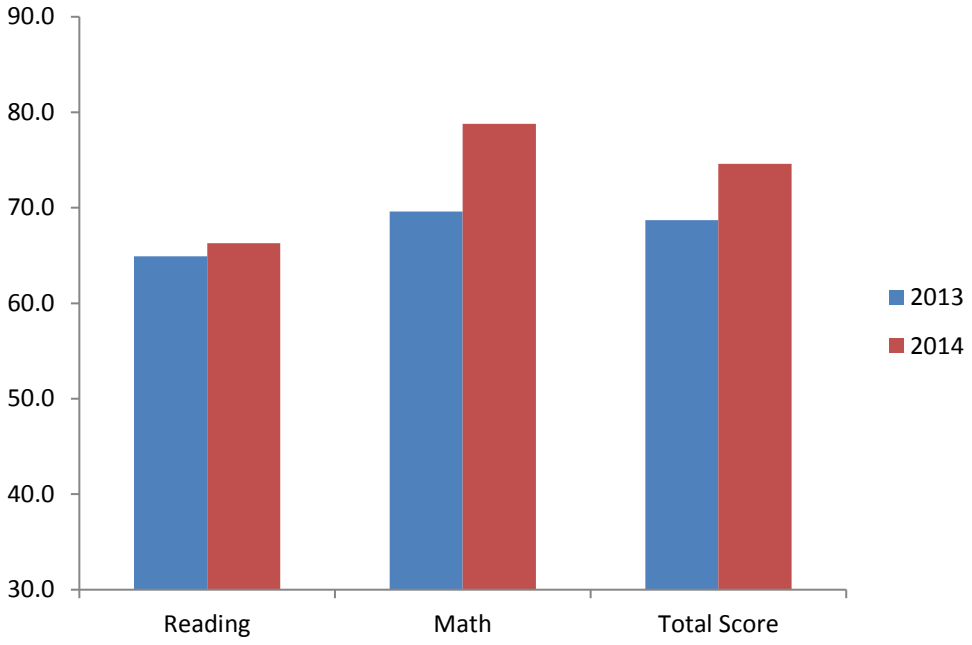


Figure 16

Comparison of Mean NCE of Grade 1 (School A)

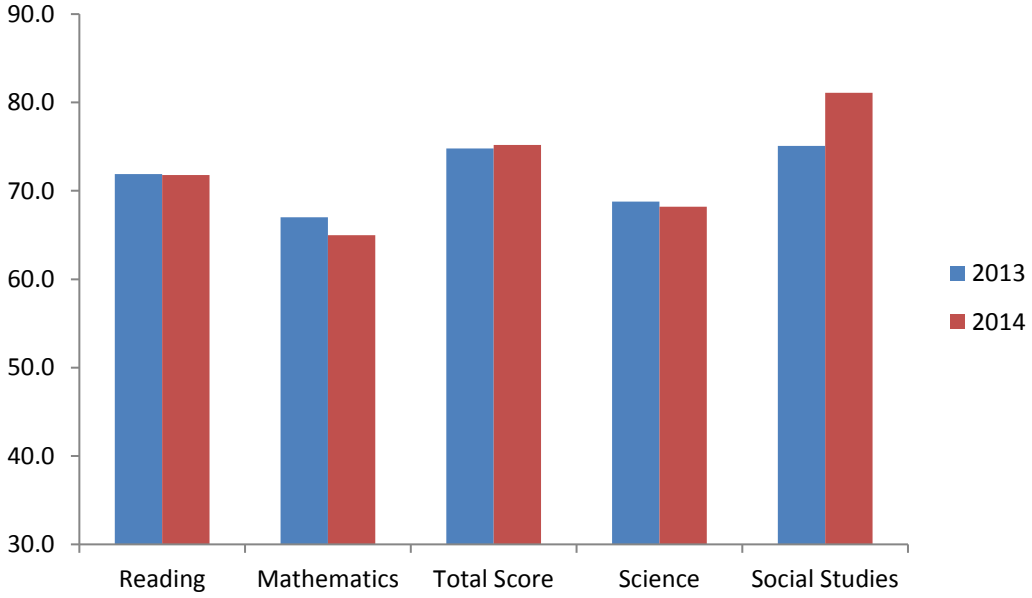


Figure 17

Comparison of Mean NCE of Grade 2 (School A)

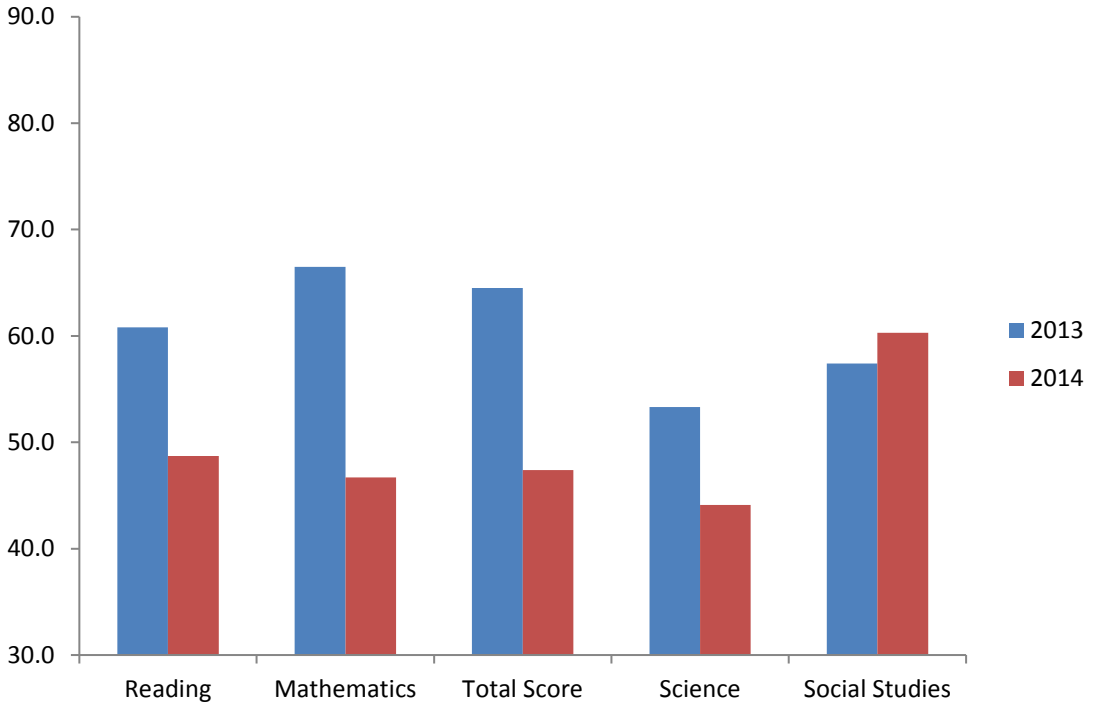


Figure 18

Comparison of Mean NCE of Grade 3 (School A)

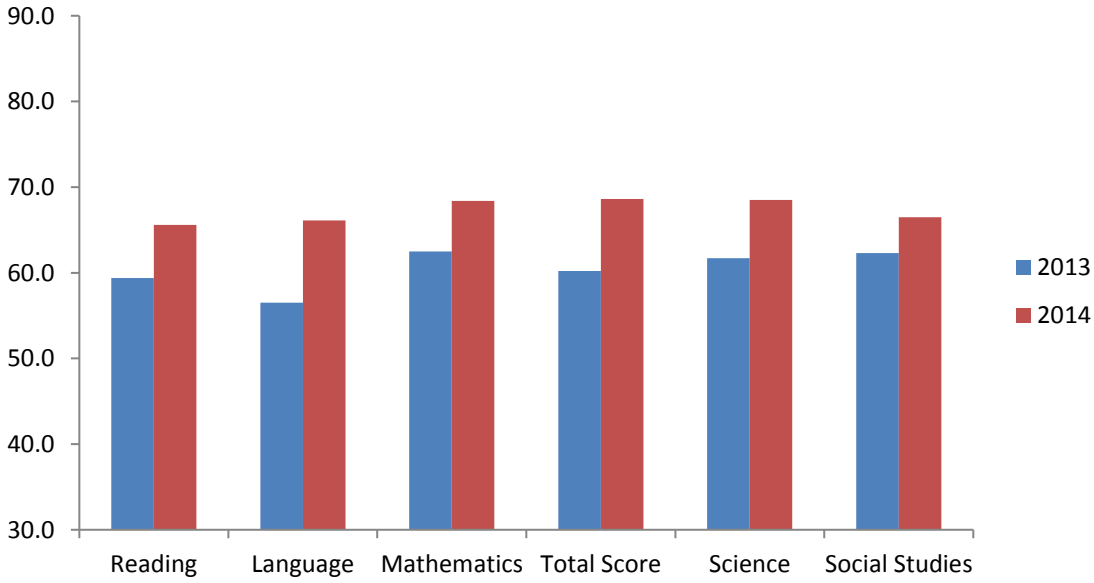


Figure 19

Comparison of Mean NCE of Grade 4 (School A)

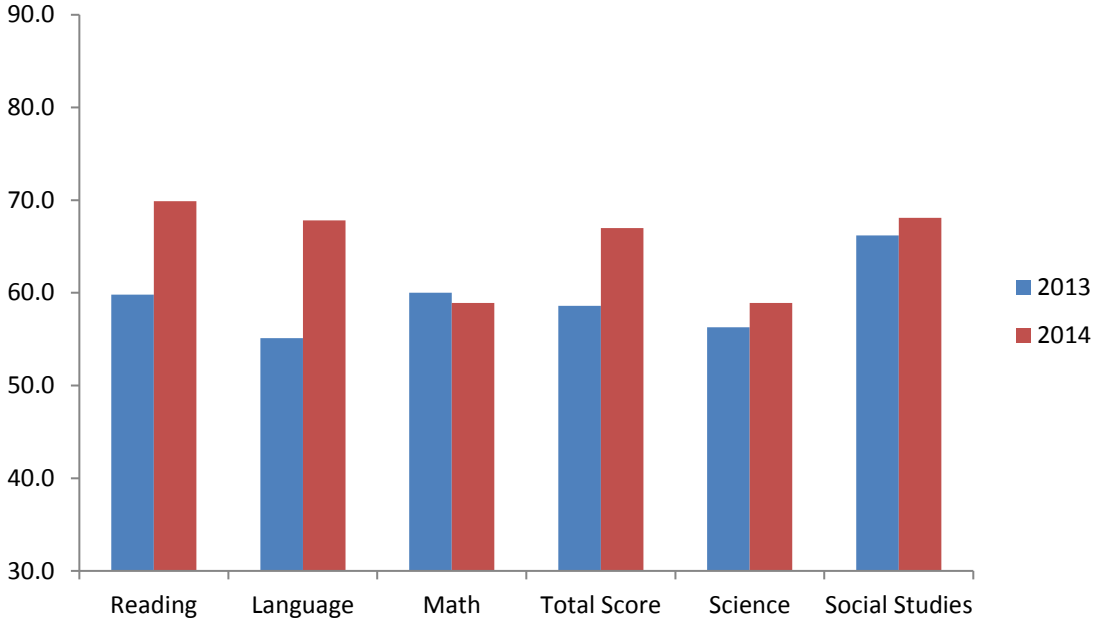


Figure 20

Comparison of Mean NCE of Grade 5 (School A)

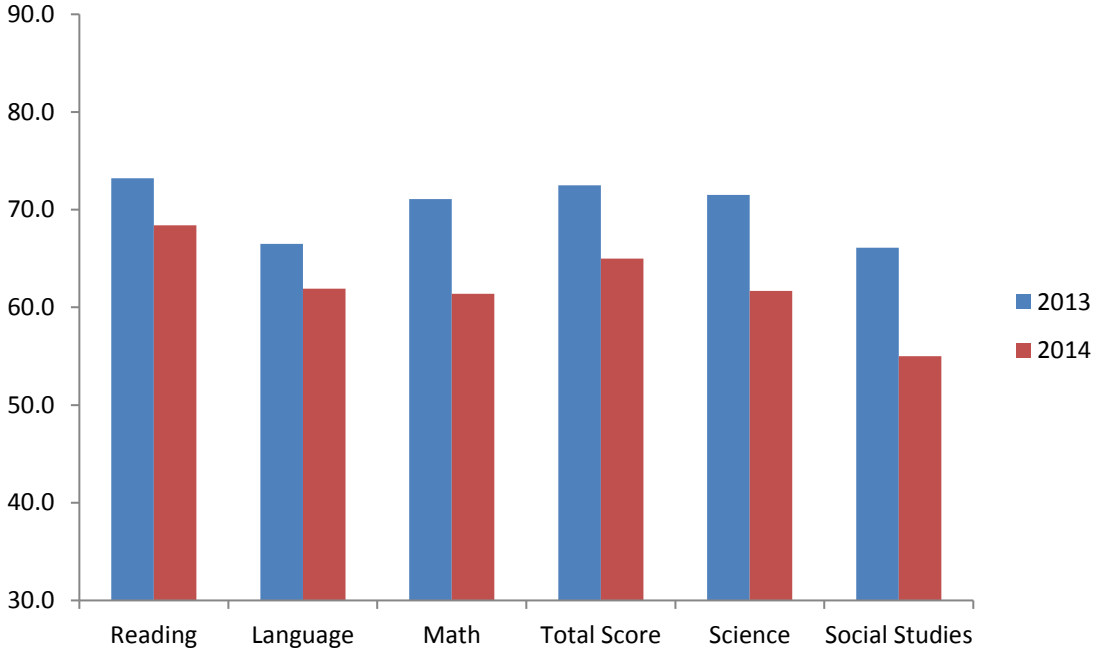


Figure 21

Comparison of Mean NCE of Grade 6 (School A)

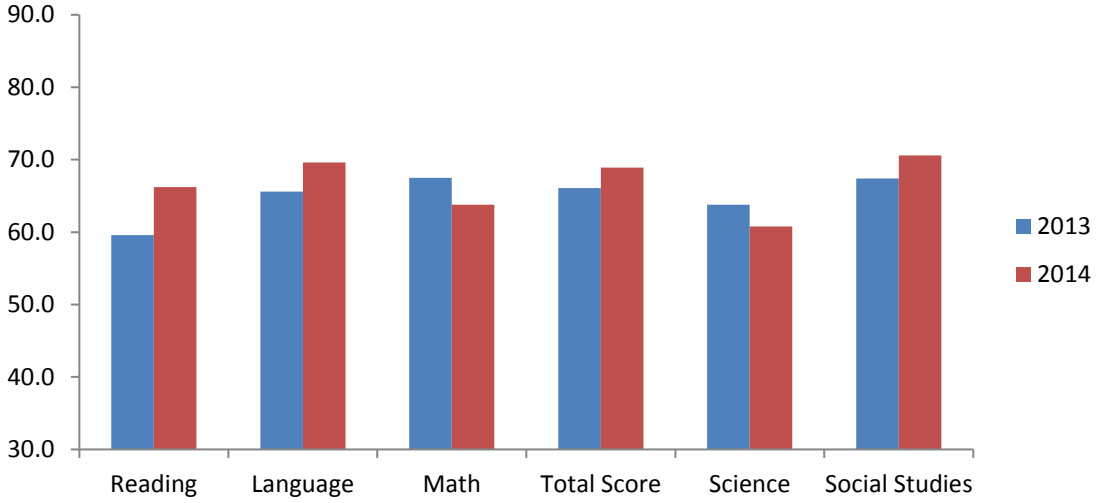
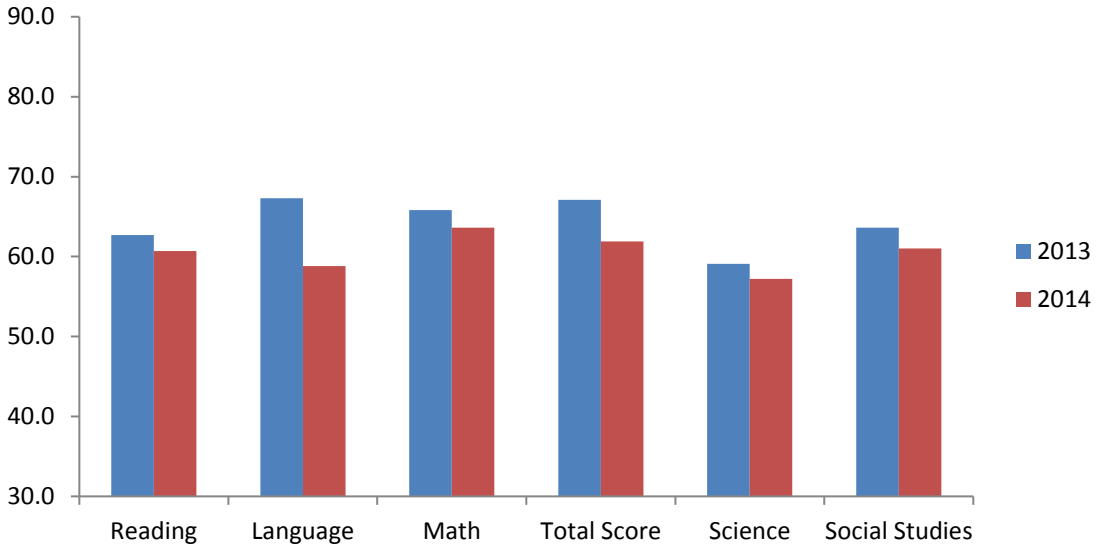


Figure 22

Comparison of Mean NCE of Grade 7 (School A)



School A implemented its multi-age classroom programs in the Fall of 2013. The scores were from the Terra Nova test administered in March 2013 and 2014. The results in Table 28 and Figures 15 to 22 showed significant growth in Mean NCE scores for

Table 29

School B Mean Normal Curve Equivalent Scores (Mean NCE)

Grade	Mean NCE	Reading	Language	Math	Total Score	Science	Social Studies
KG	**2013**	41.1		57.4	49.7		
	2014	50.8		58.8	55.4		
	Difference	9.7		1.4	5.7		
	DIFF	**Above**					
G1	**2013**	71.7		63.1	73.4	70.7	87.4
	2014	37.8		38.3	40.7	43.3	42.3
	Difference	-33.9		-24.8	-32.7	-27.4	-45.1
	DIFF	**Below**		**Below**	**Below**	**Below**	**Below**
G2	**2013**	43.3		45.4	42.7	53.6	49.1
	2014	52.7		37.5	44.5	49.5	48.6
	Difference	9.4		-7.9	1.8	-4.1	-0.5
	DIFF	**Above**		**Below**			
G3	**2014**	36.7	30.3	30.1	31.4	36.5	33.0
	2016	45.3	40.4	39.1	41.4	42.2	41.1
	Difference	8.6	10.1	9	10	5.7	8.1
	DIFF	**Above**	**Above**	**Above**	**Above**		**Above**
G4	**2013**	60.5	60.9	47.7	56.2	54.4	63.4
	2016	44.6	43.0	40.6	42.0	46.2	44.4
	Difference	-15.9	-17.9	-7.1	-14.2	-8.2	-19
	DIFF	**Below**	**Below**	**Below**	**Below**	**Below**	**Below**
G5	**2013**	56.1	56.1	40.6	50.0	46.5	45.5
	2014	57.2	64.3	56.5	60.2	60.6	51.5
	Difference	1.1	8.2	15.9	10.2	14.1	6
	DIFF		**Above**	**Above**	**Above**	**Above**	
G6	**2013**	61.7	61.5	52.7	59.7	63.6	61.4
	2014	62.1	53.4	48.3	54.5	56.9	52.9
	Difference	0.4	-8.1	-4.4	-5.2	-6.7	-8.5
	DIFF		**Below**				**Below**
G7	**2013**	58.1	60.5	53.0	57.4	50.1	57.8
	2014	63.2	69.0	59.8	66.0	52.2	59.0
	Difference	5.1	8.5	6.8	8.6	2.1	1.2
	DIFF		**Above**		**Above**		
G8	**2013**	45.4	47.5	41.1	43.5	46.5	43.8
	2014	64.3	65.1	59.5	64.4	54.9	60.4
	Difference	18.9	17.6	18.4	20.9	8.4	16.6
	DIFF	**Above**	**Above**	**Above**	**Above**	**Above**	**Above**

***Total score is Reading, Language, and Math for all levels that contain Language.*

Grade K, Grade 3, and Grade 4 in School A. However, a significant decrease is found for Grade 2, Grade 5, and Grade 7. Although there is a small change for Grade 1 and Grade 6, the difference is not considered educational meaningful. The results from School A indicated that the impact of the multi-age classroom program and the MAC PLC is mixed. For some grades, significant growth was found (K, G3, G4). For some grades, there is decrease in students' performance (G2, G5, G7).

The Mean Normal Curve Equivalent scores for grades K to 8 in School B in 2013 and 2014 are shown in Table 29. Since the data for Grade 3 in 2013 is unavailable, the Mean NCE scores of 2014 and 2016 for Grade 3 are shown. Because the data for Grade 4 in 2014 is unavailable, the Mean NCE scores of 2013 and 2016 for Grade 4 are shown. The comparison of the Mean Normal Curve Equivalent scores for grades K to 8 (except Grade 3 and Grade 4) in School B are shown in Figure 23 to Figure 29.

Figure 23

Comparison of Mean NCE of Grade K (School B)

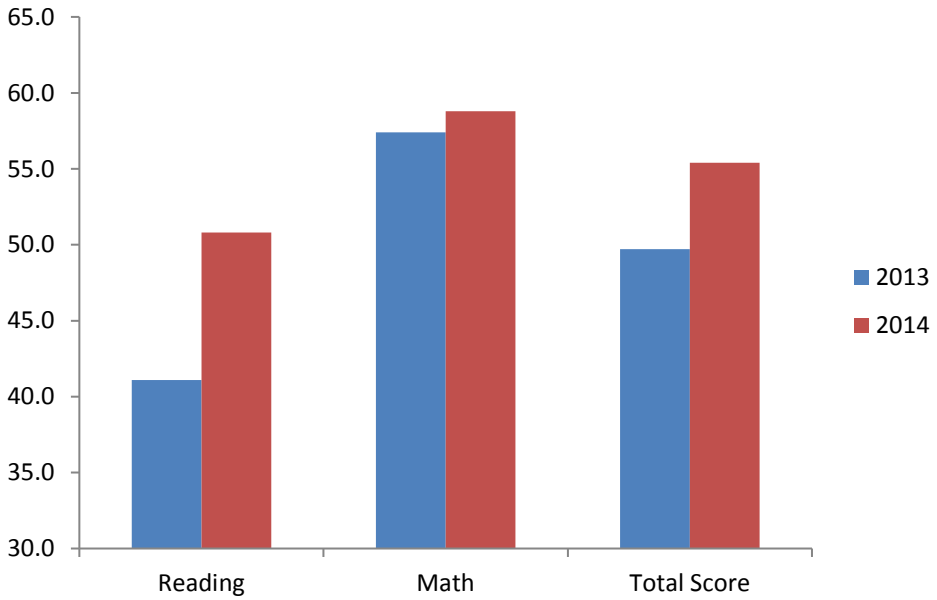


Figure 24

Comparison of Mean NCE of Grade 1 (School B)

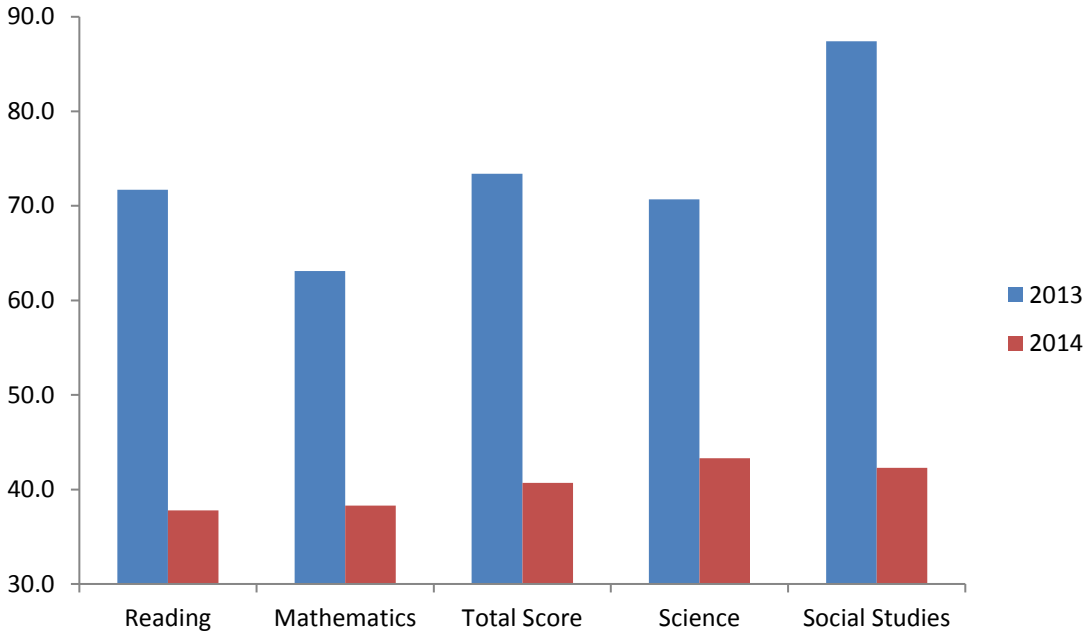


Figure 25

Comparison of Mean NCE of Grade 2 (School B)

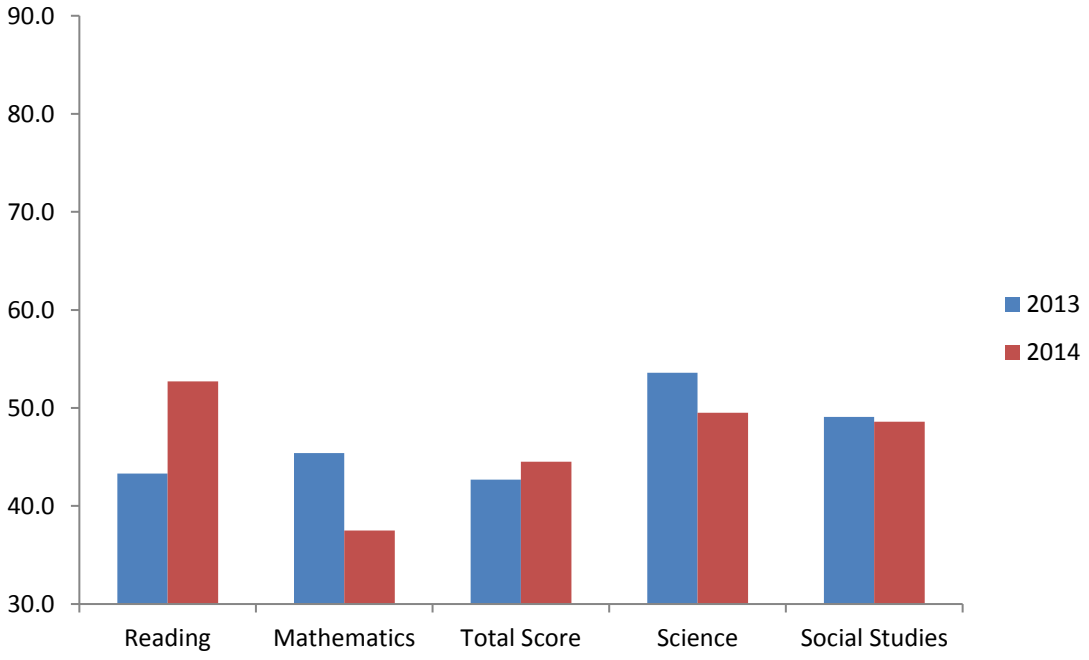


Figure 26

Comparison of Mean NCE of Grade 5 (School B)

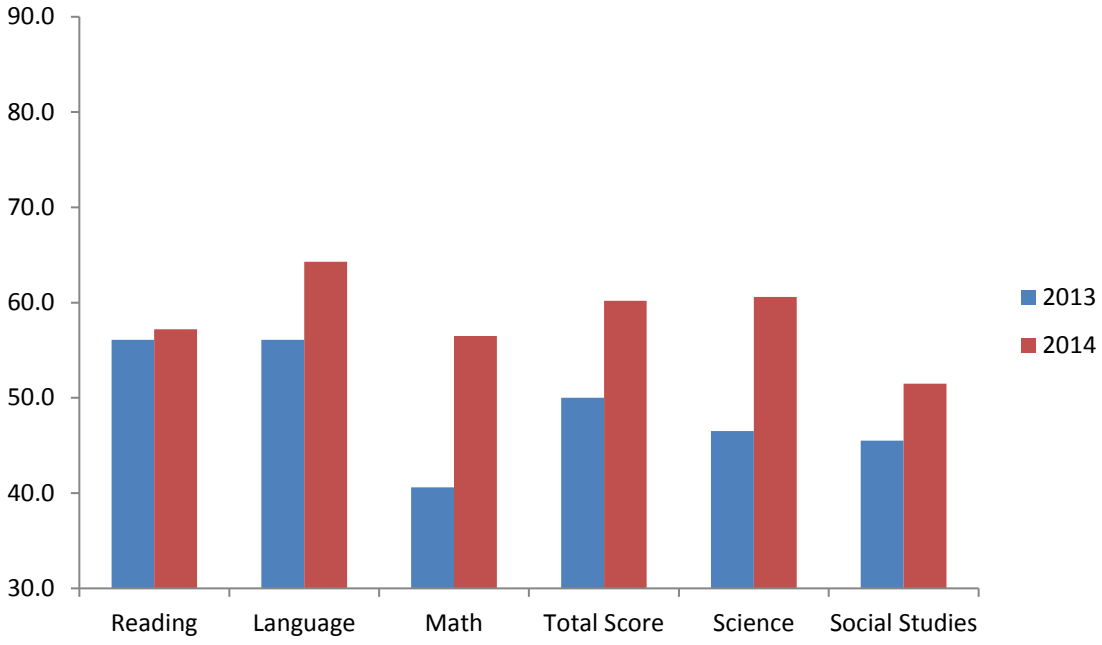


Figure 27

Comparison of Mean NCE of Grade 6 (School B)

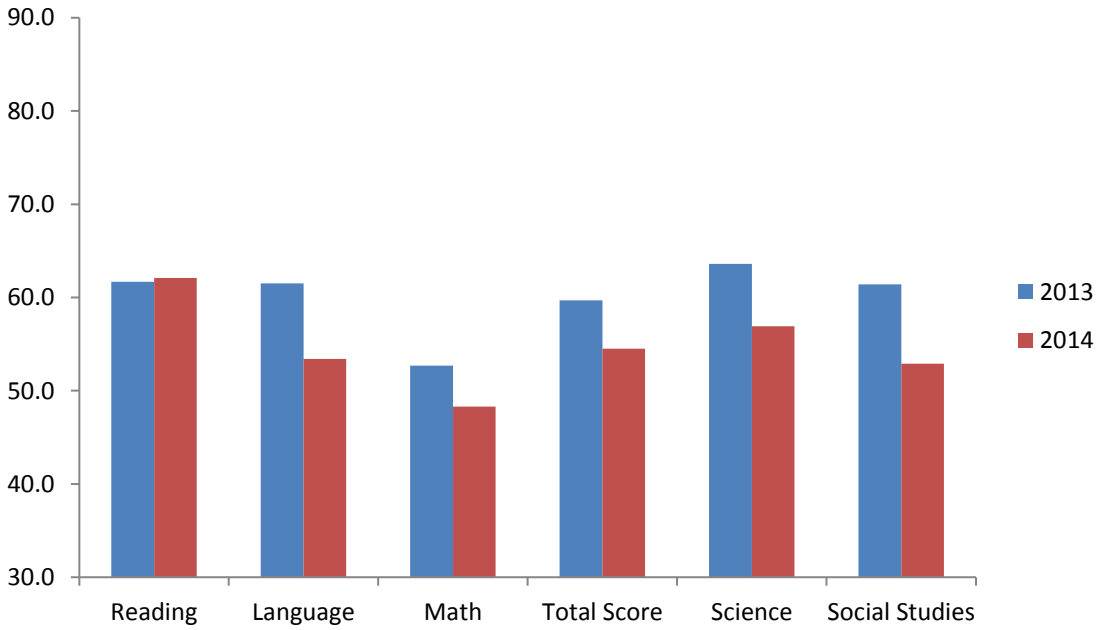


Figure 28

Comparison of Mean NCE of Grade 7 (School B)

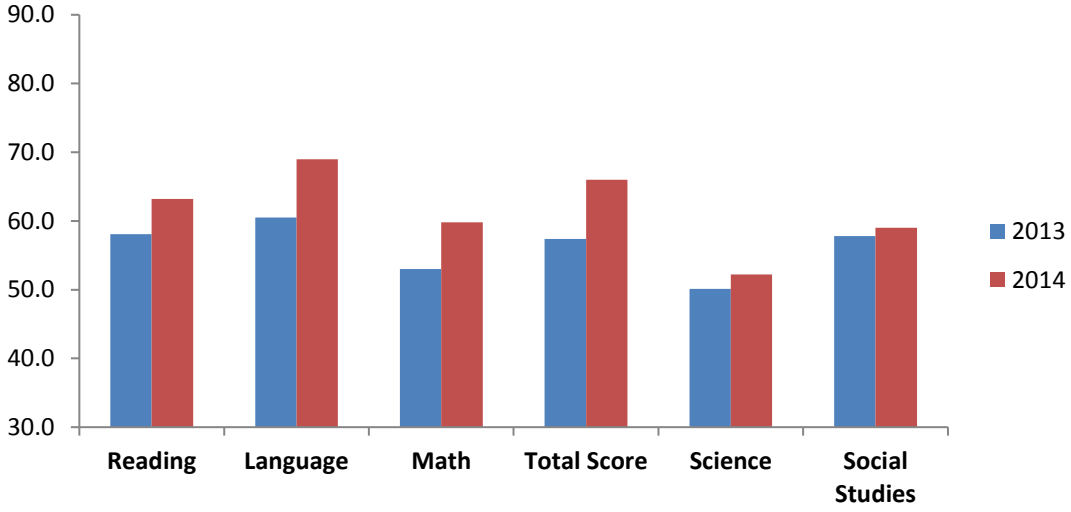
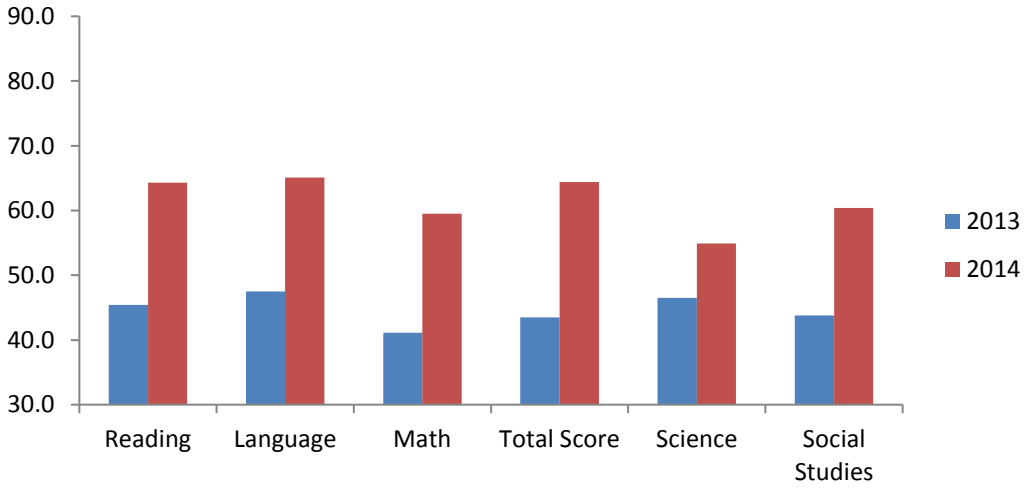


Figure 29

Comparison of Mean NCE of Grade 8 (School B)



School B also started its multi-age classroom programs in the Fall of 2013. The scores were from the Terra Nova test, administered in March 2013, 2014, and 2016. The results in Table 29 and Figures 23 to 29 showed significant growth in Mean NCE scores for Grade K, Grade 5, Grade 7, and Grade 8 in School B. The biggest increase was found in Grade 8. Significant improvements were detected in all five test areas. A significant

decrease is found for Grade 1 and Grade 6. The biggest decrease was in Grade 1 in all four test areas. Because data for Grade 3 and Grade 4 is unavailable in either 2013 or 2014, the results for the two grades are not included. A mixed result is found for Grade 2. In reading, significant growth was found, while a significant decrease was found in math. There is no significant change in other test areas, including science and social studies. The results from School B indicated that the impact of the multi-age classroom program and the MAC PLC is positive for four out of seven compared grades (57%) and negative for two out of seven compared grades (29%).

From results from schools A and B, after implementing multi-age classroom programs and the MAC PLC, significant improvement was found in nearly half of the compared grades. However, a decrease was also found in a noticeable number of grades. Therefore, the impact of the multi-age classroom program and the MAC PLC is mixed in this study. In general, it was safe to conclude that implementing the multi-age classroom and the MAC PLC did not harm students' academic performance.

The decrease in students' performance could have many reasons. One most possible reason could be the challenge introduced by the school's transformation to a multi-age school.

Teachers play a very important role in students' success. A big drop was found in Grade 1 of School B. In 2013, 14 students were in G1 and Teacher B was the first-grade teacher. In 2014, 19 students were in G1 and Teacher B7 was the first-grade teacher. Teacher B was a senior teacher with 23 years of experience in School A and seven years of experience in other schools. In total, Teacher B had 30 years of experience in teaching. However, Teacher B7 was hired just before the start of the multi-age classroom program.

Teacher B7 wrote in her 2013 September journal, "*In September multi-age was a challenge for me since I was hired the Friday before Labor Day. I was not formally trained with the workshops that were offered over the summer. Due to that situation, I had to read, research, and create what I thought a multi-age classroom would consist of. Faced with this challenge, and just the fact that September for any classroom is difficult, I don't feel that I was performing at my best*." In January 2014 journal, Teacher B7 wrote, "*My only worry about centers with the multi-age classroom is I question whether the students will be ready to take the Terranova in the spring*." In February 2014 journal, Teacher H wrote, "*At this time, it has been a difficult time for multi-age*." The Terra Nova test was given in March 2014. Teacher B7 had a very short time to adjust to the new school and the multi-age classroom. Also, Teacher B7 had no training for teaching in multi-age classrooms before she started in School B.

In multi-age classrooms, students with more age groups and diverse ability levels need to be taught. More successful instructional strategies, resources, and classroom management methods are needed. Although teachers in these two schools got training and support from the MAC PLC, it still needs some time to develop their teaching skills. More findings about teachers' perceptions of challenges in teaching students in multi-age classrooms and in implementing the PLC can be found in the following subsection of this chapter.

Another reason for the decrease in students' test scores in Terra Nova could be that grade-level standardized tests such as Terra Nova are not the best assessment method for students in multi-age classrooms. As discussed in S. Miller (2017), "*the move to standards-based education with testing on grade level has made multiage classrooms*

really challenging." Lynch (2018) also stated, "*Administrators can also struggle with the concept and the management of multi-age classrooms. However, their issues are mainly due to the federal and state accountability laws that require students to take standardized tests by grade level, as already outlined. Because multi-age classrooms tend to blur the grade level standards and do so deliberately (at least to some degree), it can also be difficult to fairly administer standardized tests.*" Frost (1997) suggested that "*standardized assessment does not challenge some students, it frustrates other students, and does not provide the kinds of information needed for formative evaluation*."

Qualitative Findings

In the MAC PLC, teachers and educational leaders collaborate on instructional practices to improve teaching and learning in multi-age schools. Participants shared their feelings and perceptions about challenges in teaching in multi-age classrooms, how MAC PLC can help, and their perceptions about PLC experiences. Qualitative data was used to answer research questions four to six and get a complete picture of PLCs in multi-age schools.

Table 30

Qualitative Data

Data Source	***Data Source Details***	***School A***	***School B***	***Total***
Survey (ID:1-ID: 155)	Open-ended questions responses from Teacher School Attitude Survey 2013-2015	93	62	155
Focus Group (ID:1-ID: 199)	Focus Group (2013-2015)	n/a	n/a	199
PLC Meeting (ID:1-ID: 25)	PLC Meeting Agendas and Minutes (2013-2015)	9	16	25
Journal (ID:1-ID: 88)	Teacher Journals (2013-2015)	32	56	88

Table 31

Questions in Qualitative Data

Data Type	***Questions***
Focus Group	FGQ1. Do you feel comfortable with the multi-age planning process based on what you have learned in the Academy? FGQ2. What strengths do you believe your school has that will influence program implementation based on what you have learned so far? FGQ3. What resources do you think you will need to successfully implement the program based on what you have learned so far? FGQ4. What are some challenges that might surface during program implementation? What challenges do you believe you will face in implementing a PLC?
Teacher Journals	JQ1. What strategies have you integrated to your classroom from the Summer Academy? JQ2. Describe the success you have in the classroom. JQ3. Show evidence of the success. JQ4. What are some challenges you have in the classroom? JQ5. How can the MAC (Multi-Age Classroom) team assist you? JQ6. How do you perceive your role as a teacher leader (think of your expertise, coaching ideas and the multi-age program)? (For teacher leaders)
Open-ended questions in Teacher School Attitude Survey	TOQ1: Do you multi-age in your classroom? Why or Why Not? TOQ4: How important is having a common approach and understanding of multi-aging among all staff in order for it to happen? TOQ5: Do you think multi-aging is applicable to this school? Why or why not? TOQ8: Describe the approach of your school (i.e., theming, collaborative planning) toward multi-aging. TOQ9: What are some considerations or planning that need to be in place before a school initiates a multi-aging approach? TOQ10: What are some successes you have experienced this year? TOQ11: What are some challenges you have faced this year

The focus group data were collected from focus group sessions conducted in the MAC Summer Academy from 2013 to 2015. In addition to focus groups, other data sources included PLC meeting agendas/minutes, open-ended questions responses from the Teacher School Attitude Survey (Q1,4,5,8,9,10,11), and teacher journals. Table 30

lists all the qualitative data used in the research. Table 31 lists questions in the qualitative data.

Both deductive and inductive analysis were used to analyze qualitative data. The researcher immersed in the data by reading through all the qualitative data and organized the data into a Microsoft Excel file. In the first cycle of coding, the researcher used deductive analysis to create an organizational schema by applying attribute codes such as data type (e.g., “focus group”, “journal”), location (e.g., “School A”, “School B”), participants (e.g., “Teacher A1”), and time period (e.g., “August 2013”).

During the second read-through of the data, the researcher created topical categories of interest and then sorts the data into those categories (e.g., “challenges”, “school human and social resources”, and “school structural conditions”).

Then inductive content analysis was used. The researcher read through the data in each data type organized in the first round of deductive coding. Next, the researcher used open coding to analyze the data line by line. The researcher created and applied codes to data excerpts and identified emerging topics or concepts as the researcher read. Data excerpts were color coded in the Dedoose software (*Dedoose*, n.d.). Open codes were generated during the data interpretation and analysis on the characteristics of the professional learning community, facilitators, and challenges in PLCs based on the theoretical framework and literature review.

After some inductive analysis of the data, deductive analysis was used to create codes (e.g., six characteristics of PLCs) based on the theoretical framework, and then the coded data were sorted into those predetermined categories. Finally, after all the patterns and themes were identified, the patterns and themes were used to answer the three

qualitative research questions for detailed explanations and a deeper understanding of the research questions.

Question 4 – Evidence of PLCs in Multi-age Schools

Question 4. What is the evidence for the professional learning community in multi-age schools?

In order to answer research question four, the researcher examined all four qualitative data sources to get a deeper understanding of the six PLC characteristics identified in the theoretical framework. Patterns across all four types of data demonstrated a strong presence of the six characteristics of the professional learning community. Frequencies and percentages of themes (in Table 32) is presented in the following section.

Table 32

Thematic Analysis Results for PLC Characteristics

PLC Characteristic	*Frequency*	*Percentage %*
Collective Responsibility	10	4%
Reflective Dialogue	69	27%
Deprivatized Practice	42	16%
Shared Sense of Purpose	41	16%
Peer Collaboration	54	21%
Focus on Student Learning	41	16%

The thematic analysis revealed Collective Responsibility as a characteristic of PLCs in multi-age schools. This theme indicated that teachers are dedicated and willing to do what it takes to have multi-age schools to be successful; teachers feel responsible to help each other do his/her best, and teachers are eager to try new ideas. Evidence of this theme is below:

- Focus Group (ID: 37, 08/2013):

Staff is creative and excited to learn. Staff has been talking about 21st century plans.

- Focus Group (ID: 188, 08/2015):

  I have a faculty that will try anything. They are not scared of anything. This is immensely important to the success of this program.

- Focus Group (ID: 64, 08/2013):

  our commitment to helping each other

There was evidence, mostly from teacher journals and PLC meeting agendas/minutes, that teachers were participating in activities related to reflective dialogue. Evidence of this theme is below:

- Journal (ID:87, 02/02/2015, Teacher A7, School A):

  I have used the writing clinic idea that you demonstrated especially with the sixth graders and it works well.

- Journal (ID:78, 02/2015, Teacher A4, School A):

  I was thinking that once we discuss the parts of plants, and more key words, I will ask the student's questions, and we can make a word wall for science, and math. Kind of like when Sr. C did the lesson with us on shapes, and solids. That was a fun way to get words for the word wall, and the class will be the ones writing the words which is great!!!

- Journal (ID:62, 12/2013, Teacher A4, School A):

  I also, enjoyed meeting with all of you, and being able to ask questions. I was glad that I was able to have information clarified.

- Journal (ID:15, 03/2014, Teacher B7, School B):

Multi-age went very well in my class last week. We started a new unit on money. This unit is perfect for both age groups of primary students since it meets both standards well.

- Journal (ID:13, Sep. & Oct. 2013, Teacher B1, School B):

  My guided reading and MA stations are going very well. I really feel like I have a good grasp on teaching in the MA classroom. I look forward to teaching each day and enjoy my MA experience.

- PLC Meeting (ID:15, 03/17/2016, School B):

  the student leader role has been really progressing. they became the teacher in their group.

- PLC Meeting (ID:13, 01/14/2016, School B):

  Lesson study was a great learning experience.

There was evidence across all four sources of data that teachers were participating in deprivatized practice, including visiting other teachers' classrooms to observe instruction, having other colleagues observe their classroom, receiving meaningful feedback from colleagues, and inviting someone to help teach their classes. Evidence of this theme is below:

- Journal (ID:68, Sep.-Dec. 2013, Teacher A6, School A):

  11/5/13 Sr. C visited classrooms and discussed finalizing the topic for implementation:

- Journal (ID:53, 03/17/2016, Teacher B3, School B):

  continue to provide feedback on ways multi-age is working and ways I can continue to grow

- Journal (ID:43, 03/31/2015, Teacher B2, School B):

  The model lesson I was shown was for a "opening lesson" and meant for the entire class

- Journal (ID:43, 03/31/2015, Teacher B2, School B):

  After my first observation I thought the class went very well. I am still gaining control of the classroom and classroom management played a large role in my lesson being perceived as "rushed".

- Journal (ID:36, 10/28/2014, Teacher B3, School B):

  I am very pleased to be getting such constructive feedback from the team this year and to see that there will be an active role played in all classrooms this year. I felt it was missing last year and as though I was left to float or sink on my own.

- Journal (ID:36, 10/28/2014, Teacher B3, School B):

  C said she would model a Writing Workshop lesson for me in the classroom. While I know and understand the components of the Workshop, I definitely think it will help my implementation to see it in action.

- PLC Meeting (ID:24, 10/16/2014, School A):

  B wanted me to do writing workshop with her kids.

- PLC Meeting (ID:24, 10/16/2014, School A):

  And then lesson study. A teacher in the PLC group takes a lesson, all the teachers develop it, and one teacher volunteers to teach it, and then you go in and watch—what are the children doing? Do they get it, and how can that improve?

- PLC Meeting (ID:24, 10/16/2014, School A):

  And then we have instructional rounds where we go around as a team and look at what's going on in the classroom. And it's not an evaluation of the teacher. It's just to figure out what's going on, what is our problem. Maybe math needs to improve in the school. So you go look to see how math's being taught and what can we do to improve on it.

- PLC Meeting (ID:24, 10/16/2014, School A):

  That would be great because we never really had a model of writer's workshop or even reader's workshop to be honest with you and I know public schools all use it and that would be fantastic if we could see that. 'Cause then we'll know…especially me…I want to do it, but I don't know where to go…

- Focus Group (ID: 193, 08/2015):

  Yes I feel in going through the workshop, to see and get the experience

- Survey (ID:111, 08/2014, Teacher A4, School A):

  Working with the 2nd grade teacher in science. We had a great time teaching science.

There was evidence across all four sources of data for a high level of shared sense of purpose. It is an important dimension in developing and sustaining an effective professional learning community. A shared sense of purpose highlights that school members have a common goal, believe in the school's values and vision, and work together to make the vision a reality. The goals and priorities for the multi-age schools are clear. Evidence of this theme is below:

- Journal (ID:26, 12/2013, Teacher B6, School B):

  We are also examining the school identity and how in the second half of the year we will work that theme into our school community.

- PLC Meeting (ID:25, 04/22/2014, School A):

  Being a team player has been part of my professional life. I truly understand that in multiage, teachers need to work together toward the goal.

- PLC Meeting (ID:21, 01/23/2014, School A):

  The principal to conceptualize mission and vision of school

- Focus Group (ID: 47, 08/2013):

  You will find strengths in the fact that the whole school will be implementing it.

- Survey (ID:84, 08/2014, Teacher A3, School A):

  It is essential for all staff members to have a clear understanding of the approach and goals of multi-aging.

- Survey (ID:66, 06/2014, Teacher A9, School A):

  It is very important so that we're all on the same pace to provide the best education for our children.

- Survey (ID:49, 02/2015, Teacher B1, School B):

  We are a collaborative themed multi-age school that focuses on literacy

- Survey (ID:12, 06/2014, Teacher B4, School B):

  multi-age is applicable to this school since all staff had one common goal

There was evidence across all four sources of data that teachers were collaboratively working together. Evidence of this theme is below:

- Focus Group (ID: 42, 08/2013):

  As a faculty, we have done collaborative and have talked about our practice.

- Survey (ID:17, 06/2014, Teacher B9, School B):

  Our school has a collaborative staff that works together.

- Journal (ID:62, 12/2013, Teacher A4, School A):

  Last Friday, December 6th, I sat down with my co-worker to work on our web. It was great that we were able to do this.

- Journal (ID:3, 11/2013, Teacher B4, School B):

  I am very thankful for the supportive staff I work with. We all work together really well, and I am grateful for them.

- PLC Meeting (ID:20, 12/05/2013, School A):

  Pk-4Teachers said their collaboration was coming along fine. They said they need to continue to collaborate more to better plan appropriate learning activities.

- PLC Meeting (ID:10, 09/24/2015, School B):

  So lesson study, we will review what we done during the summer. It is a collaborating, teachers come together, specific including study and lesson.

With the help from the MAC PLC, teachers were able to target the individual needs of all students through the application of the multi-age program components - flexible or fluid grouping, active learning, process-based curricula, interdisciplinary studies, formative assessment, and a consideration of multiple intelligences. There was evidence across three sources of data that teachers placed a focus on student learning, including the use of student work and data in order to increase rigor. Additionally, several

comments were made about how multi-age classrooms benefited students in different ways. Evidence of this theme is below:

- Journal (ID:54, 03/17/2016, Teacher B1, School B):

  The various assessments show academic mastery of the skills and concepts taught.

- Journal (ID:51, 02/18/2016, Teacher B1, School B):

  Differentiation is a solid focus of MAC. The MAC has made me always teach to all levels of learning and identify the needs and wants of my students learning.

- Journal (ID:9, 10/2013, Teacher B5, School B):

  Student learning and improvement is evident.

- PLC Meeting (ID:8, 10/02/2014, School B):

  whatever their reporting sheet is, and I can take it at the end of the week and check all the work they've done

- Survey (ID:149, 02/2015, Teacher A4, School A):

  My class has worked really hard, and it is wonderful to see the students helping one another on seatwork and/or projects.

- Survey (ID:80, 06/2014, Teacher A1, School A):

  The younger children have made progress and have been exposed to more challenging concepts and ideas.

- Survey (ID:79, 06/2014, Teacher A10, School A):

  Children are learning from one another and have improved on all skills compared to September.

- Survey (ID:24, 06/2014, Teacher B5, School B):

  A positive attitude towards MA from students and increased performance in standardized testing scores.

- Survey (ID:4, 06/2014, Teacher B1, School B):

  Using multiage in my classroom helps my students learn more skills and creates an environment for all levels of learners to achieve success.

Question 5 – Facilitators of PLCs

Question 5. What do teachers perceive as facilitators of the professional learning community in multi-age schools?

Since research has identified the benefits of PLCs in improving teacher professional development and student learning performance, it is important to examine factors that facilitate PLC development. Therefore, as stated in chapter one, this study examined factors that may facilitate the successful implementation of PLCs in multi-age schools.

For PLCs to function effectively, the physical or structural conditions and the human and social factors must be optimal (Boyd, 1992; Louis & Kruse, 1995). Louis and Kruse (1995) identify the following school structural factors that support PLCs: time, small school size, physical proximity, teacher empowerment and autonomy, and communication. Boyd (1992) summarized a similar list of facilitators to PLCs: resources, schedules, collaboration, communication, and professional development. Louis and Kruse (1995) listed the human and social resources needed for a productive PLC: openness to improvement, trust and respect, cognitive and skill base, supportive leadership, and socialization.

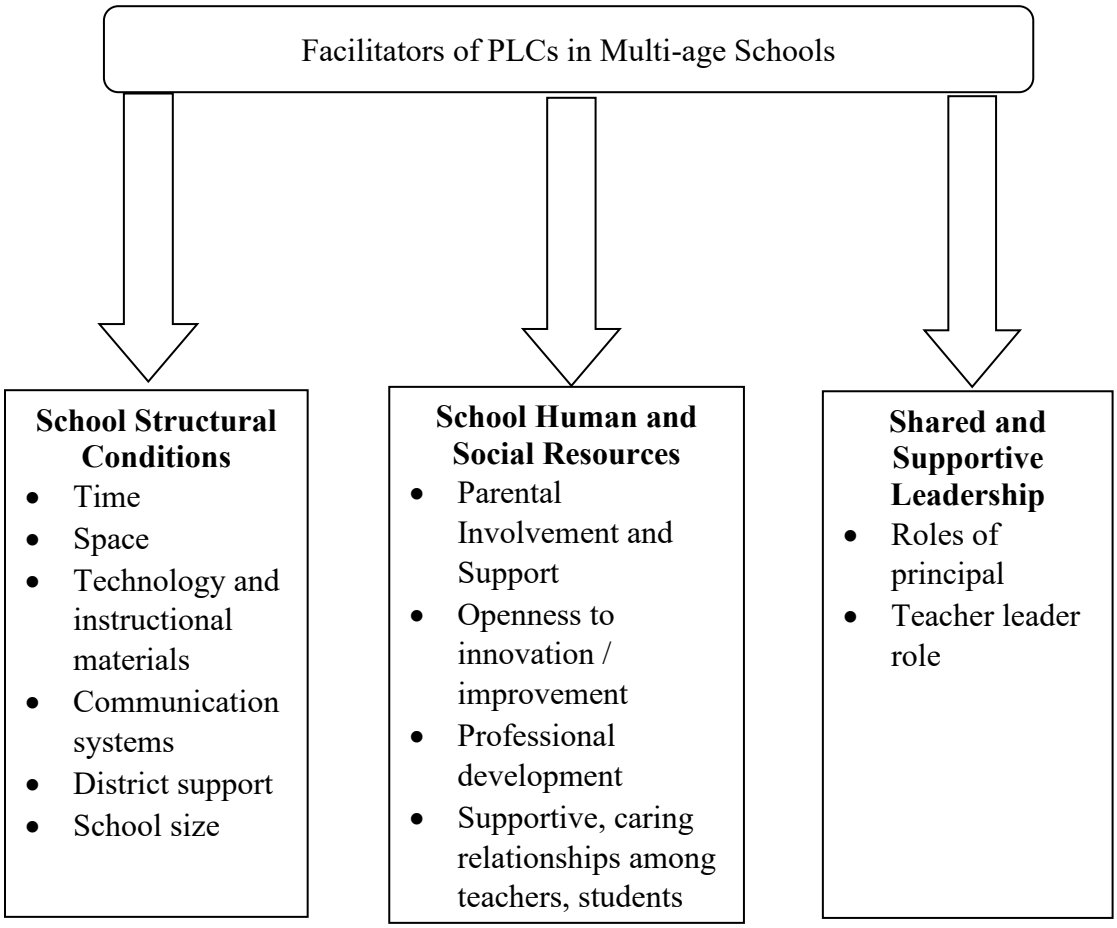
Teachers were asked to describe the implementation of school-level professional learning communities and about the assistance they received. Qualitative data helped to reveal facilitators of professional learning community implementation. Teachers were asked to share their perceptions about resources needed to implement a PLC in multi-age schools successfully. Qualitative data, especially responses of participants to the following questions, were analyzed to answer research question five:

- FGQ3. What resources do you think you will need to successfully implement the program based on what you have learned so far?
- JQ5. How can the MAC (Multi-Age Classroom) team assist you?
- TOQ5: Do you think multi-aging is applicable to this school? Why or why not?
- TOQ9: What are some considerations or planning that need to be in place before a school initiates a multi-aging approach?

The specific factors teachers perceived as necessary and important to implementing the MAC PLC were examined. From the open-coding method, themes and subthemes emerged from qualitative data regarding facilitators of professional learning communities in multi-age schools. Three themes and 12 subthemes were identified as facilitators of professional learning communities in multi-age schools. Figure 30 shows the themes and sub-themes that participants identified as facilitators of PLCs in multi-age schools. Peer review of the coding frame by experts in the field and triangulation of findings establishes the trustworthiness of the qualitative findings.

Figure 30

Facilitators of PLCs in Multi-age Schools



School Structural Conditions. The first theme that emerged from the qualitative data as a facilitator of PLC was school structural conditions. Six dimensions of supportive structural conditions were identified as facilitators of PLCs in multi-age schools. Those dimensions were: 1) time, 2) space, 3) technology and instructional materials, 4) communication systems, 5) district support, and 6) school size. Time for staff to meet, appropriate technology and instructional materials, and communication systems are the top three crucial physical conditions that facilitate the implementation of PLCs, as shown in Table 33. Gallant (2009) also identified time and materials as

facilitators of PLCs.

Table 33

Thematic Analysis Results for School Structural Conditions

School Structural Conditions	*Frequency*	*Percentage %*
Time	13	25%
Space	2	4%
Technology and instructional materials	13	25%
Communication systems	15	28%
District support	3	6%
School size	7	13%

Making time available for teachers to meet and discuss teaching and student learning issues is a critical facilitator of a PLC. Across both schools, evidence in several data sources indicated that teachers were given time for PLCs. Evidence of this theme is below:

- Focus Group (ID: 6, 08/2013):

  Principal indicated that she was trying to arrange for two hours of planning per week. The possible suggestions was to plan by PLCs.

- Journal (ID: 62, 12/2013, Teacher A4, School A):

  It was great that we were able to do this, and were given the time by the principal. It is very pleasant when you have the time to work things out, and talk to a colleague.

- PLC Meeting (ID: 23, 04/10/2014, School A):

  Staff allowed time to plan an ID unit lesson as a PLC.

- PLC Meeting (ID: 14, 02/18/2016, School B):

  It was nice to have half day to talk. It was interesting.

Participants talked about the space in which they collaborated and described the materials in the space and traffic to the space. Evidence of this theme is below:

- PLC Meeting (ID: 24, 10/16/2014, School A):

  Traffic and equipment. We're goanna need (something)-board or smartboard; we should take that into consideration.

- Focus Group (ID: 153, 08/2014):

  They are going to put one into an activity room that would make it accessible to the rest of the school.

There was a theme across serval sources of data and both schools that technology and instructional materials should be provided. Evidence of this theme is below:

- Journal (ID: 56, 05/05/2016, Teacher: B2, School B):

  The books and primary resources for history have been great.

- Journal (ID: 54, 03/17/2016, Teacher: B1, School B):

  I love the continuation of ongoing resources that you bring to our school. This helps me continue to have more options to different my lessons.

- PLC Meeting (ID: 23, 04/10/2014, School A):

  Provide lesson plans and ID planning unit to teachers.

- Focus Group (ID: 11, 08/2013):

  We were given a lot of help and resources; a lot more practical things for us to use.

There was evidence across all four data sources of the importance of communication systems. Teachers from both schools indicated the need for

communication systems to promote a flow of information across the entire school community, including staff, parents, district, and community members. 10 out of 15 (67%) mentioned communication systems with parents. Evidence of this theme is below:

- Journal (ID: 27, 09/2013, Teacher: B6, School B):

  My ultimate goal was to keep the 3 stakeholders (parents, staff, and students) as informed and calm as possible as our school moved through this transitional period.

- PLC Meeting (ID: 24, 10/16/2014, School A):

  But they try to encourage the parish and the school to do it.

- PLC Meeting (ID: 23, 04/10/2014, School A):

  Recommendation for an open house for parents 28th or 29th of April at night. Rather than a meeting with parents, do an open house during the day and parents can come in and see what MA is all about.

- Focus Group (ID: 192, 08/2015):

  Finding the right data points to lead parents to. What I heard the most from the parents is that they want to know how they know their students are doing well.

- Survey (ID: 101, 08/2014, Teacher: A11, School A):

  There should be more explanation given to all administration-teachers-parents- even children themselves –the more knowledgeable and understanding the better the results.

- Survey (ID: 100, 08/2014, Teacher: A3, School A):

  The approach should be embraced by the core school community and

completely communicated to the entire community.

District support is important for schools in the transition of school culture to multi-age schools. Evidence of this theme is below:

- Focus Group (ID: 90, 08/2013):

  Monetary support and verbal support needs to come from the District – needs to send the message that the multiaging is in the best interests of the children.

- Focus Group (ID: 87, 08/2013):

  Significant real support from the District – they need to support the initiative positively.

Teachers indicated that school size was a facilitator for PLCs in multi-age schools. Evidences of this theme are below:

- Focus Group (ID: 57, 08/2013):

  We have a small school, where everyone knows everyone else.

- Focus Group (ID: 46, 08/2013):

  The fact that we are a small school is beneficial because it will allow us to work together better across grade level and classrooms. The smaller school will make it more manageable for us to implement the PLCs. We are a K-8 school with about 130 students.

- Survey (ID: 10, 06/2014, Teacher B5, School B):

  It is because of the smaller, more intimate nature of the school that students mostly already know each other, and so they're comfortable collaborating.

School Human and Social Resources. The second theme that emerged from the qualitative data as a facilitator of PLCs was school human and social resources. This theme included four subthemes: parental involvement and support, openness to innovation/improvement, professional development, and supportive and caring relationships among students and teachers. Table 34 lists the frequency and percentage of the four sub-themes.

Table 34

Thematic Analysis Results for School Human and Social Resources

School Structural Conditions	***Frequency***	***Percentage %***
Parental involvement and support	12	33%
Openness to innovation/improvement	2	6%
Professional development	19	53%
Supportive, caring relationships among students and teachers	3	8%

There was evidence from all four types of data about the importance of parental involvement and support. Teachers from both schools indicated the need for parental involvement and support. Evidence of this theme is below:

- PLC Meeting (ID: 24, 10/16/2014, School A):

  They're all gonna be moving through and so the parents are just gonna be happy.

- PLC Meeting (ID: 7, 05/01/2014, School B):

  Parents have responded well to the implementation process.

- Focus Group (ID: 41 2013):

  Relationship that faculty has with the student body – parents are involved individually. Schools have had generations of families in the school.

- Focus Group (ID: 162 2014):

  The parents liked the idea of the others ones being mentors.

- Journal (ID: 88, 11/11/2014, Teacher: A9, School A):

  Parents met with me for conferences this past week and many are impressed to what their children are doing in K-1! Writing is a big part of the day.

- Survey (ID: 40, 08/2014, Teacher: B1, School B):

  A strong collaborative unit among staff and administrators and parent involvement.

- Survey (ID: 124, 02/2015, Teacher: A12, School A):

  It is very important as well as parent inclusion in the process.

When implementing PLCs in multi-age schools, teachers and administrators must have an open and flexible mindset to innovation and improvement. Evidence of this theme is below:

- Survey (ID: 40, 08/2014, Teacher: B1, School B):

  Open minded and good social structure.

- Survey (ID: 19, 06/2014, Teacher: B5, School B):

  flexible mindset

In order to successfully implement multi-age classroom programs, teachers need adequate training through professional development. Evidence of this theme is below:

- Focus Group (ID: 32, 08/2013):

  I had done some research about multiage on my own, but these days of the Institute actually give me some ideal of how to implement the

program.

- Focus Group (ID: 20, 08/2013):

I am much more confident today than yesterday, since I learn by seeing examples and a lot of examples were presented.

- Survey (ID: 21, 06/2014, Teacher: B4, School B):

Before multi-aging should be in place, all staff must be thoroughly trained and go to visit other multi-aging schools in the areas.

- Survey (ID: 133, 02/2015, Teacher: A13, School A):

Our teachers attend multiage professional development.

- PLC Meeting (ID: 7, 05/01/2014, School B):

Expose the School B team to the concept of interdisciplinary planning via workshop.

A final pattern noted across three data sources was the supportive and caring relationships between students and teachers. Evidence of this theme is below:

- Journal (ID: 74, 09/2013, Teacher: A4, School A):

I have to say that part of my success was do to the fact that I have an awesome class.

- PLC Meeting (ID: 24, 10/16/2014, School A):

I was very overwhelmed in the beginning, but I have a great group of kids/students; they are wonderful.

- Focus Group (ID: 44, 08/2013):

They (the students) are social with each other, they might help out. Higher level students might know lower level students.

Shared and Supportive Leadership. The third theme that emerged from the qualitative data as a facilitator of PLCs was shared and supportive leadership. The following section presents the frequency and percentages of two sub-themes (in Table 35).

Table 35

Thematic Analysis Results for Shared and Supportive Leadership

School Structural Conditions	*Frequency*	*Percentage %*
Roles of principal	24	71%
Teacher leader role	10	29%

Principal play an important role in the implementation of PLCs. Several types of principal roles are most meaningful in support of PLCs within their schools. Smith and Andrews (1989) categorized the roles of the principal into four dimensions: a resource provider, an instructional resource, a communicator, and a visible presence. More roles of the principal include change agent, culture builder, intellectual conversation facilitator, instruction leader, data analyst, and outreach spokesperson (Cozza, 2017). Evidence showed that school principals aided in scheduling of time, modeling teaching, supporting teachers, and improving communications:

- PLC Meeting (ID: 17, 10/21/2013, School A):

  Get action plans and PLC meeting schedules from principals.

- PLC Meeting (ID: 21, 01/23/2014, School A):

  The principal to facilitate specific meeting schedule for her teachers.

- PLC Meeting (ID: 24, 10/16/2014, School A):

  I liked her. I thought she was an instructional leader. That's what you need your principal to do and she did it.

- Focus Group (ID: 35, 08/2013):

I have to say that our principal is very into this and her enthusiasm is contagious; she is all for PLCs. We have excellent leadership support.

- Journal (ID: 26, 12/2013, Teacher: B6, the principal of School B):

I just keep trying to encourage them to sit and reflect on their lesson plans. Is there a better way to introduce and teach a skill without paper and pencil? I keep asking, "How can we make this easier on ourselves?" What do we need to do to accomplish the goal.

- Journal (ID: 26, 12/2013, Teacher: B6, the principal of School B):

I role modeled a religion class on Advent with one teacher.

- Journal (ID: 27, 09/2013, Teacher: B6, the principal of School B):

I spent as much time as possible in the Lower School. My ultimate goal was to keep the 3 stakeholders (parents, staff, and students) as informed and calm as possible as this school moved through this transitional period. It wasn't easy but it was expected on my part.

The development of teacher leaders has greater relevance for the advancement of multi-age schools (Cozza, 2017). Teacher leaders play a vital role in alleviating the demands placed on administration by assuming many responsibilities related to instructional development and teacher support. Evidence of this theme is below:

- Journal (ID: 48, 12/14/2015, Teacher: B3, School B):

I perceive my role as teacher leader to include collaborate with the other teachers specific to their needs in the classroom and about how I can support them. This could include providing/sharing resources,

observations, and modeling. I hope to be a resource for their needs, a support for what they need.

- Journal (ID: 51, 02/18/2016, Teacher: B1, School B):

My role as a teacher leader is to be a supportive guide to our teachers and students. Always team teach and learn from one another and to make sure lessons are differentiated.

- PLC Meeting (ID: 24, 10/16/2014, School A):

I think you could be one of the teacher leaders where other teachers come and visit and see all the wonderful things that you're doing and learn from that.

Qualitative analysis of facilitators of PLC implementation may shed light on the validity of prior frameworks, which could help to improve approaches to training, and practice in PLCs for multi-age schools.

Question 6 – Challenges in PLCs

Question 6. What challenges do teachers have in implementing a professional learning community in multi-age schools?

Teachers were asked to share their experiences and perceptions about challenges in implementing PLCs in multi-age schools and teaching in multi-age classrooms:

- JQ4. What are some challenges you have in the classroom?
- FGQ4. What are some challenges that might surface during program implementation? What challenges do you believe you will face in implementing a PLC?
- TOQ11: What are some challenges you have faced this year

Table 36

Thematic Analysis Results for Challenges in Implementing PLCs

Challenges in Teaching and Implementing PLCs	*Frequency*	*Percentage %*
Lack of time	51	24%
Lack of adequate training	17	8%
Lack of parent support	40	19%
Lack of technology, supplies, and instructional materials	55	26%
Burden of workload	11	5%
Classroom management	9	4%
Emotional factors	7	3%
Problem of teacher staffing	12	6%
Vast academic levels across grades	7	3%

The findings indicate that several challenges exist. As noted in Table 36, nine themes were identified: lack of time, lack of adequate training, lack of parent support, lack of technology, supplies, and instructional materials, the burden of workload, classroom management, emotional factors, the problem of teacher staffing, and vast academic levels across grades.

The importance of time was frequently noted across all four types of data. For example, one teacher said they had to eat lunch in the classroom with the children and had almost no free periods for prep time. The lack of time for teachers to meet and collaborate about teaching and learning was a serious issue that limited their professional growth. Evidence of this theme is below:

- Journal (ID: 57, 09/2013-02/2014, Teacher: A2, School A):

  The challenges so far that we have experienced have been with the planning time with the schedule that we have here at School A. We think if we had more time for long range planning the implementation would be more successful and smoother for both the teachers and students.

- Journal (ID: 53, 03/17/2016, Teacher: B3, School B):

Finding time for paperwork and planning

- Journal (ID: 2, 10/2013, Teacher: B4, School B):

These requests would have received a lot more focus and less frustration if they were given to us in the summer or discussed at the summer workshop, rather than during the busy school year. There's never enough time.

- PLC Meeting (ID: 25, 04/22/2015, School A):

Presently teachers often do not get to discuss or do things together in a timely manner because of time constraints and scheduling.

- Focus Group (ID: 183, 08/2014):

Time for planning, time for plcs. The schedule is tight. It is hard for teachers. Time is of the essence. People have to work after school after jobs.

- Focus Group (ID: 135, 08/2013):

All this feels very rushed. We needed more preparation time.

- Focus Group (ID: 100, 08/2013):

Finding the time to get all this stuff done. This is a different schedule for us. We have to have built-in prep time. Because we're planning for two grades in the same period it is more of a planning challenge.

- Survey (ID: 133, 02/2015, Teacher: A13, School A):

There is really very little time for collaboration.

Proper training is necessary for teachers to have the knowledge and skills to teach in multi-age classrooms. Teachers from both schools expressed their feeling of being

unprepared at the beginning of the professional learning community. Evidence of this theme is below:

- Journal (ID: 18, 09/2013, Teacher: B7, School B):

  In September multi-age was a challenge for me since I was hired the Friday before Labor Day. I was not formally trained with the workshops that were offered over the summer. Due to that situation, I had to read, research, and create what I thought a multi-age classroom would consist of.

- Journal (ID: 23, 11/2013, Teacher: B3, School B):

  I still feel that if we had had more answers over the summer, had more training in the early parts of summer and more guidance on what we were expected to do when those students walked in on the first day of school, I wouldn't be here now.

- Journal (ID: 1, 09/2013, Teacher: B4, School B):

  Though we went to the workshop in August, I still felt very unprepared for what I was getting into.

- Focus Group (ID: 94, 08/2013):

  If this academy was given in June, then I would feel more comfortable, but we were given this academy just a few weeks before school starts so I feel very overwhelmed with it and very rushed. If this had been given in June, then I would have had time to experiment with it and thought about it and do my own research and even go to another school and observe a PLC is action.

- Survey (ID: 144, 02/2015, Teacher： A4, School A):

Teachers need to have a great understanding of multi-age and should be shown different ideas before having to implement in their classroom.

There was evidence across all four data sources that teachers perceived lack of parent support as one of the top three challenges they met. This is also a challenge across the period of three years for both schools. Evidence of this theme is below:

- Survey (ID: 139, 02/2015, Teacher: A13, School A):

Parents must be informed and not find out on the first day of schools.

- Survey (ID: 32, 06/2014, Teacher: B9, School B):

Parent support is always a challenge. There was a lot of backlash.

- Journal (ID: 27, 09/2013, Teacher: B6, School B):

Parents were quiet, not always a good sign.

- Journal (ID: 4, 01/2014, 02/2014, Teacher: B4, School B):

Unfortunately, some parents are still resistant to MA, and they make that very apparent. For example, on report card night that seems to come up as a constant concern rather than the discussion of the child's academics. No matter how hard we work and drive the children, there are still parents who are resistant, gossip, and work against us rather than with us.

- PLC Meeting (ID: 25, 04/22/2015, School A):

Mother spoke at parent meeting about her concern with brothers being in the same class.

- PLC Meeting (ID: 15, 03/17/2016, School B):

We have some bossy parents. Then you cannot be the teacher.

- Focus Group (ID: 182, 08/2014):

Parents – not wanting to be part of the program, not understanding the program. To me that is the sink of swim of the program.

- Focus Group (ID: 131, 08/2013):

Parental involvement in intermittent and not substantial. There is minimal parent follow through on participation or providing resources.

- Focus Group (ID: 117, 08/2013):

To get the parents to come in and participate. Lack of parental involvement is a big issue.

- Focus Group (ID: 74, 08/2013):

I think you need to get the parents involved to become aware of what we're doing. But when parents don't know they go in the opposite direction because they are afraid of the unknown. They expect us to have all the answers right now. But we're also learning so it takes time for us to better express what this is all about. It is a learning task for us also as we get our feet wet. Parental support is one of the biggest challenges.

There was evidence across all four sources of data that limited resources and technology was a big challenge for teachers teaching in multi-age classrooms and implementing the PLC. Evidence of this theme is below:

- Journal (ID: 60, 11/2013, Teacher: A7, School A):

The computers in school are very slow and often freeze making it very hard to work on the projects.

- Journal (ID: 20, 11/2013, Teacher: B7, School B):

You start to spend money on buying manipulatives that will spark an interest in each child. Unfortunately, as you know Catholic school teachers do not make much money so this is difficult in itself. Also, sometimes it is tough to come up with four centers that focus on the same objective.

- PLC Meeting (ID: 25, 04/22/2015, School A):

Technology needs to be updated. Internet access is way too slow and sporadic for necessary research.

- PLC Meeting (ID: 8, 10/02/2014, School B):

We have a variety of technological challenges here.

- Focus Group (ID: 132, 08/2013):

Teachers buy many of their own supplies, at significant personal cost. Providing supplies and materials to classroom teachers is a very significant challenge.

- Focus Group (ID: 91, 08/2013):

All teachers concurred that more technology was needed.

- Survey (ID: 151, 02/2015, Teacher: A14, School A):

Lack of computers and tablets. No smart board. Lack of novels.

- Survey (ID: 115, 08/2014, Teacher: A7, School A):

Working with limited resources and limited technology.

There was evidence across three sources of data that teachers felt challenged by the burden of planning and paperwork. Evidence of this theme is below:

- Journal (ID: 27, 09/2013, Teacher: B6, School B):

  Staff was exhausted and overworked.

- Journal (ID: 21, 03/2014, Teacher: B3, School B):

  I am having difficulty with the many changes in paperwork and the amount of paperwork and recording that I need to do.

- Journal (ID: 2, 10/2013, Teacher: B4, School B):

  Constantly planning and assessing kept me busy enough; however, continuous requests for this curriculum, these goals, or that PDP, were a bother within itself.

- Survey (ID: 62, 02/2015, Teacher: B3, School B):

  Planning and paperwork

- Focus Group (ID: 191, 08/2015):

  With the second and third, it is a lot of one to one. Everyone is special needs. It is hard for planning. It is harder when you combine the two grades.

There was evidence across three sources of data from School B that classroom management was a challenge for teachers. Evidence of this theme is below:

- Journal (ID: 26, 12/2013, Teacher: B6, School B):

  In order for MA to work effectively the children need to be somewhat settled and ready to work. Finding that environment proved difficult. The staff work hard at getting their end right – or right according to

them- and the children do not cooperate.

- Journal (ID: 11, 02/2014, Teacher: B1, School B):

It has definitely been a challenge keeping the students on task with all these interruptions.

- Survey (ID: 31, 06/2014, Teacher B4, School B):

The most common challenge I faced was making sure that there was always classroom management techniques in place.

There was evidence across four data sources from both schools that some emotional factors caused challenges in teaching multi-age classrooms and in implementing PLCs. Evidence of this theme is below:

- Journal (ID: 43, 03/31/2015, Teacher: B2, School B):

In preparing for the school year I am super nervous over the idea of teaching multi-age classroom.

- Journal (ID: 29, 11/2013, Teacher: B6, School B):

The educational leaders from the university no longer is perceived to be the enemy, maybe not our friend, but certainly not the enemy.

- PLC Meeting (ID: 24, 10/16/2014, School A):

I don't mind talking in front of students, but talking in front of my peers or people who are older than me? I hate it. I'm shy. I've always been shy.

- Focus Group (ID: 38, 08/2013):

People indicated anxiety over new curriculum.

- Survey (ID: 150, 02/2015, Teacher: A13, School A):

Seeing myself as a failure.

There was evidence across three sources of data that problems with teacher staffing, such as teacher turnover and the lack of teacher aides, caused challenges. Evidence of this theme is below:

- Focus Group (ID: 114, 08/2013):

  During specials, we don't have an aide.

- Journal (ID: 32, 09/2013, Teacher: B8, School B):

  September was a bit bumpy for the students due to the sudden loss of one of our faculty. All these change at once was rough. They not only had to adjust to the Multi age setting but they also were thrown off by the lack of continuity of having one teacher from the start.

- Journal (ID: 27, 09/2013, Teacher: B6, School B):

  The retirement/resignation of a teacher two days before the start of school followed by the resignation/retirement of a second staff member was a bit daunting. In the long run it will be fine but in the short run is was unsettling to the school community at large.

- PLC Meeting (ID: 25, 04/22/2015, School A):

  The burden on teachers is exponentially more difficult as we lose staff. Teachers are already stretched with both teaching and ancillary work of school – duties, meetings, etc.

- PLC Meeting (ID: 8, 10/02/2014, School B):

  We only have two of the same staff members who are the same as last year.

Students from two or more age groups are combined in one multi-age classroom. Teachers perceived the vast academic levels of students as a challenge. Evidence of this theme is below:

- Journal (ID: 88, 11/11/2014, Teacher: A9, School A):

  Difficulties I have seen throughout this process is that I have a wide range of abilities.

- Journal (ID: 54, 03/17/2016, Teacher: B1, School B):

  The vast academic levels for grades 3-5 are challenging because the skill and learnings levels are really grades 1-6.

- Journal (ID: 43, 03/31/2015, Teacher: B2, School B):

  I have been given three grades in each classroom to manage and although they share commonalities within the common core the span of knowledge is too great to jump from one subset to the next.

- Survey (ID: 29, 06/2014, Teacher: B5, School B):

  A great swing in abilities across grades.

Conclusion

The overarching goal of the study is to explore the effectiveness of professional learning communities in multi-age schools. This study examined characteristics of professional learning community practices in multi-age settings and factors that may facilitate or challenge the successful implementation of PLCs in multi-age schools.

Quantitative Key Findings

After examining the results, the hypothesis can be assured as the following:

Hypothesis 1: The characteristics of the professional learning community are significantly improved after the professional learning community is in action.

It is confirmed that there are statistically significant differences in School B, at the .01 significance level, in pretest to posttest scores for collective responsibility and peer collaboration, but not for others. Collective responsibility differs before taking part in PLC (M = 4.26, SD = 0.19) and after taking part in PLC (M = 5.00, SD = 0.00) at the .01 level of significance (F (1, 6) = 44.735, p=0.001). Peer collaboration differs before taking part in PLC (M = 3.60, SD = 0.38) and after taking part in PLC (M = 4.75, SD = 0.25) at the .01 level of (F (1, 6) = 21.254, p=0.004).

Hypothesis 2: The professional learning community makes a significant unique contribution in predicting school quality measured by academic expectations, communication, and engagement.

Overall, there was evidence to support a moderate to strong correlation between the school quality measured in the Teacher School Attitude Survey and the six characteristics of the professional learning community (r ranged from 0.448 to 0.745).

Peer Collaboration and Focus on Student Learning explained a significant amount of the variance in the value of Academic Expectations. It was confirmed that the prediction model on academic expectations was statistically significant, F (2, 21) = 17.872, $p < .001$, and the independent variables explain 63% (R^2 = 0.630, Adjusted R^2 = 0.595) of the variability of the Academic Expectations. The quality of the prediction of the dependent variable is good (R=. 794). The value of Academic expectations was primarily predicted by a higher level of Focus on Student Learning. Focus on Student Learning accounts uniquely for 19.8% of the variance of academic expectations given the

other variables in the model.

Peer Collaboration and Focus on Student Learning explained a significant amount of the variance in the value of Communication. The prediction model on Communication was statistically significant, F (2, 21) = 22.288, $p < .001$, and the independent variables explain 68% ($R^2 = 0.680$, Adjusted $R^2 = 0.649$) of the variability of communication. The quality of the prediction of the dependent variable is good (R=.824). Communication was primarily predicted by a higher level of Peer Collaboration. Peer Collaboration accounts uniquely for 17% of the variance of communication, given the other variables in the model.

Shared Sense of Purpose and Peer Collaboration explained a significant amount of the variance in the value of Engagement. The prediction model on Engagement was statistically significant, F (2, 21) = 16.397, $p < .001$, and the independent variables explain 61.0% ($R^2 = 0.610$, Adjusted $R^2 = 0.572$) of the variability of engagement. The quality of the prediction of the dependent variable was good (R=.781). Engagement was primarily predicted by a higher level of Shared Sense of Purpose. Shared Sense of Purpose accounted uniquely for 20.0% of the variance of engagement given the other variables in the model.

Qualitative Key Findings

Qualitative data was collected and analyzed to gain a better picture of the professional learning community in multi-age schools. The open-ended questions of the Teacher School Attitude Survey, teacher journals, focus groups, and PLC meeting agenda/minutes were examined for themes that provided a deeper understanding of factors that facilitated or challenged the successful implementation of the professional

learning community in multi-age schools. Through the analysis of qualitative data, contextual themes emerged. The themes and related research questions are presented in Table 37.

Table 37

Summary Findings of Qualitative Data

Research Question	***Themes***
Question 4. What is the evidence for the professional learning community in multi-age schools?	• Collective Responsibility • Reflective Dialogue • Deprivatized Practice • Shared Sense of Purpose • Peer Collaboration • Focus on Student Learning
Question 5. What do teachers perceive as facilitators of the professional learning community in multi-age schools?	• School Structural Conditions - Time - Space - Technology and instructional materials - Communication systems - District support - School size • School human and social resources - Parental involvement and support - Openness to innovation/improvement - Professional development - Supportive, caring relationships among students and teachers • Shared and Supportive Leadership - Roles of principal - Teacher leader role
Question 6. What challenges do teachers have in implementing a professional learning community in multi-age schools?	• Lack of time • Lack of adequate training • Lack of parent support • Lack of technology, supplies, and instructional materials • Burden of workload • Classroom management • Emotional factors • Problem of teacher staffing • Vast academic levels across grades

CHAPTER 5 DISCUSSION

Chapter 5 presents a summary of the study. This chapter also provides a discussion of the limitation of the study, the implications for practice, and recommendations for future research.

Summary of Findings

This section provided the results of each of the research questions.

Question 1 – PLC Characteristics and Development

Question 1. What are the characteristics of professional learning communities in multi-age schools?

Overall, participants perceived that activities related to professional learning communities were occurring with a relatively low degree at the beginning of the PLC. Items with the lowest level of teacher involvement were those relating to reflective dialogue and deprivatized practice. After the implementation of the multi-age PLCs, teachers indicated relatively higher levels of the perceived professional learning community. Results showed an increase in all six characteristics. The items that had the highest level of teacher involvement were those relating to engaging in collective responsibility and focus on student learning. The biggest improvement happened in domains including collective responsibility, reflective dialogue, and peer collaboration. However, the items that had the lowest level of teacher involvement were still items relating to reflective dialogue and deprivatized practice. Landau (2014) also found that deprivatized practice had the lowest level of teacher involvement.

The increase in all six characteristics was obvious for both schools. However, no significant change was found for School A. For School B, the results from one-way

analysis of variance (ANOVA) showed a statistically significant increase in Collective Responsibility (M = 5.00, SD = .00) and Peer Collaboration (M = 4.75, SD = .25).

The development stages of the MAC PLC were evaluated through the Multiage Professional Learning Community Continuum Rubric. Results showed that MAC PLC in both schools made a satisfactory development from 2013 to 2014.

Question 2 – Impact of PLCs on School Quality

Question 2. How does the existence of a professional community impact school quality?

Overall, there was evidence to support a moderate to strong correlation between school quality and the six characteristics of the PLC (*r* ranged from 0.448 to 0.745).

It was assured that the professional learning community makes a significant unique contribution in predicting school quality measured by academic expectations, communication, and engagement. Peer Collaboration and Focus on Student Learning explained a significant amount of the variance in the value of Academic Expectations. The value of Academic expectations was primarily predicted by a higher level of Focus on Student Learning. Peer Collaboration and Focus on Student Learning explained a significant amount of the variance in the value of Communication. Communication was primarily predicted by a higher level of Peer Collaboration. Shared Sense of Purpose and Peer Collaboration explained a significant amount of the variance in the value of Engagement. Engagement was primarily predicted by a higher level of Shared Sense of Purpose.

Drawing upon the results identified in regression analysis, a path model was depicted. Focus on Student Learning and Peer Collaboration were found to have a

significant positive direct effect on academic expectations. The direct effect of Peer Collaboration and Focus on Student Learning was positive and significant on communication. The direct effect of Shared Sense of Purpose and Peer Collaboration was positive and significant on engagement.

Question 3 – Impact of PLCs on Students' Performance

Question 3. How do multi-age classrooms and professional learning community impact students' achievement?

In order to determine how the multi-age classroom program and professional learning community impact students' achievement, the researcher compared student performance measured by Terra Nova scores. Significant improvement was found in nearly half of the compared grades. However, a decrease was also found in a noticeable number of grades. Therefore, the impact of the multi-age classroom program and the professional learning community was mixed, as found in this study. In general, it was safe to conclude that implementing the multi-age classroom and the professional learning community did not harm students' academic performance.

Question 4 – Evidence of PLCs in Multi-age Schools

Question 4. What is the evidence for the professional learning community in multi-age schools?

The results indicated evidence for all six PLC characteristics occurring in both schools.

Collective Responsibility refers to teachers' belief that their colleagues share a responsibility for helping students and staff development (V. E. Lee & Smith, 1996a). Evidence from the focus group demonstrated collective responsibility that teachers were

dedicated and willing to do what it took to have multi-age schools be successful; teachers felt responsible for helping each other do his/her best, and teachers were eager to try new ideas.

Reflective Dialogue refers to teachers' conversations with colleagues focusing on instructional practice, pedagogy, and student learning (M. Lee & Louis, 2019; Lomos et al., 2011; Louis & Kruse, 1995; Louis & Marks, 1998). Both schools demonstrated high levels of reflective dialogue (27% occurrences among the six characteristics). In School A, teachers engaged in reflective dialogue about sharing teaching practices and strategies to promote student learning, discussing and sharing ideas across the grades, and seeking techniques and skills to help students learn. In School B, teachers talked a lot, sharing their experience of using technology in teaching, sharing successful multi-age teaching experiences, sharing teaching strategies such as guided reading and multi-age learning stations, and using a student leader role in classrooms.

Deprivatized Practice refers to the frequency with which teachers openly engage in their practice and support one another and the frequency teachers observe each other's teaching and give meaningful feedback (M. Lee & Louis, 2019; Louis & Marks, 1998). Contrary to the results from the Multiage Professional Learning Community Survey, there was adequate evidence that deprivatized practice was occurring (16% occurrences among the six characteristics).

At School A, the evidence was from journals, PLC meeting agenda/minutes, and survey. PLC members visited classrooms and provided feedback to teachers related to instructional practices. Teachers had instructional rounds where they visited classrooms as a team to see how a lesson was taught and how they could improve it. Teachers were

offered opportunities to see model lessons and get experiences. At School B, the evidence found was from journals and PLC meeting agenda/minutes. PLC members provided feedback on how multi-age was working and how teachers could continue growing. Opportunities existed for teachers to observe through model lessons. Teachers had PLC members to observe their classrooms and received constructive feedback on their teaching. Teachers collaborated and shared planning and teaching through the lesson study process. Teachers shared their lesson study experience and stated, "*Lesson study was a great learning experience*." Teachers also modeled lessons for their colleagues.

Shared Sense of Purpose refers to a consensus among school staff regarding school mission, goals, values, and discipline policies (Louis & Marks, 1998). There was evidence across all four sources of data for a shared sense of purpose (16% occurrences among the six characteristics). In both schools, an action plan and a vision plan were made. Staff worked as a team for a successful multi-age classroom program. Staff believed in the school's values and vision and worked together in the learning community to make the vision a reality. The principal and teachers worked together to decide their school theme. The goals and priorities for the multi-age schools were clear. Staff had a clear understanding of the approach and goals of the multi-age classroom program.

Peer Collaboration refers to teachers collaborating to design instructional programs and improve their school for student learning (Lomos et al., 2011). Both schools demonstrated high levels of peer collaboration (21% occurrences among the six characteristics) across all four sources of data that teachers were collaboratively working together on projects, planning learning activities, conducting lesson study, and seeking

the best way to approach multi-aging. Teachers felt grateful for the supportive staff they worked with. Teachers also indicated that they need to continue to collaborate more.

Focus on Student Learning refers to teachers sharing beliefs and values that all students can be academically successful, and the whole school should focus on student learning and provide supportive learning environments that address student academic performance (Bryk et al., 1997; Louis & Kruse, 1995; Louis & Marks, 1998). There was evidence across three sources of data in both schools that teachers placed a focus on student learning, including the use of student work and data in order to increase rigor. Teachers also talked about how multi-age classrooms benefited students in different ways.

Question 5 – Facilitators of PLCs

Question 5. What do teachers perceive as facilitators of the professional learning community in multi-age schools?

Research question five aimed to identify facilitators to the professional learning community in multi-age schools. Several categories of factors that enhance professional learning community development in multi-age schools emerged from the data. It was determined that 12 subthemes could be organized into three thematic categories: school structural conditions, school human and social resources, and shared and supportive leadership.

The first theme, school structural conditions, included time, space, technology and instructional materials, communication systems, district support, and school size as facilitators of PLCs in multi-age schools. Next, the second theme, school human and social resources, included subthemes parental involvement and support, openness to

innovation/improvement, professional development, and supportive and caring relationships among students and teachers. Theme three was shared and supportive leadership. This theme included subthemes roles of principal and teacher leader role.

Theme 1: School Structural Conditions. The first facilitator of professional learning communities identified by participants was school structural conditions.

A subtheme derived from the data was time (25% occurrences among the six subthemes). Participants from both schools agreed that having time to plan and work together was a crucial facilitator of the professional learning community. Across both schools, evidence in several sources of data indicated that teachers were given time for PLC activities.

The second subtheme identified by participants was space. Participants talked about the space in which they collaborated and described the materials in the space and traffic to the space.

Teachers identified technology and instructional materials as another subtheme (25% occurrences among the six subthemes). There was evidence across serval documents and both schools that technology and instructional materials should be provided for the successful implementation of the professional learning community.

The fourth subtheme was communication systems (28% occurrences among the six subthemes). Teachers from both schools indicated the need for communication systems to promote a flow of information across the entire school community, including staff, parents, district, and community members. 67% of the statements were about communication systems with parents.

The fifth subtheme was district support. Participants in focus groups mentioned the importance of having district support including monetary support and verbal support for schools in the transition of school culture to multi-age schools.

The sixth subtheme was school size. Participants in focus groups stated that "*the fact that we are a small school is beneficial because it will allow us to work together better across grade level and classrooms. The smaller school will make it more manageable for us to implement the PLCs*."

Theme 2: School Human and Social Resources. The next professional learning community facilitator identified by participants was school human and social resources.

A subtheme derived from the data was parental involvement and support (33% occurrences among the four subthemes). There was evidence from all four types of data about the importance of parental involvement and support. Teachers from both schools indicated the need for parental involvement and support.

The second subtheme identified by participants was openness to innovation/improvement.

Teachers identified professional development as the most important subtheme under the category of school human and social resources (53% occurrences among the four subthemes). In order to successfully implement multi-age classroom programs, teachers need adequate training through professional development. Participants mentioned that the training in the MAC Summer Academy gave them ideas of how to implement a multi-age classroom program. Teachers felt much more confident by seeing examples in professional development.

The fourth subtheme was supportive and caring relationships among students and teachers. Evidence was noted across three data sources. Teachers attributed part of their success in multi-age classrooms to their supportive class.

Theme 3: Shared and Supportive Leadership. The third theme identified as a facilitator of the professional learning community was shared and supportive leadership.

A subtheme derived from three data sources in both schools was the roles of the principal. Evidence showed from both schools that principals aided in scheduling time, modeling teaching, supporting teachers, and improving communications.

The second subtheme identified by participants was teacher leader role. The development of teacher leaders has great relevance for the advancement of multi-age schools (Cozza, 2017).

Question 6 – Challenges in PLCs

Question 6. What challenges do teachers have in implementing a professional learning community in multi-age schools?

The data revealed several categories of challenges in implementing a PLC in multi-age schools: lack of time; lack of adequate training; lack of parent support; lack of technology, supplies, and instructional materials; burden of workload; classroom management; emotional factors; the problem of teacher staffing; and vast academic levels across grades.

Participants identified lack of time (24% occurrences among the nine subthemes) as a challenge of PLCs in multi-age schools. The importance of time was frequently noted across all four types of data. The lack of time for teachers to meet and collaborate was a serious issue that limited their professional growth.

Teachers from both schools identified the lack of adequate training as a challenge. Proper training is necessary for teachers to have the knowledge and skills to teach in multi-age classrooms.

Participants described the lack of parent support (19% occurrences among the nine subthemes) as a challenge. There was evidence across all four sources of data that teachers perceived lack of parent support as one of the top three challenges they met. This was also a challenge across a period of three years for both schools.

Participants identified the lack of technology, supplies, and instructional materials as a challenge (26% of occurrences among the nine subthemes). There was evidence across all four sources of data that limited resources and technology was a big challenge for teachers in implementing the PLC and teaching in multi-age classrooms.

Participants identified the burden of workload as a challenge. There was evidence across three sources of data that teachers felt challenged by the burden of planning and paperwork. Participants identified classroom management as a challenge. There was evidence across three sources of data that classroom management was a challenge for teachers. There was evidence across four sources of data from both schools that some emotional factors caused challenges in teaching in a multi-age classroom and implementing PLCs. There was evidence across three sources of data that problems with teacher staffing, such as teacher turnover and the lack of teacher aides, caused challenges. Lastly, vast academic levels across grades were identified as a challenge in multi-age schools.

Limitations of the Study

Although this study is likely of interest to practitioners and future researchers, it should be considered within its limitations. A few potential limitations might impact the generalization of findings from this study.

The first limitation of this study was the small sample size, which may influence the generalizability of findings and statistical power.

Second, purposive sampling was used to select K-8 teachers in multi-age private schools as participants. Their experiences may differ from the experiences of teachers in other types of schools. The results of the research may not apply to different schools, such as public schools, and therefore, pose as a threat to external validity. Furthermore, the aspects of the study looking at the characteristics of the professional learning community were limited to teachers in K-8 grades. Therefore, the results from this study may not be generalizable to teachers in higher grades. Limiting the study to just K-8 multi-age schools also decreased the chances of having a larger sample size.

The third limitation of the study was the changeable sample size across data collection time. In the collection of the response of the Multiage Professional Learning Community Survey, there were 18 participants in August 2013. However, there were only 8 participants left in June 2014, 9 in August 2014, and 12 in February 2015. During the MAC project, some teachers left, and some new teachers joined MAC at different time. Only five out of the 18 participants (27.8%) from the beginning of the implementation of the PLC participated in February 2015. Having a changeable sample size reduced the chances of correctly comparing an effect. Multiple data sources and data analysis methods were used to mediate these limitations.

Fourth, using data collected from 2013 to 2016 for today's research on professional learning communities may have limitations, as the research findings may not accurately reflect the current state of professional learning communities. Professional learning communities can evolve and change over time as new research, policies, and practices are developed and implemented. However, since the research questions in this study focused on understanding the characteristics, facilitators, and challenges in implementing professional learning communities in multi-age schools, it is still appropriate.

Implications of Findings

The research aimed to provide a complete understanding of characteristics, facilitators, and challenges for implementing professional learning communities in multi-age schools. This study offered the following suggestions for school leaders looking to make practical and authentic changes to improve professional development during school transformation.

First, opportunities should be provided for staff members to participate in PLCs to improve teaching and learning. It is confirmed that the professional learning community helped teachers gain knowledge and skills about teaching in multi-age classrooms. Experiences in PLCs increased teacher involvement in all six domains, especially in collective responsibility, reflective dialogue, and peer collaboration. Through PLCs, teachers consider themselves responsible as a group for school improvement and student growth, and they work collaboratively to improve their teaching practice.

Second, school leaders should consider developing PLCs to improve school quality. PLCs explained significant variance in teacher-perceived school quality

measured by academic expectations, communication, and engagement. The sustainability of a successful professional learning community is vital to school quality. Furthermore, it is important to note that an emphasis on peer collaboration was positively related to increased academic expectations, communication, and engagement. When taken together, such findings suggest that PLCs can influence school quality, especially with peer collaboration.

Third, the relationship between deprivatized practice and school quality is of interest. Deprivatized practice needs to be explained and practiced more for teachers to benefit. Although it might be logical to predict that deprivatized practice would positively affect academic expectations and communication, it is possible that teachers either did not understand the concepts and process or felt comfortable about having colleagues visiting their classrooms or observing their teaching. Lesson study is an excellent collaborative professional development approach for deprivatized practice. Teachers plan and develop a lesson together. One teaches it voluntarily, and another observes the lesson with the team. Then, teachers reflect on the lesson and improve the lesson together. Finally, the other teacher reteaches the lesson. In the lesson study model, teachers can work together and observe colleagues. Also, teachers can gain constructive feedback from peers and strengthen their instructional practice.

Fourth, schools should consider building effective communication systems to facilitate the implementation of the professional learning community, especially through technology. Communication systems were identified as the most critical facilitator in the school structural conditions theme, indicating the importance of good communication. Providing information to the entire school community and stakeholders, including district

personnel, parents, and teachers, regarding school policies and changes can remedy their concerns and allow the school a greater chance of a successful transition. Technology breaks down barriers between students, teachers, and parents. Schools can use multiple ways to communicate with the community, such as using technology to increase parental involvement. Newsletters can be used to inform parents about school announcements and showcase students' work. Daily announcements newsletter can be sent to parents through emails or published on school websites to share updates on school policy, upcoming events, and important dates. Parent participation in meetings increases using videoconferencing such as ZOOM (*Zoom*, n.d.). Virtual calendars such as Google Calendar can be used to share school calendars with students and parents. Schools can use Google Docs to create slides to share with parents about school events, club activities, and more. Schools can also create news videos or podcasts to share school news and student achievements.

Fifth, shared and supportive leadership is crucial for successful PLC implementation. A team should be composed of administrators and teacher leaders committed to multi-age classrooms and can plan the training for classroom teachers and support other teachers.

Recommendations for Future Research

Limited research has been conducted on professional learning communities in multi-age schools. This study provided insight into the characteristics of the professional learning community and revealed facilitators and challenges in implementing and sustaining effective professional learning communities in multi-age schools. The following section discussed future research opportunities of this study.

First, this study can be replicated in more areas across the United States and around the world that has multi-age schools to examine the characteristics of professional learning communities, determine if there is a relationship between professional learning communities and school quality, and identify facilitators and challenges to the professional learning community. Research could also be conducted comparing PLC models in two different areas.

Second, the replication of this study could be expanded to include elementary, middle, and high schools to increase the sample size and to gain further insight into professional learning communities in different grade levels.

Third, researchers could replicate this study in more types of schools that have multi-age classrooms, including public schools, charter schools, and Montessori schools to assess if differences exist in different types of multi-age schools.

Fourth, future research could use different professional learning community assessment instruments such as PLCA-R (Olivier et al., 2010) and the revised Multiage Professional Learning Community Survey. On one hand, items in the Deprivatized Practice dimension might need be revised to increase reliability in future research. On the other hand, results from the quantitative analysis of the Multiage Professional Learning Community Survey indicated the lowest level of teacher involvement relating to Deprivatized Practice. However, there was adequate evidence across three qualitative data sources in both schools that Deprivatized Practice occurred (16% occurrences among the six characteristics). Future research with more professional learning community assessment instruments and a revised Multiage Professional Learning

Community Survey might improve statistical power and likely yield more significant results.

Fifth, this study attempted to determine the influence of the professional community on student performance by comparing Tera Nova test scores. Future studies could include in-depth interviews with principals and teachers to investigate the relationship between PLCs and student outcomes. These interviews would provide a deeper understanding of how the PLC has impacted student performance and the reasons behind the different results.

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