VERTICAL COLLABORATIVE INQUIRY TEAMS: A VEHICLE FOR BUILDING INSTRUCTIONAL CAPACITY IN TEACHERS

A disquisition presented to the faculty of the Graduate School of
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DEDICATION

Brandon Schweitzer: This disquisition is dedicated to my two daughters, Sadie and Ellie. May you never be complacent in who you are and always seek the truth in knowledge.

Kevin Bailey: I want to dedicate this disquisition to my daughters, Kelly and Katherine. You both have sacrificed the most as I have traveled this journey. Your beautiful smiles, kind words, and laughter have given me the strength to accomplish anything worthwhile. Thank you for your love and patience.

"A daughter may outgrow your lap, but they'll never outgrow your heart."
-Anonymous

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

THE DISQUISITION[1]

Overview

The culminating activity in the doctoral program in Educational Leadership (Ed.D.) at WCU is a problem-based disquisition. A disquisition is a formal discourse or treatise in which a subject is identified, analyzed and addressed in depth. The disquisition provides a concrete good for the larger community through the dissemination of new relevant knowledge. The program faculty at WCU intentionally chose this term to represent the final and culminating work of the newly re-designed Ed.D. program to highlight the collaborative work scholar practitioners do as they participate in action research and address critical problems of practice in the field of education. More particularly, for the purposes of our program, within a disquisition, issues of social justice, equity and ethics are typically at the forefront of the discourse. The process of developing the disquisition (in conjunction with the associated coursework) helps to prepare scholar practitioners who will (continue to) serve as educational leaders. The preparation of the disquisition is an exacting, stringent, worthy, dignified and towering encounter that prepares outstanding scholar practitioners in P-12 institutions, school districts and community colleges.

A Problem-Based Exercise

The WCU Ed.D. disquisition is a relevant, congruous and well-suited culminating activity for educational leadership scholar practitioners. It focuses on the issues and demands of scholar practitioners and the institutions in which they work. It sheds additional, directed and effective light on an effort to address a particular organizational quandary. In the disquisition process, scholar practitioners utilize theoretical and day-to-day understandings to address

[1] Adapted from: Western Carolina University. (2014). *Scholar practitioner handbook: Executive Ed.D. in educational leadership.* Cullowhee, NC.

practical situations. Through the exercise, they gain expertise in differentiating between the present state of an organization and the sought after or preferred state. Indubitably, the act of preparing a disquisition--absolutely and with forethought--guides scholar practitioners in addressing the challenges faced in P-12 schools, school districts, community colleges and other educational organizations.

The Disquisition Process

The disquisition process begins long before the investigation and writing begins. It starts with the evidence-based identification of a problem of practice within an institution followed by a query of effective strategies to address the problem. It culminates in the implementation and evaluation of one or more selected strategies. Such problems will often include issues of social justice, equity and ethics. The intent of the exercise is to improve the situation through investigations within the institution(s) and the acquisition and application of relevant knowledge. Critical thinking, knowledge of the field(s) and some give-and-take are necessary. While previous literature is utilized, it is not used to develop an argument, but, instead, to support and inform it. Ultimately, scholar practitioners develop a perspective on the problem and appropriately communicate the perceived resolution(s). For the disquisition, scholar practitioners work with other P-12 and community college practitioners, as well as WCU faculty to explore the problem in question. Scholar practitioners who complete the WCU Ed.D. disquisition will (1) possess enhanced comprehensive research skills; (2) provide a significant and meaningful benefit to identified constituencies around them; (3) embody the enhanced values traditionally associated with the doctoral experience, e.g., critical thinking, disciplinary inquiry and argumentation; and (4) encounter a unique and rewarding educational experience.

ABSTRACT

VERTICAL COLLABORATIVE INQUIRY TEAMS: A VEHICLE FOR BUILDING INSTRUCTIONAL CAPACITY IN TEACHERS

Kevin Bailey and Brandon Schweitzer

Western Carolina University (April 2017)

Director: Dr. Jess Weiler

This disquisition addresses the problem of student under-preparedness in the area of math, across school transitions. Disquisitioners engaged in improvement processes related to: (1) building teacher capacity to collaborate within and across school buildings, (2) identifying critical learning standards, and (3) creating conditions whereby math teachers within vertical teams will collectively describe and assess the learning progressions between grade levels in identified critical standards. The authors begin by critically examining the literature for factors contributing to student under-preparedness across school transitions including: (1) developmental factors, (2) external factors, and (3) organizational factors. In response, disquisitioners develop an improvement initiative revolving around the implementation of vertical collaborative inquiry teams. Disquisitioners use formative and summative evaluation measures to determine the effectiveness of the improvement initiative (vertical collaborative inquiry teams). Data analysis revealed teachers' experienced an increased capacity to: (1) collaborate within and across school buildings with other math teachers, (2) identify common, critical learning standards, and (3) describe and assess learning progressions between grade level math courses within critical learning standards.

CHAPTER I: INTRODUCTION AND STATEMENT OF THE PROBLEM

There is perhaps no point in our lives where we undergo more change than between the ages of eleven and fourteen. It is during this time that children undergo the middle stages of adolescent development, asserting their own independence and undergoing physical developmental changes (Hall, 1904). Compounding matters further, traditional matriculation patterns of elementary school (kindergarten through fifth grade) to middle school (sixth grade through eighth grade) to high school (ninth grade through twelfth grade) present multiple transitions for students to navigate. With so much change occurring in a young student's life, it is no surprise that academic decline is often associated with school transition (Alspaugh, 1998; Weiss & Baker-Smith, 2011). In a comparison study of forty eight rural school districts, Alspaugh (1998) found that among schools with pyramid matriculation patters (multiple feeder schools matriculating to a singular school), students transitioning from elementary to middle school showed an average academic decline across content areas of around 2% while students moving from middle schools to high school showed a decline of nearly 4%. Although teachers, parents, and school leaders must consider the variables associated with transition when addressing academic decline, they must also consider other contributing factors, especially those in which the schools are responsible. We argue that academic decline is, in large part, due to academic under-preparedness and should be examined within the context of school transitions.

The Problem: Academic Under-preparedness

Whether transitioning to middle or high school, academic demands increase as students advance to higher grade-levels with higher expectations for learning. While transitioning between schools certainly has been shown to be a contributing factor to poor academic performance (Alspaugh, 1998; Weiss & Baker-Smith, 2011), it does not account entirely for the

number of students arriving at their new schools academically underprepared--lacking the foundational skills and knowledge necessary for successful engagement in the content of the receiving course/grade level (Hourigan & O'Donoghue, 2007; House, 1993). For example, Crist (1991) reported that students labeled "at-risk" experienced academic failure and reported schoolwork was "too difficult" and that they lacked the skills needed to complete it. Similarly, in the area of mathematics, Godbey (1997) suggested that students who enter mathematics courses underprepared to engage the grade level curriculum are at a disadvantage compared to their better prepared counterparts. Godbey (1997) also reported that their under-preparedness is often accompanied by high levels of anxiety, compounding the problem.

Middle school achievement and experiences have been shown to have a strong correlation with high school graduation rates (Balfanz, 2009). Students entering high school lacking foundational academic skills are at a much higher risk of scholastic failure than those who do not. For example, students failing coursework in their first semester of high school are likely to fall into a cycle of failure often resulting in poor attendance and, ultimately, dropping out of school (Roderick & Camburn, 1999). Clearly, academic under-preparedness can have profound negative effects on student academic trajectories at both the middle and high school levels.

In order to fully explore the nature of student academic under-preparedness across transitions, disquisitioners first conducted a causal analysis (see Figure 1).

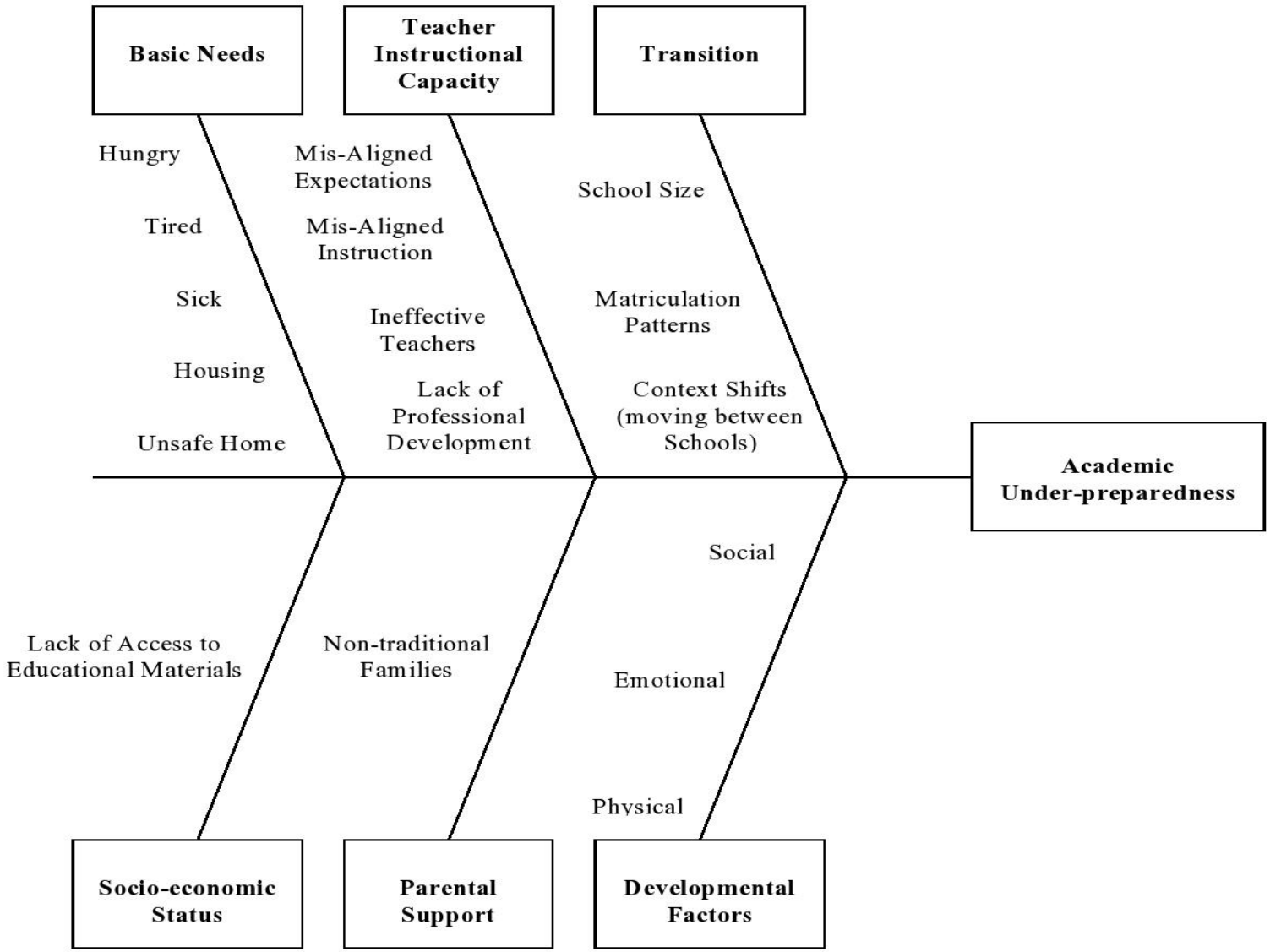

Figure 1: Causal analysis of academic under-preparedness

Causal analysis identifies the basic causes that underlie variations in performance and have been a staple of the medical community since the mid 1990's (Wu, Lipshutz & Pronovost, 2008). Specifically, disquisitioners utilized a causal analysis tool known as a "fishbone diagram" pioneered by Kaoru Ishikawa in the mid 1960's as a means of improving systems efficiency (Ishikawa, 1976). He theorized that by identifying factors related to an unwanted outcome, one could target specific areas related to the source of variance. We found this tool to be particularly useful as it allowed us to begin to conceptualize the major factors related to student academic under-preparedness. In figure 2, we illustrate the results of our causal analysis. The causes have been organized within a self-constructed framework that includes three categories: developmental, external, and organizational.

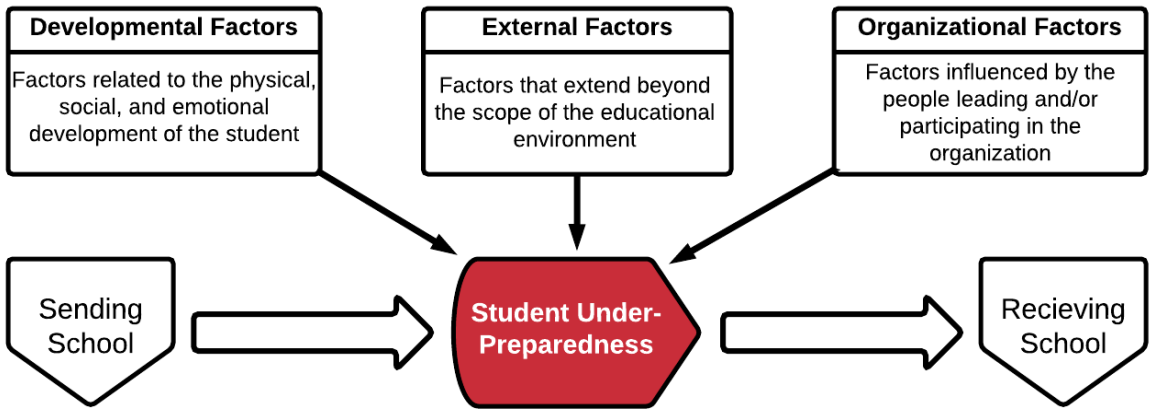

Figure 2: Factors contributing to student under-preparedness across the transition

In the subsequent sections, we will further explore each of the identified causal factors associated with student academic under-preparedness as they transition between schools as well as briefly discuss common initiatives aimed at combating student under-preparedness.

Developmental Factors

Transitions between schools can be a very stressful and demanding time for students. These transitions often coincide with developmental shifts in students including social, emotional

and physical changes (Almeida & Wong, 2009; Benner, 2011; Seifert & Schulz, 2007). If we are to begin to explore the nature of academic decline among transitioning students, we must acknowledge the developmental changes that students are experiencing in conjunction with the school transition.

When considering the transition from elementary to middle school or middle to high school, it is important to understand the physical (biological) changes that students are undergoing, namely, pubertal changes. The interaction of pubertal change and school transition may have profound consequences for the child and their social development and achievement in school (Seifert & Schulz, 2007). Within the research literature, there is a broad consensus on outcomes related to pubertal change. For instance, research associated with the timing of pubertal change has shown an association with risk factors including substance abuse (Wichstrom, 2001; Wiesner & Ittel, 2002) and an increase in delinquent behavior including oppositional behaviors related to school (Williams & Dunlop, 1999). Other factors related to pubertal change also have the potential to emerge such as depression, anxiety, and eating disorders (Patton & Viner, 2007; Pharris-Ciurej, Hirschman & Willhoft, 2012). While pubertal change is something that all students must undergo, it is perhaps the social/emotional ramifications of the change combined with the stress of transitioning schools that is most concerning for educators.

Transitions between schools represent the movement between the known and the unknown. This uncertainty tied to transition can bring about heavy stressors for students as they try to regain some semblance of equilibrium (Almeida & Wong, 2009). For example, the organization and structures of middle schools rarely resemble that of their high school counterparts. As a result, it is not surprising that immediate experiences of the high school

transition would be associated with heightened states of loneliness, anxiety, and depression as students struggle to adapt to the new context (Benner, 2011). There is also evidence that suggests these feelings have a high probability of increasing across the first two years of high school (Benner & Graham, 2009; Newman et al., 2007). The emotional challenges students face have the potential to lead to poor social or academic adjustment and hindered academic performance (McGill, Hughes, Alicea, & Way, 2012). It is for this reason that middle and secondary educators must be keenly aware of the emotional development students are undergoing in the midst of transitional challenges.

Additional key components of developmental changes are the evolving social networks that students are experiencing in, and around, school transitions. School transitions disrupt social ties with peers as well as relationships with school personnel as multiple peer social networks across elementary and middle schools now converge in an environment with an entirely new set of educators who may have very different perceptions of and expectations for students (Benner, 2011). Poorly developed or disrupted relationships have been shown to result in outcomes such as increased drug use, poor school attendance, general feelings of disconnectedness with the school, and mental health difficulties (Shochet, Dadds, Ham, & Montague, 2006). For these reasons, schools are uniquely positioned to assist in social developmental processes resulting in positive student outcomes. Studies have highlighted academically resilient students as being linked to positive interactions and relationships with teachers (Barber & Olsen, 2004; Roderick, 2003). Sadly, studies have also shown ties between student feelings disconnectedness with teachers and negative outcomes such as dropout (Roorda, Koomen, Spilt, Oort, & 2011; Whannell & Allen, 2011).

External Factors

Merriam-Webster defines the word external as "situated outside, apart, or beyond" (2016). For our purposes, the term external factors include those factors that are situated outside, apart, or beyond the scope of the educational environment. Through our causal analysis, we have identified three potential external factors related to academic underpreparedness. These factors include socioeconomic status (SES), parental involvement, and the absence or presence of basic human needs.

Socioeconomic status. Research has supported that students with more resources, such as family income and supplemental educational materials, are more likely to perform better academically than students without these resources (Baker, Goesling, & Letendre, 2002). Specifically, Akos (2015) found that students from low-income families experience great academic struggles across the elementary to middle school transition. For many students, low SES may be the greatest threat to academic success. According to Chiu (2005), parents with greater resources are more likely to teach or engage with their children in cognitive and social skill activities that serve to enhance learning. Additionally, students with parents that have fewer resources may disengage from the educational context (Benner & Wang, 2003). Clearly, schools cannot control the SES of their students. However, strategies must be developed to overcome these potential disadvantages in other ways.

Parental involvement. Parental involvement (in a child's education) is another area in which schools have less control. Jeynes (2007) defined parental involvement as, "parental participation in the educational processes and experiences of their children" (p. 83). Parental involvement at school includes characteristics such as parent-teacher meeting attendance, volunteerism on campus, and attending productions featuring students. Parental involvement in

education outside of school includes helping with homework, setting routines conducive to educational support, and discussing school experiences with the child (Lee & Bowen, 2006).

Research has shown parental involvement to be positively associated with academic achievement (Jeynes, 2007; Lee & Bowen, 2006). More specifically, parental support and involvement is shown to mitigate academic declines across transitions such as middle or high school (Grolnick, 2009; Sheldon & Epstein, 2005). Yet a reduction in parental involvement is often the norm across transitions. During the transition to high school, for example, many parents grant greater levels of autonomy to their children. A reduction of parental support and supervision combined with increased peer influences may result in an increase in risk-taking behaviors and a decrease in academic performance (Neild, 2009).

While research exists that illustrates the positive correlation of parental involvement to the academic success of students (Grolnick, 2009; Jeynes, 2007; Lee & Bowen, 2006; Sheldon & Epstein, 2005), it is important to note that many parents are simply doing the best that they can given their individual circumstances. "Schools must understand that lack of participation by parents does not necessarily mean they are neglecting their responsibilities. They simply may not have the time, resources, or know-how to help out" (Wanat, 1992, p. 47). It is important that both schools and families work together to identify means to accomplish their common goal: the educational success of the child.

Basic human needs. Teachers often complain about the difficulties of teaching students who are hungry, tired, or struggling emotionally due to circumstances at home. Many teachers feel ill-equipped or simply unable to help students overcome such formidable challenges because they have little or no influence on what occurs outside of the classroom. Abraham Maslow (1943) identified five basic human needs. Maslow’s hierarchical list of needs begins with the

most basic needs (e.g. sleep, food, water, shelter) and progresses to more sophisticated needs (e.g. self-fulfillment, personal growth). Maslow asserted that more sophisticated needs cannot be met without first meeting more basic needs. According to Maslow (1943) people are not likely to engage in activities that promote personal growth and self-fulfillment (e.g., learning) when foundational needs are unmet. The result is that many students cannot perform to their potential academically until all basic needs are met. It should also be noted that unmet needs are not necessarily a determinant factor of academic success for all students. Though many of these challenges exist beyond the scope of an educators' influence, we can benefit from acknowledging their existence and working with students, families, and other agencies to overcome these obstacles.

Organizational Factors

We consider organizational factors to be those existing within the school or school system—factors influenced by the people leading and/or participating within the organization. It is important to note that we choose to focus our disquisition on organizational factors because we believe it is within this arena that educators have the greatest amount of control and influence. There are multiple organizational variables that contribute to overall academic decline for transitioning students including: (1) new, complex organizational structures and norms, (2) ineffective and/or under-prepared teachers, and (3) insufficient teacher-capacity building programs and processes.

New, complex organizational structures and norms. When considering academic transitions experienced by students, there are several variables potentially influencing academic achievement including number of transitions, movement between separate buildings, school size, and cultural shifts. The size of a district plays an important part in the potential difficulties

students may face as they transition between schools. Research has shown that students who transition in what has become the traditional structure, from elementary (K-5) to middle (6-8) and then high school (9-12) are at a greater risk of academic decline than those who only transition once from a K-8 school to a high school (Alspaugh, 1998; Weiss & Baker-Smith, 2011). Additionally, students transitioning from multiple feeder schools into a singular school often experience greater levels of academic decline than students who move in more linear feeder patterns (Alspaugh, 1998; Schiller, 1999; Weiss & Baker-Smith, 2011). The size of schools may also play a factor in student outcomes. In a review of 57 studies since 1990 on school size effects on student outcomes, Leithwood and Jantzi (2009) found that smaller to mid-sized schools performed better in terms of student achievement, dropout rates, and school engagement.

Transitions represent uncertainty in the form of a change in context. Organization and structures of middle schools rarely resemble that of their high school counterparts. As a result, it is not surprising that immediate experiences of the high school transition would be associated with heightened states of loneliness, anxiety, and depression as students struggle to adapt to the new high school context (Benner, 2011). Compounding these socioemotional stresses, school often becomes increasingly impersonal as students move through the K-12 educational system, (Felner et al., 2001). High school teachers, as opposed to their elementary and middle school counterparts, are often perceived by students as being more impersonal, matter-of-fact, and quick to administer negative consequences (Ellerbrock & Kiefer, 2013). In addition, a cultural expectation of independency exists at the middle school and especially at the high school level. As a result, students may experience difficulties adapting to the new situational imperatives of middle and high school, especially immediately following the transition (Baker et al., 2001).

Ineffective and/or under-prepared teachers. Though organizations can point to multiple factors impacting student achievement, perhaps none are as critical as the teacher in the classroom (Nye, Konstantopoulos & Hedges, 2004; Darling-Hammond, 2000; Hanuschek, 2011; Rockoff, 2004). In order to fully explore this dynamic, we must define "effectiveness" as it relates to teachers. Problematically, there is no real consensus in the literature base for defining teacher effectiveness. Generally, definitions fall into two categories: (1) quality measures and (2) outcome measures.

Quality measures. Quality measures can generally be defined as the knowledge, skills, and dispositions of a teacher. Several leading organizations exist that have adopted general quality measures related to defining effective teaching. These organizations include the Interstate New Teacher Assessment and Support Consortium (INTASC), the National Council for Accreditation of Teacher Education (NCATE), and the National Board for Professional Teaching Standards (NBPTS). INTASC is a consortium of state education agencies and national educational organizations devoted to reforming teacher preparation and licensing and providing ongoing professional development ("The Interstate Teacher and Support Consortium," n.d.). NCATE is a national organization that works to develop standards for accreditation of teacher preparation programs ("About NCATE," n.d.). NBPTS is an organization dedicated to maintaining and developing rigorous standards for what accomplished teachers should know and be able to do ("Mission and History," 2016). Across all three organizations, standards related to teacher quality measures generally reflect the following themes: commitment to student learning, deep subject matter knowledge, the management and monitoring of student learning, reflective practice, and participation in a larger community (Mitchell, 2001).

There are perhaps none more keenly aware of ineffective teaching by way of quality measures than the students themselves. In a study involving 747 college students, 104 senior high school students, and 93 eighth grade students, Check (2001) compiled a list of perceived characteristics of ineffective teachers as identified by participants. These characteristics included: poor communication and delivery, boring and monotonous, lack of content knowledge, disorganized, insensitive to student needs, aloofness or arrogance, unenthusiastic, and unprepared. Though all of these characteristics represent potential quality measures of teacher effectiveness, defining "effectiveness" by quality measures alone could be problematic in that measures are broad and subjective.

Outcome measures. Outcome measures for teachers are those in which tangible results tied to teaching can be collected and interpreted (Crowe, Allen, & Coble, 2013). Common measures include student proficiency on state exams, the Educator Value Added Assessment System (EVAAS), and the North Carolina Educator Effectiveness System (NCEES).

Student proficiency is considered by many to be a key indicator of teacher effectiveness (Ballou & Springer, 2015). EVAAS factors the growth of students academically, providing teachers with another layer of measurement. In contrast to student driven results, NCEES is an evaluation model used by school administrators in North Carolina. School administrators are able to make assertions as to teacher performance through the use of the evaluation model. NCEES allows for feedback regarding teacher performance.

The questions school leaders must ask: Are our teachers effective? Do our teachers have the capacity to meet the needs of ALL learners, including those who perform below expectancy or arrive under-prepared? Can our teachers prepare learners so that they will be prepared for, and successful in, subsequent courses or grade-levels? If the answer to any of these questions is

"no," then school leaders must then ask themselves, "Are our efforts at building teacher-capacity resulting in teacher effectiveness?"

Insufficient teacher-capacity building programs and processes. Many school systems are beginning to utilize student performance data (outcome measures) in order to drive instructional decisions and the professional development of their teachers. This professional development represents a comprehensive means of improving teacher effectiveness that, in turn, carries an impact at the institutional level through student outcomes (ie-improving content knowledge and pedagogical knowledge). Yoon, Duncan, Lee, Scarloss & Shapley (2007) describes professional development as the foundational underpinning for improved student achievement (see Figure 3).

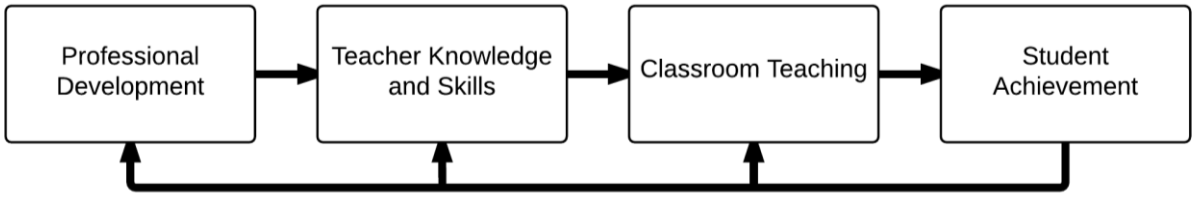

Figure 3: The relationship between professional development and student. Adapted from "Reviewing the Evidence on How Teacher Professional Development Affects Student Achievement," by Yoon, K. S., Duncan, T., Lee, S. W. Y., Scarloss, B., & Shapley, K. L., 2007, *Regional Educational Laboratory Southwest, 33*, p. 4.

Yoon, et al. (2007) specifically describe the characteristics of each element of their model, providing research based foundations for each. Yoon, et al. (2007) assert that professional development must be intensive, sustained, content focused, well defined, strongly implemented, founded on teacher learning and change, and promote best practice in instructional models. If done correctly, professional development should improve teacher knowledge and skills, translating into action in the form of improved classroom teaching (Yoon, et al., 2007). Finally,

teaching, improved by professional development, raises student achievement (Yoon, et al., 2007). While this model does a good job of describing how high quality professional development can impact student achievement, it does not give us enough information on what high quality professional development looks like.

Professional organizations such as Learning Forward have developed research based frameworks for building teacher capacity through effective professional development. Working in conjunction with 40 professional associations and education organizations, Learning Forward has developed standards for professional learning illustrated in Table 1 (Learning Forward, n.d.). Learning Forward's (n.d.) definition of professional development describes the process as a "comprehensive, sustained, and intensive approach to improving teachers' and principals' effectiveness in raising student achievement."

Many schools and organizations do not consider standards for professional learning when developing professional development for their teachers. For example, standard one of Learning Forward's Standards for Professional Learning is "Learning Communities". This standard calls for the establishment learning communities predicated on collaboration and continuous improvement (Learning Forward, n.d.). Far too often, collaborative practices are ignored, further perpetuating the inherent isolation of teachers. This professional isolationism has become a prevailing and entrenched characteristic among educational institutions at all levels. Dan Lortie (1975) pointed out how conditions of work in educational institutions fundamentally restrict collegial interactions. Sadly, not much has changed in the past 40 years as many authors have cited teacher isolationism as a major issue in the field of education (Chang, 2009; Davis, 1986; Dworkin, 2009; Fullan, 2007). Carroll (2009) points out that the idea that a single teacher can

Table 1: Learning Forward's Standards for Professional Learning

Standards	Description
Learning Communities	Professional learning that increases educator effectiveness and results for all students occurs within learning communities committed to continuous improvement, collective responsibility, and goal alignment.
Leadership	Professional learning that increases educator effectiveness and results for all students requires skillful leaders who develop capacity, advocate, and create support systems for professional learning.
Resources	Professional learning that increases educator effectiveness and results for all students requires prioritizing, monitoring, and coordinating resources for educator learning.
Data	Professional learning that increases educator effectiveness and results for all students uses a variety of sources and types of student, educator, and system data to plan, assess, and evaluate professional learning.
Learning Designs	Professional learning that increases educator effectiveness and results for all students integrates theories, research, and models of human learning to achieve its intended outcomes.
Implementation	Professional learning that increases educator effectiveness and results for all students applies research on change and sustains support for implementation of professional learning for long term change.
Outcomes	Professional learning that increases educator effectiveness and results for all students aligns its outcomes with educator performance and student curriculum standards.

Note: Adapted from "Standards for Professional Learning," Learning Forward - Professional Learning for Student Results. (n.d.). Retrieved February 04, 2017, from https://learningforward.org/home

know and do everything to meet the needs of a diverse group of students throughout the school year rarely works and is not sustainable.

The decisions school leaders make with regards to professional development carry the potential to have a lasting impact on student outcomes (Waters, Marzano & McNulty, 2003; Leithwood, Louis, Wahlstrom, Anderson, Mascall & Gordon, 2004). Meaningful professional

development aimed at building the instructional capacity of teachers has been shown to directly impact student achievement (Yoon et al., 2007). Therefore, it is pertinent for school leaders to strongly evaluate their decisions regarding professional development against the ultimate goal of building instructional capacity in teachers and affecting real change in student outcomes.

Summary

As we have shown, there are a number of factors contributing to academic decline and academic under-preparedness amidst school transition for students. We have created a theoretical problem construct that groups these factors into three main areas: developmental, external, and organizational. Developmental factors are biological in nature and are associated with the physical, emotional and social development of the child. External factors are those that extend beyond the scope of the educational setting such as socio-economic status, basic need fulfillment, or parental involvement. Organizational factors are those that are influenced by the people leading and/or participating in the educational organization that serves students. These factors include academic transition dynamics associated with new, complex organizational structures and norms, ineffective and/or underprepared teachers, and insufficient teacher-capacity building programs and processes. We have also detailed some of the initiatives that school leaders have previously employed to combat academic underpreparedness in students. It is important to note that our theoretical construct is by no means an exhaustive list of all of the factors associated with academic under-preparedness. However, it provides a substantial, research based foundation from which educational decision makers can identify potential leverage points.

Problem of Practice within the Local Context

In the section above, we described the problem of academic under-preparedness amidst school transition as it exists for many students and many schools across the country. In this section, we provide a look at the problem as it exists in the two separate contexts in which the disquisitioners serve as educational leaders: Polk County High School and Rutherfordton-Spindale Middle School. Each of these contexts offers a unique laboratory for investigating under-preparedness amidst school transitions. In the following paragraphs, each context is described including regional and school demographics, data related to student performance, and a history of the problem specific to each context. We provide a historical perspective aiming to illustrate the situation before an improvement initiative was introduced. While the issue of academic under-preparedness amidst transition exists among all subject areas, poignant data from both contexts encouraged the disquisitioners to focus on math.

Polk County High School

Demographics. Polk County Schools is a rural district located in western North Carolina. Census data from 2010 records the total population of Polk County to be 20,510 as reported in the Western North Carolina Vitality Index (n.d.). The median household income was $43,692 in 2010 (Western North Carolina Vitality Index, n.d.). Additionally, The Western North Carolina Vitality Index reported 16.5% of Polk County residents qualify for poverty status with 5.1% receiving government assistance through food stamps (n.d.). County-wide education figures from 2005-2009 show 30% of the population over 25 years of age having attained a high school diploma while 25% of those over 25 years of age having a four-year college degree (Western North Carolina Vitality Index, n.d.).

The school district is governed by a school board comprised of seven members that are elected by the community to four-year terms. They are responsible for developing district policy and representing the ideals of the community. The school superintendent reports to the school board as well as serving as the chief executive officer for the district. Reporting directly to our superintendent are seven directors: curriculum/ instruction director, testing/ accountability director, chief finance officer, student services director, pre-school/ nursing director, child nutrition director, and after school program director.

The district itself is comprised of a total of seven schools: four elementary schools, one middle school, one high school and an early college. The district average daily membership (ADM) is around 2,300 students (PowerSchool – Polk, n.d.). Polk County High School (PCHS) is the lone traditional high school in the district. It has an ADM of around 635 students (345 identified as males / 290 identified as females) (PowerSchool – Polk, n.d.). Polk County High School's student population includes students identified as white (85%), students identified as black (7%), students identified as Hispanic (7%), and students identified as Asian, Pacific Islander and American Indian (1%) (PowerSchool – Polk, n.d.). School-wide, 57% of PCHS students qualify for free or reduced lunch (PowerSchool – Polk, n.d.). Polk County Middle School has an ADM of roughly 500 students and a similar demographic breakdown to the high school (PowerSchool – Polk, n.d.).

Student performance data. Student performance data was an integral part of framing the context around the problem of under-preparedness at Polk County High School. Table 2 represents student performance data retrieved from NC Report Cards (n.d.) distributed by year, subject, and school:

Table 2

Grade Level Proficiency on Standardized Tests Across Schools in Polk County School District

	Polk County Middle School			Polk County High School			
Year	eighth Grade Math EOG	eighth Grade Reading EOG	eighth Grade Science EOG	Math I EOC	English I EOC	Algebra 1 EOC	Biology EOC
2016	61.39%	67.49%	87.3%	70.6%**	n/a	n/a	78%
2015	57.49%	65.79%	82.89%	71.3%**	n/a	n/a	57%
2014	61.49%	69.79%	89.9%	71.8%**	n/a	n/a	58%
2013*	50.9%	60.8%	n/a	49.2%	n/a	n/a	44.3%
2012	93.4%	84.7%	n/a	n/a	87.3%	85.6%	90.5%

Note. EOG = End of Grade Exam; EOC = End of Course Exam. Adapted from NC Report Cards. (n.d.). Retrieved February 05, 2017, from https://ncreportcards.ondemand.sas.com/landing.html.
*North Carolina state-wide standards re-alignment resulting in the elimination/creation of some tests
**Polk County High School implementation of a year-long Math I course

It is important to note the standards shift that occurred during the 2013 school year. During this time, standards across the state in the identified subject areas were re-aligned, in some cases re-designing or eliminating standardized testing all together. Additionally, the reader may note that some subject areas are missing data or are not included in the table. These areas saw their testing shift from a standardized format to a final exam model designed for the purpose of measuring teacher effectiveness as opposed to student proficiency. This is important to note as grading for these exams is non-standardized, being locally determined by individual school systems. As a result, they cannot be used objectively in data analysis of student performance. For the purposes of this disquisition, data analysis of student performance in context was effectively limited to the subject areas of math and science. Data collected after the standards shift in 2013 saw Polk County Middle School performance in math average 57.81% across the 2013-2016 time-frame while Polk County High School Performance averaged 65.73% during the same period. Polk

County Middle School averaged a student performance rating of 86.6% from data collected from 2014 through 2016 in science while Polk County High School averaged 64.3% from the same time frame in corresponding ninth grade biology courses. While data preliminarily suggested science as a potential area of focus for addressing the issue of academic under-preparedness, district leadership determined math to be an area of need. As a result, the disquisitioner was directed to explore math deficit areas as they might correspond to student under-preparedness across school transition.

In a goal summary analysis of test results for all state tested math courses in the district (third grade through ninth grade [Math I]) from 2012-2015, data illustrates multiple trends related to cohort pathways. Figure 4 illustrates goal summary ratings from 2012-2015 in mathematics for Polk County Schools. The figure separates math standards and provides student proficiency scores for each standard and respective grade level. Additionally, the figure is color coded to illustrate cohort progression across three years. For example, when analyzing scores related to the learning progression associated with understanding geometric properties, there was a 17.2 percentage point drop from eighth grade students in 2014 to the same group of students in ninth grade in 2015. Across all math standards, there was an average drop of 8.33 points as students moved from eighth to ninth grade from 2013-2015.

History of the problem at Polk County High School. As research supports, the transition between schools is somewhat alleviated by the existence of only one middle and one high school in the district (Alspaugh, 1998; Schiller, 1999; Weiss & Baker-Smith, 2011). While Polk County Schools may benefit from this linear matriculation pattern, there are currently no formal programs in place to support student transitions between schools at a macro level.

Instructional decision making has been left to individual schools which have functioned almost exclusively in isolation from one another.

With this isolation has come professional development efforts designed specifically for each school and based upon data derived solely from each respective context. In other words, data related to student performance in ninth grade at the high school has not been utilized as a part of instructional decision making efforts at the middle school. Conversely, student performance data from the middle school has been largely ignored as a part of instructional decision making at the high school. This isolation of data has resulted in professional development plans being designed at each school that are absent critical components addressing student transition and subsequent performance.

Much of the past professional development efforts at PCHS have focused on relatively broad skills for educators. For example, PCHS leadership contracted with outside agencies to provide staff development from the 2012 school year through the 2014 school year on Marzano's Nine Effective Instructional Strategies. These strategies were developed by Robert Marzano et al. (2005) as a result of a meta-analysis of research based effective instructional strategies. This particular professional development program spanned across two years involving several outside speakers and a book study of Marzano, Pickering, & Pollock, (2005) work entitled *Classroom instruction that works: Research-based strategies for increasing student achievement.* More recent professional development has focused on specific instructional strategies for engaging students with special needs. These examples serve two purposes: (1) they illustrate the past focus of leadership and decision makers at PCHS, and (2) they show how instructional decision makers at PCHS have not yet acknowledged transitional difficulties faced by students as a

Polk County Schools Goal Summary Ratings

Math Standards

	Grade	% of Items	2012-13	2013-14	2014-15
Operations and Algebraic Thinking	3rd	31.9	70.3	73.9	76
	4th	15.9	64.9	59.2	65.8
	5th	6.8	69.9	62.9	61.3
Expressions & Equations	6th	30.0	63.0	56.5	60
	7th	26.0	64.7	49.4	58.8
	8th	32.0	57.1	57.5	57
Algebra	Math I	30.6	N/A*	45.6	45.5**

	Grade	% of Items	2012-13	2013-14	2014-15
Measurement and Data	3rd	25.0	60.7	63.2	67.6
	4th	15.9	63.4	59.3	60
	5th	13.6	64.6	64.4	62.9
Stats and Probability	6th	10.0	56.8	64.6	53.7
	7th	14.0	56.5	64.2	50.2
	8th	16.0	61.6	58.1	63.1
Stats and Probability	Math I	15.3	N/A*	54.8	48.7**

	Grade	% of Items	2012-13	2013-14	2014-15
Numbers and Operations - Base Ten	3rd	9.1	72.0	69.0	74.7
	4th	25.0	75.4	64.3	66.4
	5th	25.0	68.5	63.0	66.3
The Number System	6th	30.0	65.2	62.8	60.5
	7th	10.0	39.5	35.4	35.3
	8th	6.0	24.2	29.4	31.1
Number and Quantity	Math I	6.1	N/A*	22.2	26.9**

	Grade	% of Items	2012-13	2013-14	2014-15
Geometry	3rd	11.4	79.9	81.6	85
	4th	13.6	65.2	69.2	72.1
	5th	4.6	58.6	59.7	56.4
Geometry	6th	16.0	67.0	58.0	64.3
	7th	24.0	66.6	45.0	60.9
	8th	22.0	56.2	65.7	52.6
Geometry	Math I	10.2	N/A*	61.8	48.5**

	Grade	% of Items	2012-13	2013-14	2014-15
Numbers and Operations - Fractions	3rd	22.7	67.2	72.5	76.9
	4th	29.6	59.8	60.7	61.9
	5th	50.0	64.2	62.0	60
Ratio & Proportional Reasoning	6th	14.0	56.2	57.1	52.7
	7th	26.0	54.6	57.1	52.9
Functions	8th	24.0	52.5	59.8	52
Functions	Math I	37.7	N/A*	42.7	41.4**

* denotes Algebra I test administered

** denotes Math I instruction given in second semester only

Notes: 2012-13 was the first year of implementation for the new Common Core standards

Figure 4: Polk County Schools goal summary rating sheet. This figure illustrates data related to student achievement by math standards and cohort.

specific area of focus nor has there been emphasis placed on academic under-preparedness of students on a broad scale.

This does not mean that PCHS has not taken any steps to address the issue of underprepared students entering ninth grade. Math achievement has been an area of focus for PCHS leadership in the past several years. At PCHS, the math department is comprised of seven teachers, three of which teach ninth grade Math I courses. Polk County Middle School also has seven teachers in its math department, two of which teach eighth grade math. While overall math achievement numbers are very high when compared to the state level there are still many students who are not achieving grade-level proficiency in ninth grade Math I courses (see Table 2 above).

In response to declining math scores, PCHS implemented a math program in 2014 aimed at building incoming ninth grade student fundamental math skills prior to taking the Math I course. From 2014 through present day, all incoming ninth grade students are required to take a "Fundamentals of Math I" course before they are permitted to take the official Math I course. The only exceptions are students who make either an "A" or "B" in Math I in the eighth grade. Additionally, students who fail the "Fundamentals of Math I" course during their first semester are then enrolled in a "Foundations of Math" course in an effort to establish remedial skills for engagement in math curricula. While there has not been enough data collected to draw full conclusions about the ultimate effectiveness of the intervention, initial data shows a marked increase in the number of students enrolled in remedial math courses (see table 3). Students identified in need of foundational math skills in ninth grade has increased from eight total students in 2012 to 39 in 2015 supporting the theory of student under-preparedness as they transition from eighth to ninth grade.

Table 3

Students Enrolled in Foundational Math Courses at PCHS by Year

	2012	2013	2014	2015
Students Enrolled	8	12	32	39

Note. Adapted from PowerSchool - Polk [Computer software]. (n.d.). Retrieved February 5, 2017, from https://polk.powerschool.com/admin/reports.html. Secure Site

It is important to note the role of collaborative practice in PCHS's efforts to address the issue of student under-preparedness in math upon entering ninth grade. As a current practicing administrator, the disquisitioner situated in the PCHS setting has observed relatively high levels of collaborative practice occurring within the math department. Math teachers meet weekly on a formal basis, and sometimes bi-weekly on an informal basis, to discuss current instructional trends and needs. Conversely, there has been little to no communication or collaboration with Polk County Middle School math teachers regarding student performance or instruction. Additionally, the disquisitioner has observed very low levels of collaboration between middle school math teachers. These contrasting collaborative patterns led the disquisitioner to ask: (1) Do teachers understand the positive impact of collaborative practice? (2) What can be done to improve communication and collaboration both inside of each respective school and across schools?

Rutherford-Spindale Middle School

Demographics. Rutherford County Schools is a medium-sized school system nestled in the foothills of Western North Carolina. The system is controlled by a seven-member local school board. Executive leadership includes the superintendent, assistant superintendent, Chief Technology Officer/Chief Operating Officer, and a human resource director. The school system includes three (3) traditional high schools, three (3) middle schools, ten (10) elementary schools, one (1) early college, and one (1) alternative high school. The district average daily membership

(ADM) is approximately 8,200 students (PowerSchool-RCSNC, n.d.). Rutherfordton-Spindale Middle School (RSMS) is one of three middle schools within Rutherford County Schools. The school serves approximately 631 students in grades six through eight. A total of twenty seven (27) core teachers, eight (8) exploratory teachers, five (5) Exceptional Children Teachers, one (1) counselor, one (1) technology facilitator, one (1) media coordinator, two (2) assistant principals, and a principal are employed by the local Board of Education to serve the students in the Rutherfordton-Spindale geographic (PowerSchool-RCSNC, n.d.). Rutherfordton-Spindale Middle School's student population includes students identified as white (70%), students identified as black (16%), students identified as two or more (7%), students identified as Hispanic (6%), and students identified as Asian, Pacific Islander and American Indian (1%), male (49%), and female (51%) (PowerSchool-RCSNC, n.d.). School wide, 72% of RSMS students qualify for free or reduced lunch. RSMS operates on a yearlong block schedule. Within this schedule, exploratory courses rotate each grading period (six weeks). Students are organized into teams according to demonstrated ability level. Each team has three teachers: English-Language Arts (ELA), mathematics, and science/social studies. Students also take two exploratory courses each six weeks. These courses include: Band, chorus, art, EXCEL Enrichment, health, business and marketing, and physical education. RSMS also offers four courses for high school credit to advanced students. These courses include: Math I, Math II, English I, and Environmental Earth Science. RSMS operates under a pyramidal structure. Four elementary schools feed RSMS from four distinct communities in the county.

Rutherford County Schools is a rural district. Census data from 2010 records the total population of Rutherford County to be 67,810 as reported in the Western North Carolina Vitality Index (n.d.). The median household income was $35,364 in 2010 (Western North Carolina

Vitality Index, n.d.). Additionally, The Western North Carolina Vitality Index reported 21.5% of Rutherford County residents qualify for poverty status with 15% receiving government assistance through food stamps (n.d.). County-wide education figures from 2005-2009 show 34% of the population over 25 years of age having attained a high school diploma while 14% of those over 25 years of age having a four year college degree (Western North Carolina Vitality Index, n.d.).

Student performance data. When considering what subject area to address the issue of under-preparedness at Rutherfordton-Spindale Middle School, the disquisitioner used student performance data. Table 4 represents student performance data from NC Report Cards (n.d.) distributed by year, subject, and school:

Table 4

RCS Grade Level Proficiency on Standardized Tests Across Schools

	Feeder Elementary Schools (composite)			Rutherfordton-Spindale Middle School	
Year	fifth Grade Math EOG	fifth Grade Reading EOG	fifth Grade Science EOG	sixth Grade Math EOG	sixth Grade Reading EOG
2016	64.2%	64.5%	77.6%	53.4%	62.6%
2015	62.5%	64%	75.7%	46.6%	51%
2014	54.5%	56.3%	65.5%	41.8%	56.4%
2013*	51%	39.3%	44.5%	35.1%	38.9%
2012	74.8%	72.3%	78.7%	76.8%	72.6%

Note. EOG = End of Grade Exam; EOC = End of Course Exam. Adapted from NC Report Cards. (n.d.). Retrieved February 05, 2017, from https://ncreportcards.ondemand.sas.com/landing.html.
*North Carolina state-wide standards re-alignment resulting in the elimination/augmentation of some exams

In 2013, there was a substantial shift in the learning standards for students. Some standards were realigned, added, or eliminated completely. It is also important to note that no End-of-Grade

(EOG) exists for science in the sixth grade in North Carolina at this time. The disquisitioner choose math as the subject area of interest due to math having the most significant declines from fifth to sixth grade. From 2013 until 2016, mathematics experienced an average decline of 13.8 percentage points as students traveled from fifth grade to sixth grade. During that same time, reading numbers declined by 3.7 percentage points as students traveled from fifth to sixth grade. Determining mathematics as the subject area in greatest need, the disquisitioner chose this subject for the improvement initiative.

Figure 5 shows a significant decline in several math standards from fifth to sixth grade in Rutherford County Schools. The goal summary report shows cohorts in like colors. One can use this cohort data to interpret changes in academic performance between fifth and sixth grade. For example, in the 2012-2013 school year, students were 59.2 % proficient in Operations and Algebraic Thinking in fifth grade. That same cohort of students was only 45.6% proficient in sixth grade for Operations and Algebraic Thinking in the 2013-2014 school year. While District leaders acknowledge the many factors involved, the focus is on those factors that offer the greatest gains for students.

History of the problem at Rutherfordton-Spindale Middle School. Current Collaborative structures within RSMS include monthly subject area teacher-team meetings and weekly grade level meetings. Regular meetings also occur within the four elementary schools that feed into RSMS: Pinnacle Elementary, Mount Vernon-Ruth Elementary, Spindale Elementary, and Rutherfordton Elementary. Before the initiative, teachers were not collaborating vertically between fifth and sixth grades.

The lack of collaboration between fifth and sixth grade math teachers is concerning. Absent from collaboration, teachers work in their own independent bubbles. Briscoe and Peters

Rutherford County Schools Goal Summary Ratings

	Grade	% of Items	2012-13	2013-14	2014-15
Operations and Algebraic Thinking	3rd	31.9	64.1	68.1	69
	4th	15.9	58.4	57.7	60.1
	5th	6.8	59.2	51.7	51.8
Expressions & Equations	6th	30.0	44.5	45.6	40.8
	7th	26.0	50.9	52.0	51.3
	8th	32.0	41.6	45.1	42.7
Algebra	Math I	30.6	41.1	42.2	41.2

	Grade	% of Items	2012-13	2013-14	2014-15
Measure- ment and Data	3rd	25.0	55.6	56.7	57
	4th	15.9	54.2	55.5	53.9
	5th	13.6	56.8	58.1	56.7
Stats and Probability	6th	10.0	52.0	54.5	50.9
	7th	14.0	56.4	54.7	56.8
	8th	16.0	44.1	46.3	43
Stats and Probability	Math I	15.3	49.3	47.5	44.6

	Grade	% of Items	2012-13	2013-14	2014-15
Numbers and Operations - Base Ten	3rd	9.1	65.6	66.0	66.2
	4th	25.0	64.9	63.8	64.6
	5th	25.0	58.5	55.8	57.9
The Number System	6th	30.0	51.3	50.8	47
	7th	10.0	24.7	25.6	28.1
	8th	6.0	15.9	17.8	18.5
Number and Quantity	Math I	6.1	31.1	32.9	28.1

	Grade	% of Items	2012-13	2013-14	2014-15
Geometry	3rd	11.4	77.0	76.2	77.4
	4th	13.6	64.5	65.3	62.3
	5th	4.6	55.2	48.9	45.1
	6th	16.0	47.4	50.6	43.6
	7th	24.0	40.9	41.4	41.3
Geometry	8th	22.0	47.6	54.0	48.6
Geometry	Math I	10.2	53.4	54.7	45.3

	Grade	% of Items	2012-13	2013-14	2014-15
Numbers and Operations - Fractions	3rd	22.7	63.0	67.7	67.7
	4th	29.6	54.5	57.5	58.4
	5th	50.0	54.5	54.6	53.3
Ratio & PR	6th	14.0	50.5	52.8	48.8
	7th	26.0	49.4	50.2	49.9
Functions	8th	24.0	42.8	47.1	43.9
Functions	Math I	37.7	38.0	37.0	39.2

Figure 5: Rutherford County Schools goal summary rating sheet. This figure illustrates data related to student achievement by math standards and cohort.

(1996) assert the importance of teacher collaboration as it leads to increased student outcomes and greater job satisfaction.

There are notably no formal policies to foster collaboration across these schools. Each school operates on its own island, preventing cross-school collaboration and potential opportunities for capacity building. Each school year, fifth grade students from feeder elementary schools visit RSMS during a school day. Students are introduced to sixth grade teachers, receive a snapshot of general student expectations, and complete a campus tour. This one day may be the only time a sixth grade teacher will see a fifth grade teacher the entire school year. Aside from this brief induction for students, there are currently no other efforts made by RSMS, the Elementary Schools, or by the District.

The disquisitioner feels that the lack of collaboration between fifth and sixth grade teachers is a product of logistical obstacles as opposed to anti-collaborative mindsets. The initiative revealed the amount of time, commitment, and desire required to address deficits in vertical collaborative practices. The initiative also revealed the willingness of teachers to build their professional capacity with fidelity when such opportunities are facilitated and provided.

CHAPTER II: THE IMPROVEMENT INITIATIVE

Addressing the issue of academic under-preparedness across school transitions is a complex undertaking. While we have illustrated several of the factors contributing to the problem, we reiterate the importance of educational leaders discerning which factors they can indeed influence. To the point, what are the ways in which we, the educators, have contributed to the problem and/or have not sufficiently addressed the problem? In this case, how have we created or contributed to students' academic under-preparedness as they transition to new schools? As we detailed earlier, ineffective teachers and insufficient or inadequate capacity building (variables controlled by schools and school districts) drive this problem. Conversely, research contends that *effective teachers* and *high-quality capacity building* can solve this problem. In this section, we provide: (1) a summary of common initiatives aimed at addressing academic underpreparedness, (2) research connecting high-quality teacher capacity building with student preparedness and academic success, (3) a summary of the literature supporting collaborative inquiry teams as a tool for increasing teacher effectiveness, (4) a summary of the literature supporting "best practices" for improvement process design, and (5) a description of the improvement process that occurred within each context. For the latter, we will detail how the disquisitioners, serving as school leaders, worked with their design-teams to prove their theory of improvement: *high-quality capacity development through vertical, collaborative teaming increases student preparedness for math courses across transitions*.

Common Initiatives Aimed at Addressing Academic Underpreparedness

School leaders who recognize under-preparedness as a cause of academic decline, understand the importance of identifying foundational or prerequisite skills for course success. Students who possess prerequisite skills are more likely to have access to academic content

which increases the likelihood of overall academic success (Emmett & McGee, 2011). In response, school leaders across the country have employed a number of strategies to combat academic under-preparedness. Some middle schools have offered "summer academies" aimed at both remediating low performing students as well as acclimating them to middle school organizational norms such as moving from one class to another--largely non-existent in the self-contained settings of a traditional elementary school (Balfanz, 2009; George, Breslin & Evans, 2007). Many high schools have implemented similar summer remediation programs and have even extended efforts through the creation of freshman academies aimed at increasing academic achievement through individualized attention and support while removing social pressures and competition from older students (Breslin & Evans, 2007). In a study pitting ninth grade student achievement in schools containing freshman academies against traditional high schools, Styron & Peasant (2010) show marked increases in student performance for schools containing freshman academies. While transition programs like freshman academies show promise, they are not the only solution to under-preparedness and may not always be feasible given context specific constraints related to implementation such as limitations of the physical building, staffing, and/or funding.

Effective Teachers and the Advancement of Student Learning

A growing body of research points to teacher effectiveness as instrumental in the academic growth and trajectories of students (Nye, Konstantopoulos & Hedges, 2004; Darling-Hammond, 2000; Hanuschek, 2011; Rockoff, 2004). Teacher effectiveness carries such an impact on student learning that it even outweighs the effects of differences in class size or heterogeneity (Darling-Hammond, 2000). Studies have continued to show that highly effective teachers hold the potential to close achievement gaps facing poor and minority students and even

go so far as to suggest that the cumulative effect of having highly effective teachers consecutively, over several years, is enough to close minority achievement gaps all together (Haycock, 1998; Gordon, Kane & Straiger, 2006; Darling-Hammond, 2000). If school leaders are to begin to analyze issues related to student achievement, perhaps they should look closer at the largest determinant factor: the teacher.

As previously cited, Yoon, et al. (2007) provided a model for professional development illustrating the connection between professional development and student achievement. This model asserts that high quality professional development enhances teacher knowledge and skills thereby improving classroom teaching and subsequently raising student achievement (Yoon, et al., 2007). Figure 6 represents our adaptation of Yoon et al.'s (2007) description of professional

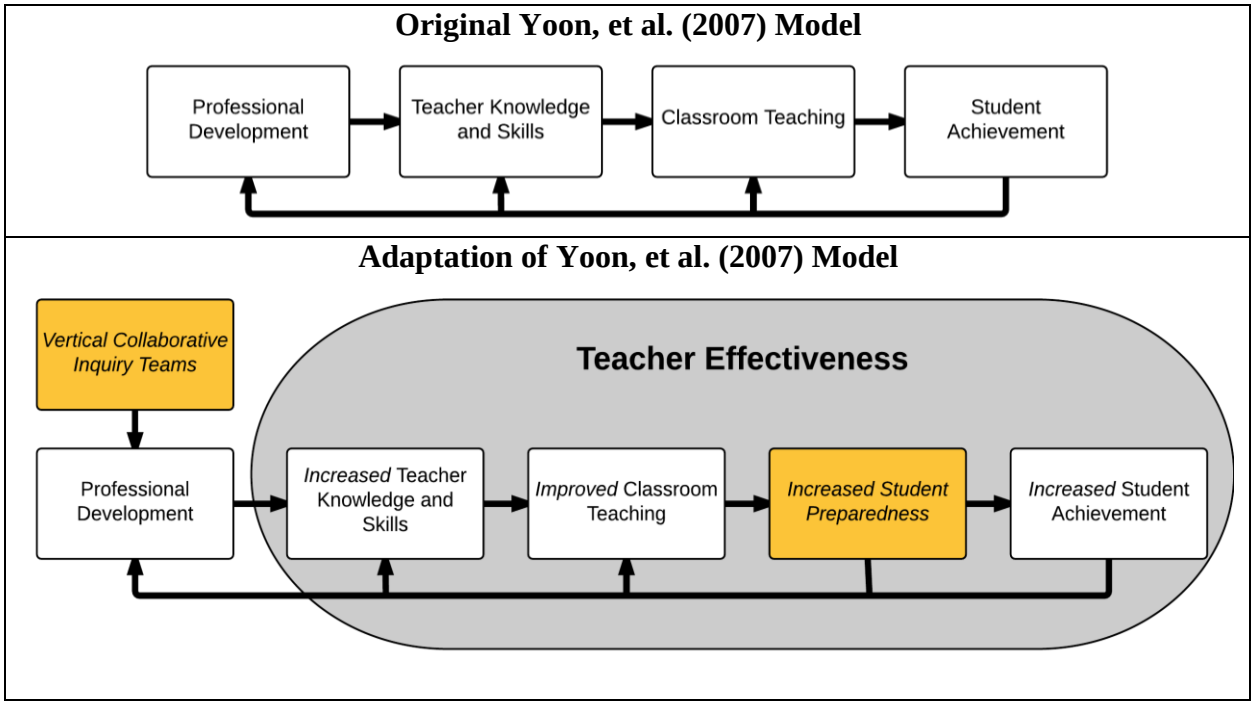

Figure 6: The relationship between high-quality capacity development through vertical, collaborative teaming and academic achievement. Adapted from "Reviewing the Evidence on How Teacher Professional Development Affects Student Achievement," by Yoon, K. S., Duncan, T., Lee, S. W. Y., Scarloss, B., & Shapley, K. L., 2007, *Regional Educational Laboratory Southwest, 33,* p. 4.

development as it relates to student achievement. In our adaptation, we believe the implementation of vertical collaborative inquiry teams acts as the specific professional development needed for increasing teacher effectiveness through increased teacher knowledge and skills leading to improved classroom teaching. This will, in turn, result in increased student preparedness across school transitions and ultimately increase student achievement. Additionally, we believe teacher knowledge and skills, classroom teaching, student preparedness and student achievement are elements situated inside the realm of teacher effectiveness. As a result, the implementation of vertical collaborative inquiry teams represents professional development capable of positively impacting teacher effectiveness.

Collaborative Inquiry Teams as a Tool for Increasing Teacher Effectiveness

Increasing the teaching capacity and effectiveness of teachers is a major goal of professional development. Unfortunately, engaging in substantive dialogue about teaching and learning is somewhat uncommon in American public schools (Nelson, Deuel, Slavit, & Kennedy, 2010). Sarason (1990) noted, "it is virtually impossible to create and sustain, over time, conditions for productive learning for students when they do not exist for teachers" (p. 45). The realization of this truth may be one reason that collaborative inquiry groups are proliferating in schools across America in recent years (Nelson et al., 2010). Teachers must first become learners and critical of their own practice before meaningful change can occur.

Teacher inquiry groups are a viable alternative to top-down, mandated professional development efforts as goal oriented inquiry groups are able to focus on improving student outcomes (Butler & Schnellert, 2012). Student improvement is a product of the collegial dialogue that engages deeply the acts of teaching and learning (Nelson et al., 2010). Shank (2006) identified four critical benefits of teacher inquiry groups: “(1) facilitate the creation of a

collaborative learning space based on trust, validation, collegiality, authenticity, and open doubt; (2) provide the participating teachers mirrors for thinking about practice and windows for seeing pedagogical possibilities; (3) help the teachers connect the personal-practical dimension of their practice—the domain of individual classrooms and minds—with the more public, conceptual dimension of pedagogical issues; and finally, (4) facilitate a shared understanding of what constitutes good pedagogy" (p. 712). While collaborative inquiry teams hold the potential for meaningful capacity building in teachers, the potential is wasted unless a communal sense of values and beliefs are established as well as a dedication to putting what is learned into practice.

The term *professional learning community* (PLC) is common amongst today's educators. Some regard the PLC as a program, a set of meetings, or a professional book club. The PLC process is none of these. The PLC concept represents "an ongoing process in which educators work collaboratively in recurring cycles of collective inquiry and action research to achieve better results for the students they serve" (DuFour, DuFour, Eaker, & Many, 2010). True PLC groups work in perpetuity towards their desired outcomes. The PLC process does not require teachers to work harder than they have in the past; it asks those involved to redefine their roles and change the ways they do business (DuFour & Marzano, 2011). PLC's break the boundaries of scheduled meeting times and infiltrate the true philosophy of teaching and learning within teachers.

Eaker and DuFour (1998) outlined six characteristics of effective professional learning communities: (1) Shared mission, vision, and values, (2) collective inquiry, (3) collaborative teams, (4) action orientation and experimentation, (5) continuous improvement and (6) results orientation (pp. 25-29). These six characteristics affirm Carroll's (2009) statement that, "Quality teaching is not an individual accomplishment, it is the result of a collaborative culture that

empowers teachers to team up to improve student learning beyond what any one of them can achieve alone" (p.13).

A shared mission, vision, and values are vital to the success of the PLC (Eaker & DuFour, 1998). It is this shared commitment to guiding principles that determines what people believe and how they go about conducting the business of the school. Collective inquiry is, "the engine of improvement, growth, and renewal in a professional learning community" (Eaker and DuFour, 1998, p. 25). Collective inquiry invites curiosity and open mindedness. It also places a great deal of value on the process of finding the answer rather than the answer itself. Collaborative teams provide the structure for learning from one another, thus enhancing the collective capacity for learning amongst all involved. Action orientation and experimentation allows team members to turn ideas into action. With action orientation and experimentation, there is value placed in being engaged in the experiences of improvement efforts. Continuous improvement calls for repealing the status quo and a perpetual search for better methods to conduct PLCs. This refusal to be idle pushes the PLC to perform at the highest level possible. Finally, results orientation builds the case that improvement efforts must be measured using data rather than the intentions of the group. For these six characteristics to be fulfilled with fidelity, skillful school leaders are needed.

The PLC will never reach its potential without effective leadership (DuFour & Marzano, 2011). Effective leadership in this context refers to district and school level leaders who develop strategies for gaining the perspectives of others and who foster dialogue amongst all constituents. Effective leaders "are hungry for feedback so they can make adjustments and course corrections" (DuFour & Marzano, 2011, p. 43). This mode of thinking is contrary to the traditional top-down approach that many school leaders employ when implementing initiatives for school

improvement. The problem with a top-down approach is that the focus is often on short-term results that tend to limit capacity building and teacher enthusiasm (Jacobson, 2010). The collaborative design structure of the PLC provides a means for focused interactions between principals and teachers (DuFour & Marzano, 2011).

Figure 7 displays the importance of the principal's actions. Effective principals will select and develop teachers to lead collaborative teams because without such leadership, the collaborative process will deteriorate (Gallimore, Ermeling, Saunders, & Goldenberg, 2009). The results of effectively implemented collaborative PLC teams will promote deeper thinking regarding pedagogical practices, enhanced teacher communication structures, and improved student outcomes (DuFour & Marzano, 2011). Principals acting alone to influence teacher actions in the classroom will have to exert much more time and energy than those who implement effective collaborative teams.

In an effort to maximize the effectiveness of the PLC, Jacobson (2010) advocates for alignment across teams, coherence across team meetings, and integration of professional development and professional learning community. The alignment across teams involves the identification of priority learning goals. As teams review school data in order to identify priority standards, school wide issues can emerge. This can provide PLC teams the opportunity to confront issues that extend beyond any one classroom. Coherence across team meetings is the result of planning backwards to ensure that lessons and assessments are collaboratively formed to target the priority learning goals (Jacobson, 2010). The integration of professional development and PLC unites the need for professional development while confronting the needs of practice.

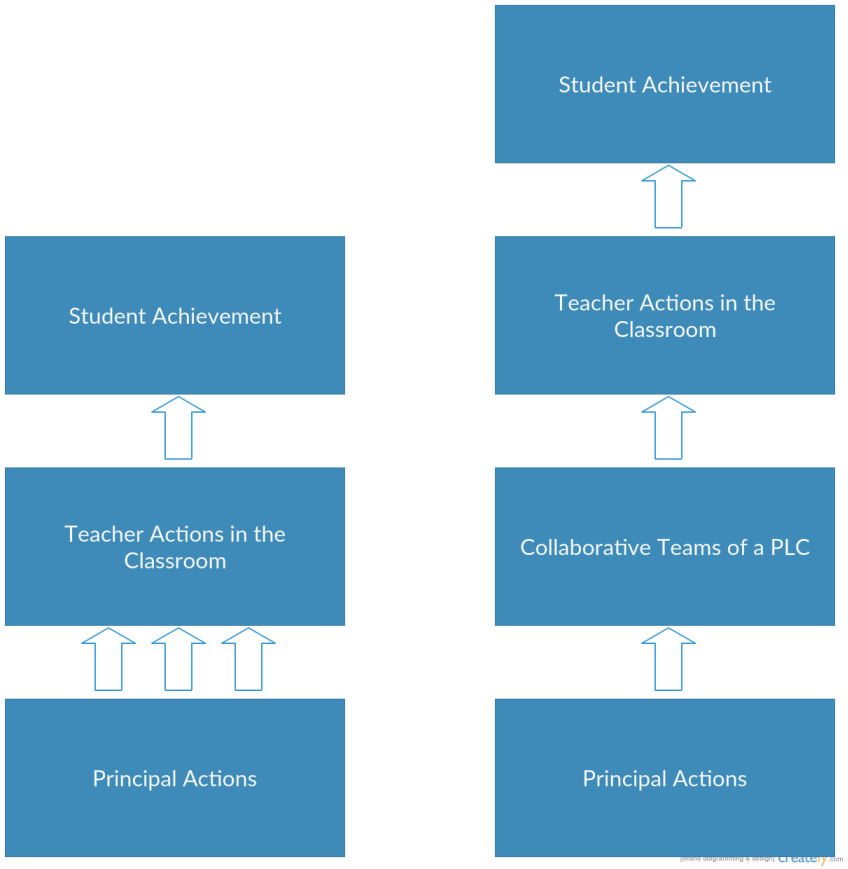

Figure 7: Relationship between principal behavior and student achievement with the collaborative teams of a professional learning community. Adapted from "*Leaders of Learning: How District, School, and Classroom Leaders Improve Student Achievement*," by R. DuFour and R. J. Marzano, copyright 2011, Solution Tree Press, p. 52

When implemented correctly, collaborative inquiry teams hold the potential to have lasting impacts on teachers through increased teaching capacity and effectiveness (Nelson et al., 2010). The use of collaborative inquiry teams provided a means of utilizing research supported PLC processes that have been proven to increase student achievement (DuFour et al., 2010). We believe that by combining deep inquiry of practice emphasized by collaborative inquiry teams with the action oriented nature of professional learning communities, we will create a community of teachers dedicated to improving their practice through relentless self-assessment, implementation and analysis of practice, and a dedication to student learning.

Best Practices for Improvement Process Design

"Design thinking" has emerged in recent years as a cutting edge means of conceptualizing the work of practitioners (Brown, 2008; Brown & Wyatt, 2015). Design thinking refers to how designers (in our case, teachers) see problems and consequently engage in thought processes to solve problems (Liu, 1996). In the service arena, this process involves the fundamental deconstruction of issues related to a delivered service, and the redesign and alignment to end-user need (Brown, 2008). For our specific context, this equates to deconstructing the issues associated with academic under-preparedness as it relates to the current system, and redesigning or developing a system that better meets the needs of students.

Razzouk & Shute (2012) cite systems thinking as one of the key characteristics of design thinkers. As a result, addressing issues of academic under-preparedness requires educators to think beyond their own classroom. It is for this purpose that the collaborative inquiry teams extended both horizontally inside of grade levels, and vertically between them. This uniquely positioned the team to be able to develop a more holistic solution utilizing transition variables within the scope of their control.

Though design and systems thinking have become popular in recent years, it is not a new construct. In 1931, Walter Shewhart published a work entitled "Economic Control of Quality of Manufactured Product". Through his work, Shewhart (1931) argued for the recognition of a concept called "the problem of control." This concept asserts that when a standard is set for an outcome product from a given system, the unknown causes will inevitably cause variance in the outcome product (Shewhart, 1931). As a result, those looking to improve the system and maintain strict predetermined standards must be able to evaluate variables that might ultimately lead to product variance. Edward Deming built upon Shewhart's work in the 1950's and

introduced the Plan-Do-Check-Act (PDCA) cycle as a means to evaluate errors, establish standards and provide for the ongoing re-evaluation of those standards (Langley, et al., 2009). This model would provide the foundation for today's Plan-Do-Study-Act (PDSA) cycle used in improvement science models.

The Plan-Do-Study-Act (PDSA) Cycle serves as an improvement model for leaders. The PDSA Cycle contains four components (see figure 8) essential to the successful implementation of an intervention.

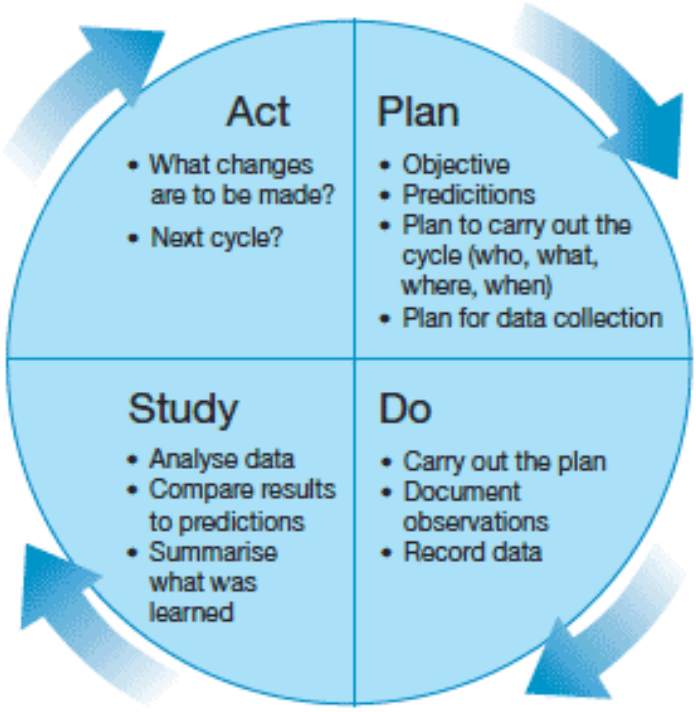

Figure 8: The Plan-Do-Study-Act Cycle. Adapted from "*The Improvement Guide, A Practical Approach to Enhancing Organizational Performance*," by G. J. Langley, R.D. Moen, K.M. Nolan, T.W. Nolan, C.L. Norman, L.P. Provost, copyright 2009, Jossy-Bass, p. 97

Langley et al. (2009) describe the four components of the PDSA Cycle.

The four steps in the cycle used for testing consist of planning the details of the test and making predictions about the outcomes (Plan), conducting the test and collecting data

> (Do), learning from comparing the predictions to the results of the test (Study), and taking action based on the new knowledge (Act) (Langley et al., 2009, p. 142).

In addition to providing leaders with a framework for improvement, the PDSA Cycle allows new knowledge to be generated as improvement cycles are

A good plan is critical to the success of an improvement effort. The *Plan* phase of the PDSA Cycle includes the formation of objectives and predictions regarding desired outcomes. This phase serves to focus leaders on the *who, what, when, and where* of the improvement effort. Where will the intervention take place? What will be the components of the intervention? What methods will be used to evaluate the results? The answers to such questions should be clear prior to advancing to the following phases of the PDSA Cycle.

The *Do* phase includes performing the intervention and collecting data (Langley et al., 2009). This phase has many learning opportunities for leaders. Recording unforeseen obstacles and unexpected issues help to promote learning for the leader so that improvements can be made in subsequent PDSA Cycles. The collection of data is of great importance in the *Study* phase of the Cycle.

The *Study* phase of the PDSA Cycle marries the predictions made in the *Plan* step and the results collected in the *Do* step. If the results of the intervention match the predictions made, leaders can feel more confident in their knowledge and understanding of concerning the problem. If the results of the intervention conflict the predictions made, there is opportunity to explore why the prediction was not correct (Langley et al., 2009). For example, if an intervention is not successful leaders might conclude:

- The change was not properly executed.
- The support processes required to make the change successful were not adequate.

- The change was executed successfully, but the predicted results did not occur (Langley et al., 2009, p. 143).

The *Act* phase of the PDSA Cycle is an opportunity for leaders to determine the next course of action. Decisions regarding the continuation of the improvement effort must be made during this phase. Should the intervention be abandoned? Should it be adapted? Should it be implemented with more fidelity? The answers to these questions and others will dictate the direction of future PDSA Cycles.

The PDSA cycle served as a useful tool in the long range design of our initiative. In the subsequent sections, we will describe how each context implemented the overall initiative design. Imbedded in each model is the first steps of the PDSA cycle. While the scope of this disquisition only allowed for the description of the first cycle, disquisitioners in both settings emphasized a recursive design model calling for a constant re-evaluation of the overall initiative design and investigation of elements related to academic underpreparedness.

Additionally, disquisitioners recognized that these processes do not occur based on the input and evaluation of any one person, but require buy-in from all participating members in the improvement of the overall system. As a result, a critical leadership element the initiative was involving participating members in the decision and design making process moving forward. This "distributed leadership" serves to enhance morale and motivation, and promote a sense of responsibility and commitment to organizational effectiveness and improvement (Spillane, 2005). The distributed perspective requires that we look beyond the fixation on administrators as the sole agents of change and focus instead on the team of individuals who take responsibility for leading (Spillane, 2009). We consider this approach to be a strength of our design as we are placing decision making and design processes beyond the initial phases of the intervention in the hands of the team.

Improvement Methodology for Polk County Schools

Design Team

Disquisitioners were uniquely situated within their contexts as scholar-practitioners, serving as participants, observers and evaluators of the improvement initiative design team and process. The disquisitioner first established a design team to further explore the issue of academic under-preparedness across school transition in math. Members of the design team were selected by the disquisitioner on the basis of organizational and systems leverage as well as expertise (knowledge base). In addition to the disquisitioner, the design team consisted of the following organizational job roles:

- District Director of Curriculum and Instruction
- Middle School Principal
- Middle School Curriculum Coordinator
- High School Principal

The design team was presented with initial data supporting the problem of academic under-preparedness across school transition in our district. This data included a comparison of grade level proficiency on standardized tests across schools in Polk County School District (see Table 2) as well as goal summary performance data related specifically to math achievement (see Figure 4) and remedial math enrollment data (see Table 3). The team collectively agreed that the greatest area of leverage was organizational factors, specifically professional capacity of teachers. As a result, the team developed an improvement charter (see Appendix A) as a framework for addressing under-preparedness including initial team goals and proposed outcomes. An improvement charter is a written expression of the "aim" of the initiative (Langley, et al., 2009). In other words, an improvement charter answers the question: What are

we trying to accomplish? Additionally, improvement charters can provide answers to the question "How will we know that a change is an improvement?" through the establishment of performance goals (Langley, et al., 2009). Figure 9 illustrates an excerpt from the improvement charter developed in Polk County Schools outlining the project scope.

4. Project Scope
INTENT *What is the rationale for this cycle?*
Students are entering ninth grade math courses lacking the prerequisite skills needed to be successful.
BACKGROUND *What is the current state of knowledge on the topic?*
Math teachers in the ninth grade indicate that large amounts of time is spent re-teaching materal at the beginning of each course that is thought to be covered in previous grades. Initial data shows increased placement in remedial math courses in ninth grade, suggesting academic underpreparedness. Additionally, there are no collaborative structures established between grade levels and varying levels of collaboration inside of grade levels.
AIM *What do we wish to accomplish through this cycle?*
The purpose of this intiative is to improve student overall readiness upon entering math classes in the ninth grade through the establishment of a vertical team between eighth and ninth grade teachers

Figure 9: Excerpt from Polk County Schools implementation charter.

This excerpt from the Polk County Schools implementation charter illustrates the intent, background, and aim of the initiative. The intent, or rationale, is that students are arriving in ninth grade math courses under-prepared to engage grade level content. The background, or current knowledge on the topic, details specific indicators related to a need for improvement. Finally, the aim statement details the purpose of the initiative: to improve overall readiness upon entering math classes in the ninth grade through the establishment of a vertical team between eighth and ninth grade teachers**.**

Desired Outcomes

A critical question that should be asked in any design team process is "How will we know that a change is an improvement" (Langley, et al., 2009, p. 61)? To answer this question, multiple data points are needed due to the complexity involved in the system in which we are trying to improve. Langley, et al. (2009) proposes that these data points, or "outcome measures" can be divided into three separate levels of measurement: (1) outcome measures, (2) process measures, and (3) balancing measures.

Outcome measures are broadly defined as the final performance measures of the system you are trying to improve (Langley, et al., 2009). Outcome measures are highly specific and relate directly to the aim of the project (Langley, et al., 2009). They represent the "end product" or measure of a set standard one wishes to achieve.

Process measures are defined by Langley, et al. (2009) as indicators of whether or not an activity has been accomplished. In other words, process measures represent the specific steps in a process that produce a particular outcome. Langley, et al. (2009) describes process measures as most often used to determine if a PDSA cycle was carried out as planned.

Balancing measures are an important means of ensuring that through the PDSA cycle, any related measures are not negatively affected by our efforts (Langley, et al., 2009). In other words, while implementing processes to ensure academic preparedness for students, an appropriate balancing measure might be ensuring that overall student performance does not decline.

Figure 10 represents the desired process and outcome measures employed by the Polk County Schools design team. In the case of our design, outcome measures were divided into two sub-categories: long term and short term outcome goals. Long term goals represent long range

measures we hope to improve through adjustments to the overall system. Increased student preparedness was chosen as a long term outcome goal. Due to the scope of this disquisition, long term outcomes were not able to be measured in the first PDSA cycle. This measurement data would need to be collected over the course of several years to represent a viable measure.

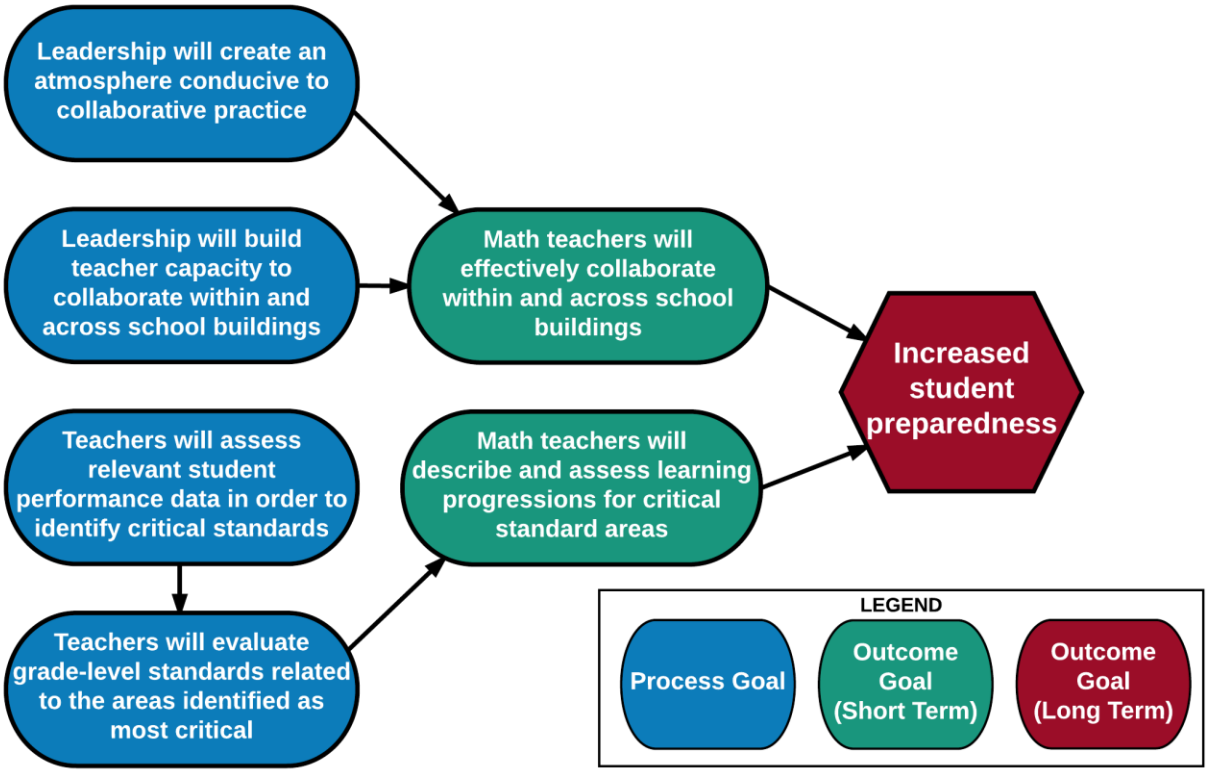

Figure 10: Desired outcomes for the design team and the improvement process

Short term outcome goals represent related measures that are obtainable through the scope of this disquisition. Short term outcome goals included math teachers effectively collaborating within and across school buildings and math teachers being able to describe and assess learning progressions for identified critical standard areas. Learning progressions are defined as the pathways students travel as they progress toward mastery of a given skill ("Standards Aligned System", n.d.). The disquisitioners define “critical standards” as those that

are identified by participating teachers in the initiative as essential to arriving prepared to the next level of math content. Both of these process goals have been determined by the design team to be directly related to increasing student preparedness. Additionally, we have previously cited literature connecting both collaborative practices and the improvement of teacher knowledge/skills to increased student achievement (Darling-Hammond, 2000; DuFour et al., 2010; DuFour & Marzano, 2011; Gordon, Kane & Straiger, 2006; Hanuschek, 2011; Haycock, 1998; Nelson et al., 2010; Nye, Konstantopoulos & Hedges, 2004; Rockoff, 2004; Sarason, 1990; Yoon, et al., 2007).

The design team set several desired process goals related to corresponding short term outcome measures. First, process goals related to teacher collaboration included initiative facilitators creating an atmosphere conducive to collaborative practices. Additionally, facilitators will build the capacity of teachers to effectively collaborate within and across schools. Second, for math teachers to be able to describe learning progressions in critical standard areas, those areas must be first identified by the teachers participating in the initiative. Subsequently, teachers will then explore current grade level standards related to the identified areas in both sending and receiving grades.

Balancing measures were also considered in the goal formation phase of the design team process. Two important balancing measures were developed related to short term outcome goals. First, disquisitioners wanted to ensure that in the efforts to build teacher capacity to collaborate within and across schools, we did not inadvertently turn them against collaborative practices as a whole. Therefore, it became important to measure teacher beliefs related to collaborative practices throughout the initiative. Second, it was important that improvement efforts not remove teachers from their classrooms for extended periods of time, thereby presenting a possible

negative effect on students because of their teacher's absence. As a result, the initiative design was developed to minimize missed class time. However, it was important to measure participating teacher perceptions related to time away from their class as a relevant balancing measure.

Participants

A total of five teachers were identified as likely candidates for the improvement initiative. These teachers represented all of the eighth and ninth grade math teachers in our district. Three ninth grade math teachers were involved from Polk County High School while two eighth grade math teachers participated from Polk County Middle School. Teachers were sent a written invitation explaining the goals of the initiative and asked to respond on a volunteer basis for participation. All five teachers volunteered for participation and were instructed that they could withdraw at any time. For the purposes of this disquisition, each teacher will be given the pseudonym "teacher" along with a corresponding internal identifying label of "P" indicating a Polk County Schools participant followed by a final internal identifying number.

As stated, three ninth grade math teachers participated from Polk County High School. Teacher P1 was a veteran teacher of fourteen years, four of which were served at PCHS as a ninth grade math teacher. Teacher P1's highest degree obtained was a bachelor's degree in mathematics and secondary education. Teacher P2 was in their ninth year of education, all of which have occurred at PCHS as a ninth grade math teacher. Teacher P2's highest degree obtained was a bachelor's degree in mathematics and secondary education. Teacher P3 was in their fifth year of experience in education with all of those years transpiring at PCHS as a ninth grade math teacher. Teacher P3's highest degree obtained was a bachelors in math education.

Two eighth grade math teachers participated from Polk County Middle School (PCMS). Teacher P4 was in her twenty second year of public education with twelve of those years occurring at Polk County Middle School. During those twelve years at PCMS, Teacher P4 taught nine years as an eighth grade math teacher and three as a sixth grade math teacher. In total, Teacher P4 has fifteen years of experience as an eighth grade math teacher. Teacher P4's highest degree obtained is a bachelors in math education. Teacher P5 had seventeen years of experience in public education, with ten of those years occurring at PCMS. Teacher P5 taught eighth grade math for all ten years they were at PCMS and has a total of twelve years of experience in eighth grade math. Teacher P5's highest degree obtained is a masters of mathematical studies.

Implementation Process

A four-step process was developed by the design team in Polk County Schools to address the problem of academic under-preparedness across the transition between schools. These steps included: (1) team formation, (2) teacher inquiry, (3) data analysis, and (4) turning learning insights into action. A total of seven vertical collaborative inquiry team (VCIT) meetings were scheduled spread across the four steps beginning January 18, 2016 and extending through April 2016. Although the design team predicted the estimated number of inquiry team meetings for each step, the disquisitioner was permitted additional meeting times as needed based upon formative assessment results. Figure 11 illustrates the steps in succession as developed by the design team.

Team formation. In step one of figure 11, the disquisitioner was responsible for assembling the team of teachers. Potential team members were identified based upon their current teaching assignment and grade level. The five teachers that were invited to participate in the vertical collaborative inquiry team represented all of the acting eighth and ninth grade math

teachers in Polk County Schools at that time. The five invited teachers included three ninth grade math teachers from PCHS, and two eighth grade math teachers from PCMS. These teachers were sent an invitation to the initiative that included a brief description of the overall scope and aim of the initiative along with a copy of the charter developed by the design team (see Appendix A). The invited teachers were instructed that participation was on a volunteer basis and they were permitted to withdraw at any time. All five teachers responded indicating they wished to participate in the team.

After the selection and verification of team members was concluded, all members were asked to attend the first VCIT meeting, scheduled to take place during a district-wide staff development symposium. This initial meeting would last approximately four hours and was dedicated to team member socialization, team review of literature supporting PLC practices and concluded with goal and norm setting for the team.

Teacher inquiry. Step two of Figure 11 represents the teacher inquiry phase. This phase was spread across two meetings, each of which occurred after school and lasted for approximately one and a half hours. During the first session, VCIT members were asked identify and share perceived areas of deficiency in math skills. The team then compiled a list of collaboratively agreed upon skills that were currently deficient and were most critical to student preparedness/success as they entered ninth grade math.

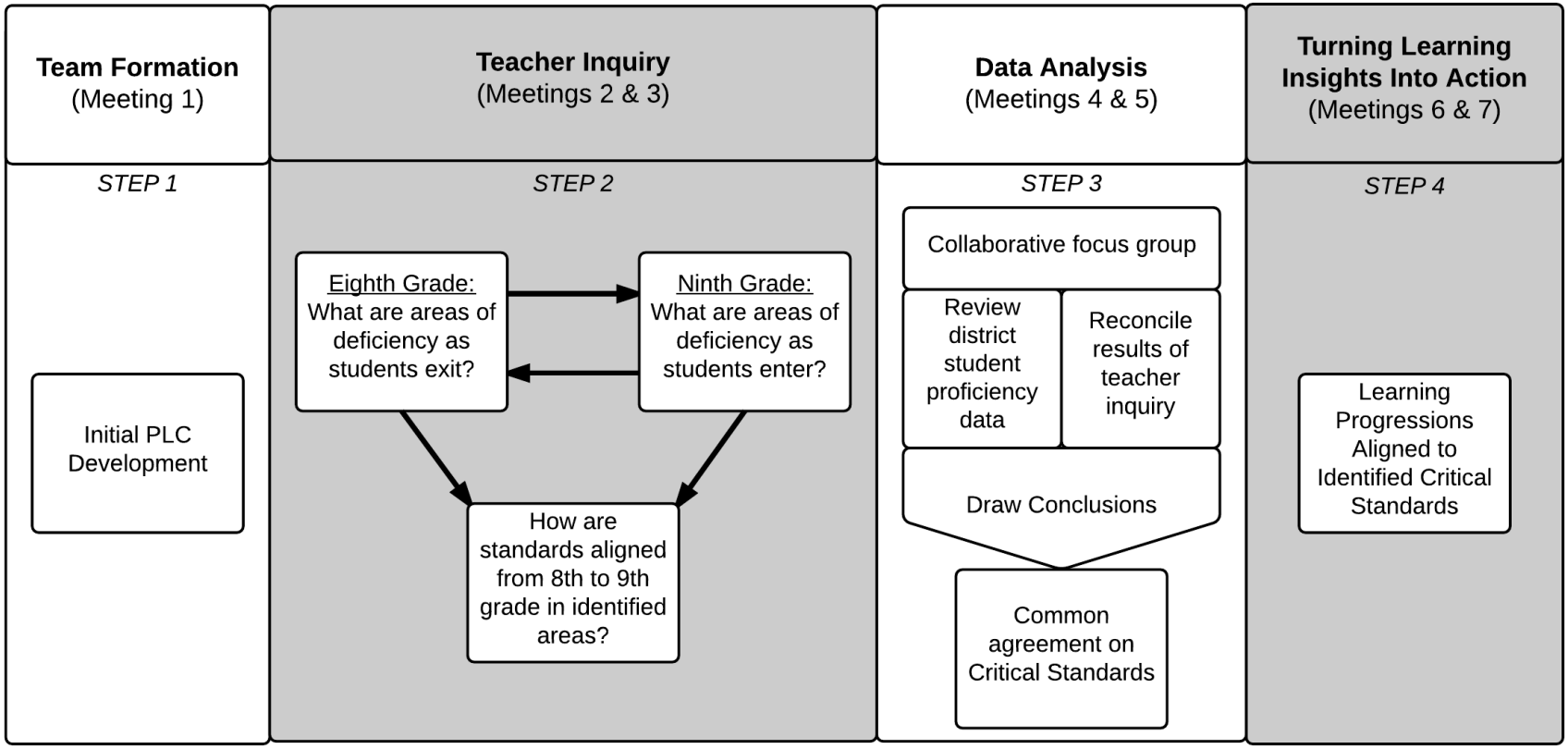

Figure 11: Polk County Schools improvement initiative implementation plan

In the second meeting teachers extended their work in self-identifying perceived areas of deficiency in math skills as student's transition from eighth to ninth grade. During this meeting teachers began to explore current grade-level standards related to their own identified areas. Team members first evaluated and identified ninth grade math standards related to the identified areas of skills deficiency. The meeting concluded with team members evaluating and identifying eighth grade math standards related to perceive skill deficiency areas.

Data analysis. Step three of figure 11 asked teachers to complete analyze and evaluate data in relation to their perceptions. This phase was spread across two meetings. The first was an all-day professional development session asking teacher to review and analyze student performance data. The second meeting was an hour long meeting dedicated to developing common agreement on critical standards to be addressed by the team.

During the all-day session, teachers reviewed district goal summary data (see figure 5) and identified emergent trends. During this session, teachers worked with the disquisitioner as well as the district Testing/Accountability Director to understand and evaluate student performance indicators. Over the course of the meeting, team members were provided professional development in understanding state-generated assessment data as well as identifying multiple factors related to data set development.

A portion of the first meeting was dedicated to teachers determining whether their perceptions aligned with student performance outcomes. This process extended into, and was concluded in, the second meeting. As a final phase to the overall data analysis step, teachers were asked to develop common agreement on critical standards as an area of focus for future work. These critical standards were comprised of a reconciliation of teacher perceptions along with student performance data.

Turning learning insights into action. In step four, teachers were asked to turn their learning insights into action. A total of two meetings, each one and a half hours in length, was allotted for this step by the design team. This action step would require teachers to develop learning progressions aligned to the critical standards identified in the previous step. These learning progressions would represent the pathway of skills and abilities needed to master the identified critical standard area. Teachers again evaluated current standards respective to eighth and ninth grade curriculums for the critical standard area. Additionally, teachers began to break down and map the necessary prerequisite skills associated with the critical standard.

Improvement Methodology for Rutherford County Schools

Design Team

In an effort to best address the issue of under-preparedness across transitions, the disquisitioner formed a design team. The design team was purposefully comprised of members with diverse experiences and expertise. The design team included:

- Fifth grade math teacher
- Sixth grade math teacher
- Assistant Principal
- Elementary Curriculum Specialist
- Middle Grades Curriculum Specialist
- Director of Middle Grades Education
- Director of Secondary Education
- Director of Elementary Education

The RCS design team was introduced to the multiple factors contributing to academic under-preparedness across school transition. The design team decided that focusing on

organizational factors, specifically the professional capacity of teachers, would be paramount in addressing this problem. An improvement charter (see Appendix B) was developed by the design team to foster the desired change.

Desired Outcomes

Like the disquisitioner from Polk County Schools, process goals, outcome goals, and balancing measures were used (see descriptions for each above). Process and outcome goals agreed upon by the design team in Rutherford County Schools mirrored those utilized in Polk County Schools (see figure 12).

Outcome measures were divided into two sub-categories: long term and short term outcome goals. Long term goals represent long range measures we hope to improve through adjustments to the overall system. Increased student preparedness was chosen as a long term outcome goal. Due to the timespan of this disquisition, long term outcomes were not able to be measured in the first PDSA cycle. Such measurement data would need to be collected over a greater timespan to represent a viable measure.

Short term outcome goals included math teachers effectively collaborating within and across school buildings and math teachers being able to describe and assess learning progressions for identified critical standard areas. As mentioned before, learning progressions are defined as the pathway students travel as they progress toward mastery of a given skill ("Standards Aligned System", n.d.). The disquisitioners define “critical standards” as those that are identified by participating teachers in the initiative as essential to arriving prepared to the next level of math content. Both of these process goals have been determined by the design team to be directly related to increasing student preparedness. Additionally, we have previously cited literature connecting both collaborative practices and the improvement of teacher

knowledge/skills to increased student achievement (Darling-Hammond, 2000; DuFour et al., 2010; DuFour & Marzano, 2011; Gordon, Kane & Straiger, 2006; Hanuschek, 2011; Haycock, 1998; Nelson et al., 2010; Nye, Konstantopoulos & Hedges, 2004; Rockoff, 2004; Sarason, 1990; Yoon, et al., 2007).

The design team set several desired process goals related to corresponding short term outcome measures. Process goals related to teacher collaboration included initiative facilitators creating an environment conducive to collaborative practices. Additionally, facilitators will build the capacity of teachers to effectively collaborate within and across schools. Second, for math teachers to be able to describe learning progressions in critical standard areas, those areas must be first identified by the teachers participating in the initiative. Subsequently, teachers will then explore current grade level standards related to the identified areas in both sending and receiving grades.

Balancing measures were also considered in the goal formation phase of the design team process. Two important balancing measures were developed related to short term outcome goals. First, disquisitioners wanted to ensure that in the efforts to build teacher capacity to collaborate within and across schools, we did not inadvertently turn them against collaborative practices as a whole. Therefore, it became important to measure teacher beliefs related to collaborative practices throughout the initiative. Second, it was important that improvement efforts not remove teachers from their classrooms for extended periods of time, thereby presenting a possible negative effect on students because of their teacher's absence. As a result, the initiative design was developed to minimize missed class time. However, it was important to measure participating teacher perceptions related to time away from their class as a relevant balancing measure.

Participants

The participants of the study included one fifth grade math teacher from each of four feeder elementary schools and four sixth grade math teachers. Teachers were encouraged but not mandated to participate in the improvement initiative. Each teacher was given the pseudonym "teacher" along with a corresponding internal identifying label of "R" indicating a Rutherford County Schools participant followed by a final internal identifying number. Teacher R1 is a fifth grade math teacher with thirty years of experience. She has taught fifth grade math for over twenty years and has a master's degree in education. Teacher R2 is a fifth grade math teacher with thirteen years of experience. She has taught fifth grade math for five years. Teacher R3 is a fifth grade math teacher with ten years of experience. She has taught fifth grade math for one year. Teacher R4 is a fifth grade math teacher with twenty-seven years of experience. She has taught fifth grade math for twelve years and has a master's degree in education. Teacher R5 is a sixth grade math teacher with six years of experience. She has taught sixth grade math for three years. Teacher R6 is a sixth grade math teacher with twenty-two years of experience. She has taught sixth grade math for five years and has a master's degree in instructional technology. Teacher R7 is a sixth grade math teacher with twenty-two years of experience. She has taught sixth grade math for one year. Teacher R8 is a sixth grade math teacher with twenty-five years of experience. She has taught sixth grade math for nine years.

Implementation Process

Like the design team in Polk County, the design team in Rutherford County implemented a four-step plan to address the issue of academic under-preparedness. These steps included: (1) team formation, (2) teacher inquiry, (3) data analysis, and (4) turning learning insights into action. Figure 10 shows the sequential flow of steps as they relate to the improvement initiative.

Team formation. The first step involved the formation of the vertical inquiry team. The design team contacted all teacher-participants and described the improvement initiative. At the first teacher-team meeting, the disquisitioner used a general icebreaker activity that allowed teachers to get to know each other. The activity was entitled, "What would you ask a fifth/sixth grade teacher." The icebreaker proved to be a humorous way for teachers to ask opposing grade levels questions. One sixth grade teacher asked, "Do you teach them [students] anything?" The disquisitioner noted that teachers were forming bonds as a result of the activities in the first meeting and concluded that teachers were experiencing positive interactions with each other. The first step also served as an opportunity for teachers to analyze data and discuss potential goals for the vertical inquiry teams. Teachers used goal setting templates (see Appendix C) as and aid for their discussions.

Teacher Inquiry. In step two the focus shifted from a focus on group interactions to a concentration on learning standards and data. A Data Review Protocol (see Appendix D) was used to aid in the interpretation and understanding of Goal Summary Data. The data review process was lengthy. Teachers appeared to struggle initially with the data constructs. The disquisitioner in RCS hypothesized the struggle with data interpretation was due to a lack of previous experience with school-level data. However, through support and practice teachers experienced increased comfort with the data sets.

Data Analysis. Step three combined data analyses with teacher inquiry. Using goal summary reports, teachers successfully identified critical standards. The process involved in-depth conversations aimed at prioritizing the most critical standards.

Turning learning insights into action. Step four began with sorting through the proposed critical standards. Discussions regarding learning progressions to bridge the standards

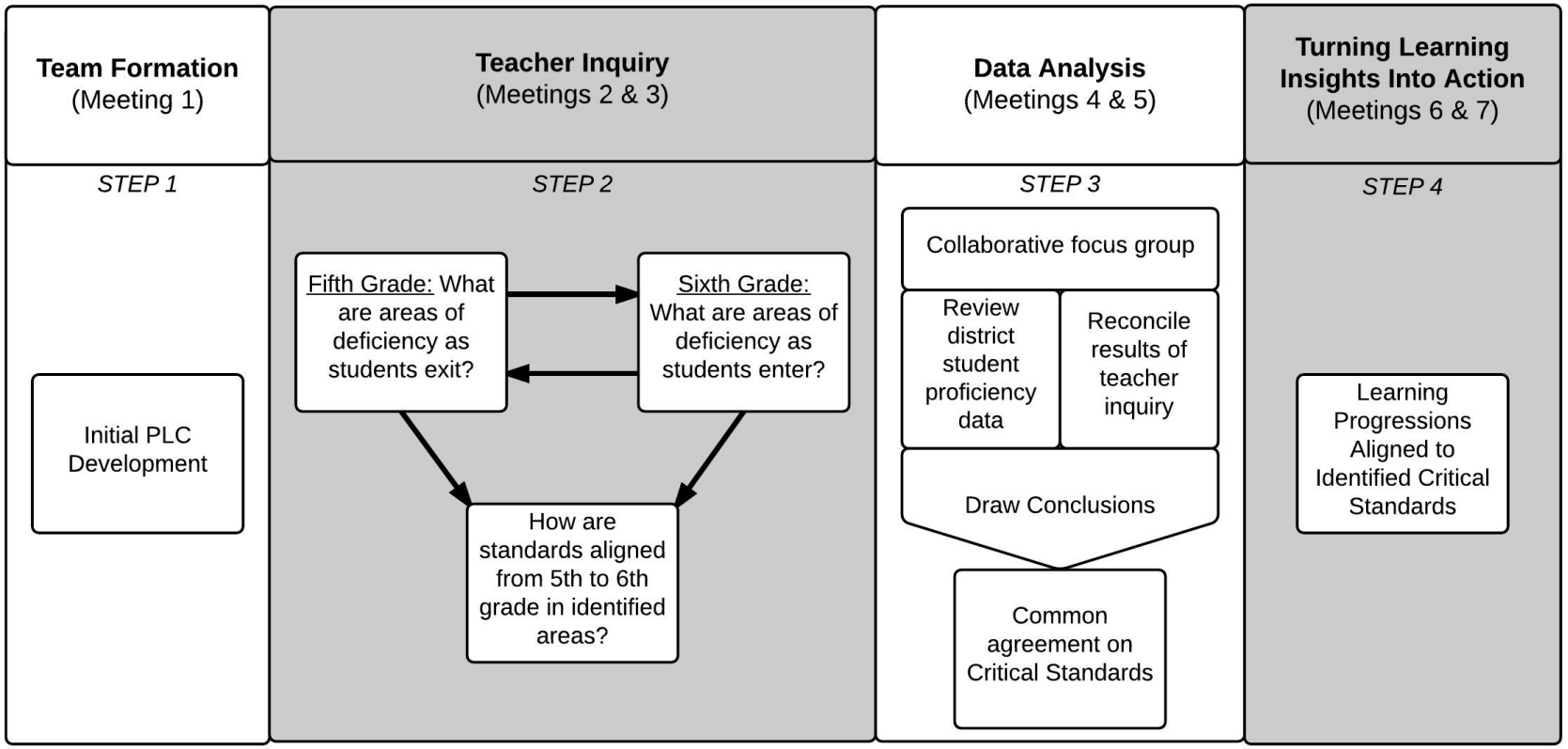

Figure 12: Rutherford County Schools improvement initiative implementation plan

together. The process of developing learning progressions and inter-standard bridges brought forth much dialogue. Teachers were placed in groups of two or three and given a set of critical standards from which to work. Teacher groups were eager to identify learning progressions and worked past the designated end time of one of the meetings to continue their work. Teachers combined their work into a single document (see Appendix E). This document served as a resource for the teachers as they plan lessons for their students. The document also served as an artifact that details the work done by the vertical inquiry group.

Summary

Vertical collaborative inquiry teams were developed inside each respective laboratory of practice and were comprised of teachers representing corresponding feeder patterns for each district. For Polk County, the team consisted of all eighth grade (Polk County Middle) and ninth grade (Polk County High) math teachers. For Rutherford County, the team included fifth grade math teachers across four elementary schools (Pinnacle Elementary, Rutherfordton Elementary, Mount Vernon Ruth Elementary, Spindale Elementary) and sixth grade math teachers (Rutherford Spindale Middle). The goal of these teams was to build teacher capacity through increased knowledge and skills related to math standards. Ultimately, the goal of this process was to increase student preparedness as a result of teachers putting the knowledge and skills they learn into practice in the classrooms thereby yielding positive student outcomes.

CHAPTER III: EVALUATAION OF THE IMPROVEMENT METHODOLOGY

The aim of this improvement initiative was to build teacher capacity to effectively collaborate, within and across school buildings, in order to increase student preparedness for math courses following school transitions. This section provides an evaluation of the improvement methodology for the purpose of determining whether the aim was achieved.

Improvement initiatives are unlikely to achieve their desired outcome if they are not supported by evidence-based processes for implementation. One of those processes is continuous assessment. Both school-based design teams conducted formative and summative evaluations of their improvement initiatives knowing that both would provide data to inform next steps. Continuous assessment increases the possibility of achieving positive results in practice (Bryk, 2009).

This section includes: (1) methods for formative assessment, (2) results of the formative assessment within the two separate contexts, (3) methods for summative assessment, (4) results of the summative assessment within the two separate contexts, and (5) validity and reliability considerations.

Methods for Formative Assessment

Formative assessment is a necessary tool for school leaders (as action researchers) who want to implement improvement initiatives. Formative assessment requires school leaders to put an improvement design into practice, conduct ongoing assessment of the design components and make necessary adjustments following the suggestion of the data (Collins, Joseph, & Bielaczyc, 2004). We formatively assessed the success of our design initiative through the use of the following practical assessment measures aimed at process measure goals: (1) an internally

developed mid-term survey, (2) observations recorded in field notes, and (3) meeting attendance logs.

A mixed methods approach was chosen as a means of strengthening data collection in relatively small sample sets in each respective implementation setting. Cresswell (2012) defines mixed methods designs as "procedures for collecting, analyzing, and mixing both quantitative and qualitative data in a single study" (p. 22). Additionally, convergent mixed methods design allowed disquisitioners to assess the relationship between quantitative and qualitative data collected both in formative and summative periods (Creswell, 2012, p.540). The strength of this design is that it combines the advantages of each form of data collection: quantitative measures can provide generalized data, while qualitative data offers contextual information (Creswell, 2012).

The mid-term survey instrument used was developed by the disquisitioners as a means of evaluating several key threshold measures of the initiative and included quantitative and qualitative measures (see Appendix F). The survey was administered at the conclusion of step three in both of the initiative design processes. Table 5 describes these measures and how they aligned with the overall intervention design and established thresholds for design adjustments. These measures were designed to evaluate key process including leadership's ability to create an atmosphere conducive to collaborative practice, leadership's ability to build teacher capacity to collaborate, the identification of critical standards, and evidence of the evaluation of grade level standards as they relate to areas identified as "critical" by the team. Question formatting included both Likert-type (Creswell, 2012) questions used as quantitative measures and open-ended questions used for qualitative measures. All survey items were peer reviewed before distribution. This included the evaluation of survey items for validity and reliability by fellow doctoral

Table 5
Mid-Term Survey Assessment Measures Used to Determine Progress

Measure	Measure Type	Targeted Process Goal	Measure Description	Threshold for Change
Initiative impact on knowledge of collaborative practices	Quantitative	Teacher collaborative capacity	5 point interval scale from "strongly disagree" [1] to "strongly agree" [5]	> 3
Characteristics of effective collaborative teams	Qualitative	Teacher collaborative capacity	Ability to describe characteristics or behaviors of effective collaborative teams	
Characteristics of effective collaborative teams implemented	Qualitative	Teacher collaborative capacity	Descriptions of characteristics or behaviors of effective collaborative teams in practice by current VCIT members	
Self-efficacy related to collaboration	Quantitative	Teacher collaborative capacity	7 point interval scale from "much weaker" [0] to "much stronger [100]	> 50
Opinions of leadership facilitation constructs (meeting frequency, allocation of time, planning, resources, distributed leadership, responsiveness)	Quantitative	Conducive atmosphere to collaborative practice	7 point interval scale from "strongly disagree" [0] to "strongly agree [100] for each construct	> 50 average across constructs
Identification of critical standards	Quantitative	Critical standard Identification	Categorical measure ("yes" or "no")	> 75% "yes"
Process for identifying critical standards	Qualitative	Critical standard Identification / Critical standard development	How were standards identified as "critical" by the team	
Critical standard agreement	Qualitative	Critical standard development	Individual agreement that the standards identified are most critical	

candidates in the Western Carolina University system.

Field notes were kept by each disquisitioner in their respective context describing each professional development session. Data from field notes was deductively coded for emergent themes prior to the midpoint of the intervention design and again before summative assessment of the intervention. Field notes were analyzed using deductive coding methods described by Creswell (2012, p. 244). Figure 13 details the coding process used by the disquisitioners.

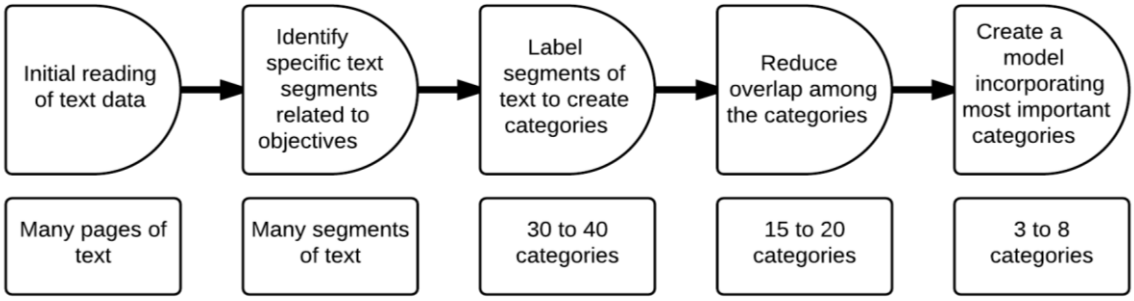

Figure 13: Deductive coding process. Adapted from Creswell (2012, p. 244, Figure 8.4) by permission of Pearson Education, Inc. (© 2012, Upper Saddle River, NJ).

During the coding process, disquisitioners began with four pre-set codes aligned to process goal measures. These codes included: (1) collaborative atmosphere, (2) collaborative capacity, (3) critical standards identification, and (4) critical standards development. Additionally, in-vivo coding was used to identify emergent themes not previously developed by the disquisitioners. Cresswell (2012) describes in-vivo coding as codes stated in the participants actual words (p. 244). In the subsequent sections, disquisitioners will describe codes reflecting emergent themes unique to each context

Results and Analysis of the Formative Assessment

Polk County Schools

As previously stated, the design team in Polk County Schools developed four process goals to serve as formative assessment measures of the overall initiative. The process goals developed were

- initiative facilitators creating an atmosphere conducive to collaborative practices;
- facilitators will build the capacity of teachers to effectively collaborate within and across schools;
- teacher identification of critical standards; and
- teachers will evaluate grade level standards related to standards previously identified as 'critical"

The following sections provide: (1) a brief description of each process goal, (2) explains how thresholds for change were established, (3) provides data supporting whether or not goals were achieved and what was learned, and (4) how the disquisitioner responded to the data.

Atmosphere conducive to collaboration. The first process goal sought to determine if the facilitator (disquisitioner) was able to create an atmosphere conducive to collaborative practice. Before we can fully evaluate this goal, we must first understand what elements represent building a collaborative culture. DuFour et al. (2010) cites several key elements involved in creating collaborative cultures including making time for collaboration, providing meaningful resources to the team, developing a clear direction for the team, and modeling distributed leadership practices. For the purposes of this disquisition, we have combined these elements into an overall composite called leadership facilitation constructs.

Survey response items related to *leadership facilitation constructs* provided an evidential bases for evaluating the facilitator's ability to create an atmosphere conducive to collaborative

practice. Table 6 represents the results of the mid-term survey items related to *leadership facilitation constructs.*

Table 6
Polk County Schools Leadership Facilitation Constructs Survey Results

Measure	PCS Result	
Appropriate meeting frequency	M= 67.8	SD= 16.29
Minimize lost instruction time	M= 89	SD= 12.44
Planned	M= 56.8	SD= 23.99
Adequate support materials	M= 67.8	SD=26.54
Teacher driven process	M= 76	SD= 14.85
Responsive to needs of team	M= 94.8	SD= 6.65
Leadership Facilitation Composite	M= 75.4	

Survey participants were asked to respond on a seven point interval scale from "strongly disagree" [0] to "strongly agree" [100] for each construct with a response rating of fifty (50) representing "neither agree nor disagree." As a result, the threshold point for change was established at any score greater than fifty (50) indicating a positive agreement with the corresponding leadership construct.

While all indicators related to leadership facilitation constructs met threshold standards, there were several areas worth noting. The standard deviation in all areas were quite high. However, given the relatively small sample size, the standard deviation and mean can be heavily influenced by one or two outliers. Areas of meeting frequency appropriateness, meeting planning, and supportive materials supplied all showed a statistical average aligning with either "somewhat agree" or "neutral". Additionally, standard deviations in meeting planning and

supportive materials supplied were significantly higher than other categories possibly illustrating disagreement among respondents regardless of sample size.

Additionally, field notes provided further depth to process goal acquisition. In the six meetings prior to the survey, the disquisitioner recorded several difficulties in facilitating the development of a PLC among participants. Through participation in professional development related to PLC's, it was discovered that there was virtually no horizontal collaboration occurring between eighth grade participants. Conversely, ninth grade participants cited horizontal collaborative practices on a weekly basis. Additionally, one of the eighth grade participants, Teacher P5, displayed somewhat combative behavior. Teacher P5 frequently attempted to derail productive conversation. In their absence at one meeting, the attending members made unsolicited comments about Teacher P5's behavior including concerns over purposeful sabotage of group efforts. Specifically, the group was concerned that Teacher P5 had multiple issues with high school protocols and viewed the disquisitioner (a high school administrator) as an ear to her plight. Regardless of Teacher P5's true intentions, these dynamics give further depth and validation to survey responses related to collaborative practices.

In response to field notes and survey data, the disquisitioner chose to revisit elements of effective collaborative teams. This effort included a greater emphasis on learning community best practice. Additionally, the disquisitioner chose to remove himself from future meetings. For the final two meetings, the disquisitioner would coordinate meeting times, provide guidelines for meeting facilitation and provide appropriate resources for the team. This departure from team participation by the disquisitioner was an effort to respond to team concerns related to interpersonal dynamics preventing the team from progressing while also acknowledging a need for better planning and resources for PLC development.

Building teacher capacity to collaborate. The second process goal was that leadership would build teacher capacity to collaborate within and across schools. One of the quantitative measures used as an indicator of success was survey responses aligned to teacher perceptions that the initiative had built their knowledge of collaborative practices. The response was based upon a five point ordinal scale measure from "strongly disagree" (scale score zero) through "strongly agree (scale score five). A scale score measure of three indicated "neither agree nor disagree." Disquisitioners determined any scale score greater than three to be the threshold for change indicating a positive agreement that the initiative had increased their knowledge base of effective collaborative practice.

An additional quantitative measure used was survey responses aligned to teacher self-efficacy related to collaboration. The response was based upon a five point ordinal scale measure from "much weaker" (scale score zero) through "much stronger" (scale score 100). A scale score measure of fifty (50) indicated "no change." Disquisitioners determined any scale score greater than fifty to be the threshold for change indicating a positive self-efficacy related to participants ability to engage in collaborative practice.

Table 7 illustrates quantitative mid-term survey results measuring participant perceptions of initiative impact on knowledge of collaborative practices as well as self-efficacy related to collaboration. Both indicators exceeded threshold requirements. The standard deviation for

Table 7
Polk County Schools Survey Results Reflecting Collaborative Capacity Building

Measure	PCS Result	
Initiative impact on knowledge of collaborative practices	M= 3.8	SD=.98
Self-efficacy related to collaboration	M= 61	SD= 32.19

impact on knowledge of collaborative practices was quite low suggesting broad agreement that the initiative had positively impacted participants. However, the standard deviation was quite high for teacher perceptions of self-efficacy related to collaborative practice, possibly indicating broadly varying perceptions of participants' ability to engage in effective collaborative practice.

Coded qualitative data collected from the mid-term survey supported quantitative findings. When asked to list effective characteristics of collaborative teams, all respondents were able to identify at least three of the six characteristics established by DuFour and Eaker (1998) with at least three participants listing all six characteristics. When asked if the characteristics identified by the respondent had been implemented by the team, all respondents confirmed. However, two respondents cited inconsistencies including "lack of focus" and "not enough buy-in."

Coding of field notes revealed emergent themes including a need for continued efforts to build collegiality among participating members. As previously stated, the disquisitioner recorded how negative interpersonal dynamics among group members might be an indication of ineffectiveness related to building capacity to collaborate. Additionally, the disquisitioner recorded that there was a need to narrow the overall focus of the group, citing conversation that lacked depth and a lack of adherence to pre-defined team goals. These themes illustrated a possible weakness in PLC development, specifically collaborative practice.

Overall, the data supported the successful achievement of the process goal related to building collaborative capacity; however, adjustments were made moving forward. This included revisiting norms established by the team as a reminder of effective collaborative practice. Additionally, the disquisitioner removed themselves from the team for the final two meetings. This process not only eliminated the potential for distraction due to interpersonal dynamics

within the team as previously discussed, but it allowed for leadership of the team to pass fully to team members thereby empowering them to internally develop strategies to address any problematic areas of the collaborative process moving forward.

Identification of critical standards. The identification of critical standards based upon the assessment of relevant student performance data was an important process measure as it served as a precursor to the final process measure of *Evaluation of grade level standards related to identified critical standard areas*. For this goal, disquisitioners sought to establish that teachers could utilize multiple data sources to determine which standards were "critical" to student academic preparedness upon engaging math content at the ninth grade level.

When asked on the mid-term survey if the team was able to identify critical standards as an area of focus, 80% responded in agreement. A subsequent probing free response question asked those that answered "yes" to identifying critical standards if they agreed that the standards identified where most critical and to justify their response. All four participants responded in agreement that the standards identified where most critical citing supporting student proficiency data as the primary justification. Two participants additionally cited concerns over the critical standard identified as being "too broad" and "in need of further focus".

Additional data derived from the analysis of field notes indicated the successful ability of initiative participants to identify critical standard areas citing the standard associated with "functions" specifically "linear functions" as the agreed upon critical standard to address moving forward.

In response to concerns over a desired narrow focus related to the identified critical standards, the disquisitioner presented the team with a framework for future discussion related to the topic. The framework comes from an article by Richard Dufour (2004) and espoused three

guiding questions: (1) What do we want each student to learn? (2) How will we know when each student has learned it? (3) How will we respond when a student experiences difficulty learning? This framework allowed for more concrete means of engaging in collaboration surrounding critical standards.

Evaluation of grade level standards related to identified critical standard areas. The final process goal involved teachers evaluating grade level standards in relation to the previously identified critical standard areas. Two potential qualitative data points on the mid-term survey yielded evidence supporting process goal acquisition. First, participants were asked to describe the process for identifying critical standards. Four of the five respondents were able to articulate analysis of student performance data as well as analysis of current grade level standards. Second, participants responding that the team had identified critical standards were asked to justify if they agreed that those standards were most critical. All four respondents agreed that the identified critical standard areas were most critical and again cited student performance data in support.

Analysis of field notes confirmed the team's ability to evaluate grade level standards as they related to critical standard areas. The disquisitioner recorded the team's efforts in analyzing data citing participant surprise at deficiency areas indicated by student performance. Additionally, the disquisitioner recorded the process the team underwent to analyze the identified critical standard area (functions) in terms of how grade level standards interrelated. Notes recorded Teacher P4's surprise that "matrices" were no longer taught in ninth grade.

Rutherford County Schools

Like Polk County Schools, Rutherford County Schools developed four process goals to serve as formative assessment measures of the overall initiative. The process goals developed were

- initiative facilitators creating an atmosphere conducive to collaborative practices;
- facilitators will build the capacity of teachers to effectively collaborate within and across schools;
- teacher identification of critical standards; and
- teachers will evaluate grade level standards related to standards previously identified as "critical."

The following sections provide: (1) a brief description of each process goal, (2) explains how thresholds for change were established, (3) provides data supporting whether or not goals were achieved and what was learned, and (4) how the disquisitioner responded to the data.

Atmosphere conducive to collaboration. The first process goal sought to determine if the facilitator (disquisitioner) was able to create an atmosphere conducive to collaborative practice. The elements involved in creating collaborative cultures were stated in previous sections. The disquisitioner combined these elements into an overall composite called *leadership facilitation constructs*.

Survey response items related to *leadership facilitation constructs* provided evidence of the leader's (disquisitioner's) ability to create an environment conducive to effective collaboration practices. Table 8 represents the results of the mid-term survey items related to *leadership facilitation constructs.*

Table 8
Rutherford County Schools Leadership Facilitation Constructs Survey Results

Measure	RCS Result
Meeting frequency	M= 86.56 SD= 9.11
Minimize lost instruction time	M= 95.33 SD= 7.06
Planned	M= 93.44 SD= 7.88
Support Materials	M= 89.44 SD= 9.35
Teacher driven	M= 96 SD= 5.72
Responsive to needs of team	M= 98.33 SD= 4.37
Leadership Facilitation Composite	M= 93.2

Survey participants were asked to respond on a seven point interval scale from "strongly disagree" [0] to "strongly agree" [100] for each construct with a response rating of fifty (50) representing "neither agree nor disagree." As a result, the threshold point for change was established at any score greater than fifty (50) indicating a positive agreement with the corresponding leadership construct.

Seven (7) constructs were used to determine the success of leadership facilitation of the intervention. All *leadership facilitation constructs* met the established thresholds indicating agreement. Four (4) of the constructs indicated that teachers *strongly agree* with the corresponding measure.

The disquisitioner recorded field notes as an additional means of formative data collection. The participants in this study were congenial in their dealings. The meetings were often filled with plenty of productive discussions regarding standards, collaborative practices in general, and data analyses. The field notes revealed that participants were accustomed to meeting regularly in other PLC type settings. These experiences made this initiative operate more

smoothly and without any obvious signs of unwillingness or inability to work together as a cohesive unit. Participants were trained how to interpret various sources of data. According to field notes, the participants' ability to use and interpret data was adequate. Most or all of the participants responded well to data instruction and were able to apply the acquired skills to the tasks before them. Field notes also revealed that participants responded well to critical standard identification exercises. Participants were successfully able to identify critical standards by the end of the school year.

All participants were able to identify critical standards as an area of focus. A subsequent probing free response question asked those that answered "yes" to identifying critical standards if they agreed that the standards identified where most critical and to justify their response. All eight participants responded in agreement that the standards identified where most critical citing supporting data as the primary justification.

The disquisitioner evaluated the data promptly so that changes, if any, could be made. Fortunately, every data point exceeded the threshold for change. However, the disquisitioner felt that more formative data would have been beneficial to the assessment of the intervention. The mid-term survey occurred at the conclusion of step three of the intervention design. While field notes were used throughout the intervention, the disquisitioner would employ additional formative measures earlier in the improvement initiative.

Building teacher capacity to collaborate. The second process goal was that leadership would build teacher capacity to collaborate within and across schools. One of the quantitative measures used as an indicator of success was survey responses aligned to teacher perceptions that the initiative had built their knowledge of collaborative practices. The response was based upon a five point ordinal scale measure from "strongly disagree" (scale score zero) through

"strongly agree (scale score five). A scale score measure of three indicated "neither agree nor disagree." Disquisitioners determined any scale score greater than three to be the threshold for change indicating a positive agreement that the initiative had increased their knowledge base of effective collaborative practice.

An additional quantitative measure used was survey responses aligned to teacher self-efficacy related to collaboration. The response was based upon a five point ordinal scale measure from "much weaker" (scale score zero) through "much stronger" (scale score 100). A scale score measure of fifty (50) indicated "no change." Disquisitioners determined any scale score greater than fifty to be the threshold for change indicating a positive self-efficacy related to participants ability to engage in collaborative practice.

Table 9 illustrates quantitative mid-term survey results measuring participant perceptions of initiative impact on knowledge of collaborative practices as well as self-efficacy related to collaboration. Both indicators exceeded threshold requirements. The standard deviation for

Table 9
Rutherford County Schools Survey Results Reflecting Collaborative Capacity Building

Measure	RCS Result
Initiative impact on knowledge of collaborative practices	M= 4.56 SD=.05
Self-efficacy related to collaboration	M= 82 SD= 10.49

impact on knowledge of collaborative practices was low. Such a small standard deviation indicates little variation between responses. Conversely, the standard deviation was high for teacher perceptions of self-efficacy related to collaborative practice, possibly indicating broadly varying perceptions of participants' ability to engage in effective collaborative practice.

Coded qualitative data collected from the mid-term survey supported quantitative findings. When asked to list effective characteristics of collaborative teams, all respondents were able to identify at least three of the six characteristics established by Eaker and DuFour (1998) with at least three participants listing all six characteristics. When asked if the characteristics identified by the respondent had been implemented by the team, all respondents affirmed.

Coding of field notes revealed teachers' enthusiasm for engaging in collaborative practices. The disquisitioner noted that given the time, resources, and proper organizational structures- Teachers will engage in collaborative practices that enhance their teaching ability.

Identification of critical standards. The identification of critical standards based upon the assessment of relevant student performance data was an important process measure as it served as a precursor to the final process measure of *Evaluation of grade level standards related to identified critical standard areas*. For this goal, disquisitioners sought to establish that teachers could utilize multiple data sources to determine which standards were "critical" to student academic preparedness upon engaging math content at the sixth grade level.

All teachers indicated an ability to identify critical standards as an area of focus on the mid-term formative survey. A subsequent probing free response question asked those that answered "yes" to identifying critical standards if they agreed that the standards identified where most critical and to justify their response. All eight participants responded in agreement that the standards identified where most critical citing supporting student proficiency data as the primary justification.

Field notes affirm the ability to successfully identify critical standards in this improvement initiative. Teachers were observed engaging in discussions regarding critical

standards. Through these discussions, teachers found agreement on those standards considered to be most critical.

Evaluation of grade level standards related to identified critical standard areas. For the fourth process goal, teachers examined and evaluated grade level critical standards. Teachers were asked to describe the process for identifying critical standards. All eight respondents successfully articulated an analysis of student performance data as well as analysis of current grade level standards. Teachers also responded that the team had identified critical standards and were asked to justify if they agreed that those standards were most critical. Again, all eight respondents agreed that the identified critical standard areas were most critical.

Field notes revealed the VCIT's ability to evaluate critical standards in fifth and sixth grade mathematics. The VCIT created extension activities to link fifth and sixth grade math standards together. The disquisitioner noted the VCIT's work with standards. Data analysis was key in identifying and evaluating the selected critical standards.

Methods for Summative Assessment

Carnegie Mellon University (n.d.) defines summative assessments as a "means to measure the level of success or proficiency that has been obtained at the end of a given task, by comparing it against predefined standards or benchmarks." To recap, disquisitioners in both settings set out with the same short term goals: (1) Math teachers within and across schools will effectively collaborate, (2) Teachers will identify critical learning standards connected to knowledge, skills, and abilities needed to arrive prepared for subsequent math courses, and (3) math teachers will demonstrate an increased understanding of the learning progressions between context specific grade levels. Since data would be unable to show increased student preparedness

within the constraints of this study, disquisitioners instead chose to focus on the assessment of the previously mentioned process goals.

The disquisitioners utilized interviews as a means of summative assessment. Interviews are a qualitative measure in which the researcher asks open-ended responses allowing the participant to create the options for responding (Cresswell, 2012). The interview protocol has been provided in the appendix labeled as Appendix G. Questions from the interview were compartmentalized into three major sections; collaborative practices, standards, and leadership processes. Interviews were analyzed using in-vivo coding methods (Creswell, 2012, p. 244).

It was important for disquisitioners to be able to triangulate data gathered from interviews against other summative assessment sources (Cresswell, 2012, p. 259). As a result, summative data triangulation included analysis of interview data, field notes, and relevant artifacts produced in each context. This triangulation of data served to strengthen the overall summative assessment deign by providing corroborating evidence from multiple sources (Cresswell, 2012, p. 259).

Though the overall design of the improvement initiative was very similar in each context, subtle differences produced slightly different themes as a result of coding processes. In the following sections, disquisitioners in their respective context will present unique sets of codes as a result of data analysis.

Results and Analysis of the Summative Assessment

Polk County Schools

Summative assessment of the Polk County VCIT initiative were related to the following short-term outcome measures: (1) math teachers will effectively collaborate, and (2) math teachers will describe and assess learning progressions for critical standard areas. In the

subsequent sections, each of these goals will be briefly described along with relevant data supporting whether or not the goal was achieved.

An interview instrument (see Appendix G) was utilized by the disquisitioner as a means of summatively assessing outcome goal attainment. Participant interviews were conducted for three team members, all representing teachers from ninth grade. An additional, electronically submitted response was considered from one of the eighth grade participants who declined the interview, but agreed to answer interview questions via e-mail. Disquisitioners were unable to contact the final eighth grade participant. Interviews were divided into three main topics: collaboration, working with standards, and leadership. After coding interview responses from initiative participants, several themes began to emerge related to each main topic as illustrated in Table 10.

Table 10
Polk County: Themes Developed as a Result of Coding Processes

Code	Code (Longhand)	Description
O	Opportunities	Positive dispositions as a result of the work within the team
C	Challenges	Difficulties faces as a result of the work within the team
I	Insights	Deeper levels of understanding as a result of the work within the team
E	Efficiency	Deeper levels of understanding related to productivity as a result of the work within the team

"Opportunities" refers to the positive dispositions respondents noted as a result of the work they completed as a member of the team. These dispositions included feelings of hopefulness, excitement, and enjoyment identified as sub-codes. "Challenges" refers to difficulties noted by respondents as a result of experiences working within the team. "Insights" represented examples of deeper levels of understanding as a result of the work within the team.

"Efficiency" represented examples of deeper levels of understanding related to improved productivity as a result of working with the team.

Evidence from field notes and artifacts was also used as a means of corroborating data collected from interviews. These additional data sources provide support for themes developed as a result of coding interview results and serve to strengthen the overall accuracy of he reported outcomes.

Math teachers will effectively collaborate. One of the short-term outcome goals related to the VCIT initiative in Polk County Schools was the ability for teachers to effectively collaborate within and across schools as a precursor to improving student academic preparedness across student transition.

Interview participants were asked several questions related to their current perceptions of collaborative practices. Table 11 illustrates some of the responses related to current perceptions of collaborative practices. While every respondent indicated that collaborative practices were beneficial, each espoused concerns over the difficulties faced during the process. High school responses indicated concerns fostering relationships with the eighth grade teachers while middle school responses indicated some feelings of alienation. All concerns pointed to issues of group cohesion as the intervention progressed in its first cycle.

Despite these concerns, a majority of responses indicated professional growth as a result of the intervention experience. One high school response stated "...there's been more sharing, more ideas, being brought to the table. That's something that hasn't happened between eighth and ninth grade." Similarly, the middle school respondent indicated that participating in the vertical teaming initiative was an "...eye opening experience that stretched me personally and professionally."

Table 11

Polk County Schools Perceptions of Collaboration Following First Intervention Cycle

	Opportunities	**Challenges**
High School Responses	"It's a great idea" "I feel like it's definitely necessary" "Maybe there's a way that your colleague teaches something that you don't teach in the same way, but that's the way that students understand" "This vertical team has showed me how important [collaboration] really is" "Extremely worthwhile"	"Sometimes, people take things personally and it creates tension" "...don't want to step on anyone's toes" "We struggled to foster a relationship…" "...keep in mind that each person approaches a concept, a topic, differently, and to embrace those differences" "It's been a challenge across schools" "Not everyone initially willing to participate"
Middle School Responses	"Potential to be very fruitful" "...eye opening experience that stretched me personally and professionally"	"...initially felt like I had done something wrong" "Lack of focus at times"

Juxtaposed to this position, one high school respondent expressed serious concerns over the overall success of the vertical team:

> "Just a lack of willingness of people to discuss things in detail, either curriculum, or strategies, or people kind of want to be ... They don't want to talk about what they do, or what I do, or what somebody else does and then kind of decide what's best or how does it fit in. It's just pretty much, like the conversations have been very shallow."

These feelings seem to support the comments made by all team members related to the challenges faced when engaging in collaborative practices. Field notes produced by the disquisitioner address similar concerns citing difficulties in the development of PLC practices. Specifically, disquisitioner field notes detail concerns over the message sent to eighth grade

participants when the problem is posed that incoming ninth grade math students are entering underprepared to engage in grade level content.

Despite these difficulties, evidence suggests the initiative was overall successful in building the capacity for teachers to collaborate. However, as evidenced through some of the previously cited data, there is a tremendous amount of room for growth and improvement leading into cycle two of the overall initiative.

Math teachers will describe and assess learning progressions for critical standard areas. The second major short-term outcome measure was the ability of participating math teachers to describe and assess learning progressions for identified critical standards. Evidence collected from interview responses, field notes and artifacts suggest the team was able to make great strides related to working with standards including identifying critical standards and assessing connections between grade levels in identified critical standard areas.

Interview responses related to working with standards revealed two overarching themes. First, participants cited major strides in identifying "gaps" in critical standard areas. Coded as "insights," one ninth grade participant reflected by saying "Things are not being covered at the depth we thought." Eighth grade teacher responses further evidenced the discovery of curriculum gaps citing "...I had no idea that some of the standards I was teaching are no longer in the curriculum." Responses such as these support teacher awareness of the interconnectedness of standards and are indicators of the work completed through the development of learning progressions for identified critical standard areas.

Another key theme emerging from summative data was the concept of efficiency. Several respondents indicated the work conducted by the vertical collaborative team would empower participating teachers to save time through the elimination of unnecessary repetition of some

skills. One eighth grade respondent noted "...we realized how much time we spent overlapping."

Additionally, artifacts produced through the initiative support a strengthened understanding of learning progressions related to identified critical standards. Appendix H illustrates one such artifact as team members mapped the connection of "functions" through eighth and ninth grades. Additionally, they identified standard strands associated with the learning progression and were able to describe how the standards from eighth grade translated to ninth grade standards. This artifact reflects the team's ability to not only identify appropriate learning progressions inside of a given critical standard area, but their ability to describe and assess how standards relate to one another across grade levels.

The amalgamation of interview data, field notes and artifacts present strong evidence that the vertical collaborative team in PCS was successful in their efforts to identify critical standards as well as describe and assess the connection between grade levels for those identified standards.

Rutherford County Schools

Summative assessment of the Rutherford County VCIT initiative were related to the following short-term outcome measures: (1) math teachers will effectively collaborate and (2) math teachers will describe and assess learning progressions for critical standard areas. In the subsequent sections, each of these goals will be briefly described along with relevant data supporting whether or not the goal was achieved.

The same interview protocol used by the Polk disquisitioner was used by the Rutherford disquisitioner as a means of assessing outcome goal attainment in a summative manner. Teacher interviews were conducted for VCIT members. Interviews were divided into three main topics: collaboration, working with standards, and leadership. After coding interview responses

from initiative participants, several themes emerged related to each main topic as illustrated in Table 12.

Table 12

Rutherford County: Themes Developed as a Result of Coding Processes

Code	Description
Value	Positive perceptions as a result of the work within the team
Challenges	Difficulties faces as a result of the work within the team
Practice	Reflection of teaching methodology as a result of the work within the team
Efficiency	Deeper levels of understanding related to productivity as a result of the work within the team

Responses regarding general collaborative practices were positive. The code term *value* was used to categorize positive perceptions as a result of the work within the team. Respondents also noted some difficulties with the overall experience. Most notably, respondents indicated that time was a challenge. *Challenge* refers to difficulties one faces as a result of the work within the team. One respondent stated, "The challenge for us was finding time to collaborate." One respondent mentioned the desire to get to know the others in the group better while another mentioned the effect that preconceived stereotypes might have played on the group. She stated, "I think one challenge may be, this may sound strange, but preconceived stereotypes." Both respondents expressed positive feelings regarding the initiative overall. The code term *practice* was used to describe the reflection of teaching methodology as a result of the work within the team. Finally, the code term *efficiency* was used to indicate deeper levels of understanding related to productivity as a result of the work within the team.

Table 13 details responses deemed to have value and the challenges associated with the improvement initiative.

Table 13
Rutherford County Schools Perceptions of Collaboration Following First Intervention Cycle

	Value	Challenges
Elementary School Responses	"I do think it is very important." "I think that it is important for both ends so that the sixth grade teachers that they're rising to, understand exactly what the fifth grade teachers have covered." "I think it's important for fifth grade teachers to have an idea of how they might enrich high level students in order to prepare them for exactly what the curriculum in sixth grade will incur." "They are absolutely needed." "Everything this initiative does seems like something that obviously needs to be done. We just never did it." "...this initiative has made me reflect on my teaching." "I think I'm a better teacher now because of it."	"I think one challenge is just timing. We met after school, so of course that's really difficult." "I would have appreciated a little bit more time getting to know the other people and exactly what their roles were." "I think one challenge may be, this may sound strange, but preconceived stereotypes."
Middle School Responses	"I think it's totally worthwhile" "I like them" "I think they're very beneficial" "Well, I think it's been very positive." "I think that they have a positive impact on students and teachers as well."	"It was a little odd to begin with because we haven't really discussed together, but after the first initial meeting, I think everything fell into place." "The challenge for us was finding time to collaborate."

One notable theme derived from the responses was that of professional growth. Each participant referred to some aspect of professional growth in his or her respective interviews. One respondent noted, "I always thought it was positive, but I really think planning through the vertical team made me realize how positive it can be and how much you can learn from that vertical planning." Similar statements were made by other participants.

Math teachers will effectively collaborate. One of the short-term outcome goals related to the VCIT initiative in Rutherford County Schools was the ability for teachers to effectively collaborate within and across schools. The development of this ability serves as an avenue for improving student academic preparedness across student transition.

Interviews sought to determine teachers' current perceptions of collaborative practices. Table 10 illustrates some of the responses related to current perceptions of collaborative practices. All respondents acknowledged the benefits of collaborative practices. However, challenges were provided concerning the difficulties faced during the process. The most notable challenges offered by teachers was *time*. Many of the participating teachers felt the allocation of time was a challenge. Teacher meetings were held after school. As such, scheduling time for VCIT meetings required careful planning and a commitment to making the team a priority.

Responses were overwhelmingly positive. One fifth grade teacher even noted, "I think I'm a better teacher now because of it." A sixth grade teacher stated, "I think it's totally worthwhile." Other responses alluded to the importance that the initiative has for teachers and students.

Math teachers will describe and assess learning progressions for critical standard areas. Another short-term outcome measure was the ability of participating math teachers to describe and assess learning progressions for identified critical standards. Data collected from

interview responses, field notes and artifacts suggest the team was able to identify critical standards and assess connections between grade levels in identified critical standard areas.

Interview responses related to working with standards revealed two overarching themes. First, teachers mentioned a lack of knowledge with regard to the opposing grade level math standard. In other words, fifth grade math teachers do not know sixth grade math standards and vice versa. At the conclusion of step four, however, teachers were more confident in their knowledge of the standards in the opposing grade level.

Another key theme emerging from summative interview data was the concept of adaptation. Teachers found that slightly adapting teaching methods for several math skills students would be exposed to standards for both fifth and sixth grade. One fifth grade teacher stated, "I learned I could make small changes that would allow me to cover both fifth grade and sixth grade standards in some cases."

Additionally, artifacts produced through the initiative support a strengthened understanding of learning progressions related to identified critical standards. Appendix E illustrates one such artifact as VIT members developed extension activities between standards. These activities revealed the learning progressions between fifth and sixth grade math standards.

Interview data, field notes and artifacts demonstrate the success of the vertical collaborative team in RCS. Overall, the challenges faced did not impact the ability of the VCIT to meet their goals. Teachers were able to identify critical standards as well as describe and assess the connection between grade levels for those identified standards.

Validity/ Reliability

Cresswell (2012) defines validity as the "development of sound evidence that the test interpretation matches the proposed use" (p. 159). Reliability is defined as measures from and instrument that remain stable or constant (Cresswell, 2012, p. 159). The following paragraphs

describe how disquisitioners took steps to ensure both validity and reliability in measurement instruments employed throughout this disquisition.

Multiple data sources were used throughout the disquisition in both formative and summative phases of the design. Triangulation of data included interview and survey data, field notes from each meeting with their respective teams, and relevant artifacts produced by each team. Creswell (2012) asserts that triangulation "is the process of corroborating evidence from different individuals, types of data, or methods of data collection in descriptions and themes in qualitative research" (p. 259). Additionally, triangulation of data was achieved through data collected on individual subgroups within the design such as groups representing singular grade levels. This allowed disquisitioners to not only assess the progress of the entire team, but analyze individual grade levels participating within each team for comparison. Finally, this study was conducted in separate context allowing for comparative analysis of results.

Disquisitioners in both settings took various additional steps to strengthen the validity and reliability of this study. Member checking was utilized as participants were asked to verify field notes taken by each disquisitioner. Additionally, survey and interview instruments used were peer reviewed prior to their being administered. Throughout the entire study, data collected was externally audited by each researcher. Data collected in the RCS setting was analyzed by the disquisitioner from PCS and data collected in the PCS setting was analyzed by the disquisitioner from RCS. In order to strengthen the validity of the survey instrument used for summative data analysis of the study, corresponding disquisitioners administered interview protocols and coded data collected separately before collaboratively conducting second level coding. The interview protocol was also peer reviewed and IRB approved prior to it being administered.

Limitations

The disquisitioners acknowledge that limitations in this disquisition exist. These limitations should be considered carefully when drawing conclusions for possible application as a whole, or in part, in another context. The following paragraphs describe the potential limitations of this disquisition.

The overall size of the disquisition is considered a limitation. The disquisition included two school districts and seven total schools. Separated by district, Polk County included one high school and one middle school and Rutherford County included one middle school and four elementary schools. It may be difficult to generalize the effectiveness of similar initiatives based upon the outcomes of initiative designs of this size.

The number of participants should also be considered. Polk County included three high school math teachers and two middle school math teachers while Rutherford County included four middle school math teachers and four elementary math teachers. Such a small number of participants create the possibility for skewed results or findings. The number of participants who agreed to comply with data collection efforts should also be considered. Each district had one participant who chose not to participate in the interview process. This fact reduced the amount of data collected from an already small number of participants.

The disquisitioners feel that the transferability of this initiative can be replicated in other settings dependent upon a variety of factors. School leaders should consider the many contextual, resource, and logistical factors when deciding to replicate this initiative in other settings. The factors include, but are not limited to: District size, school feeder patterns, financial resources, human resources, teachers' needs and abilities, etc. School leaders are also encouraged to

customize an initiative such as this one to fit the needs of their respective organizations. Such customization will maximize effectiveness and greater results may be achieved.

CHAPTER IV: CONCLUSIONS, RECOMMENDATIONS AND LEADERSHIP LESSONS LEARNED

In this chapter, we will build upon conclusions outlined in chapter III by discussing lessons learned in each context related to the improvement initiative. Additionally, disquisitioners will provide a summation of shared leadership lessons learned through the improvement initiative process. The chapter concludes with a discussion on future directions for each context as well as final thoughts related to the overall improvement initiative.

Conclusions & Recommendations: Polk

While reflecting on the overall improvement initiative, several important conclusions and recommendations were developed for consideration for future leaders attempting similar initiatives. In order to properly conceptualize these insights the following sections describe conclusions and recommendations for each of the overall goals of the initiative including: (1) effective collaboration of math teachers within and across schools, and (2) math teachers demonstrating an increased understanding of learning progressions between grade levels.

Building collaborative capacity among math teachers

Collaborative practice was utilized as a vehicle for engaging in meaningful dialogue and personal growth surrounding academic preparedness of math students. Ample research supports collaborative practices as positive means of encouraging professional growth among teachers (Butler & Schnellert, 2012; DuFour et al., 2010; DuFour & Marzano, 2011; Gallimore et al., 2009; Nelson et al., 2010). This professional growth among teachers increases effectiveness thereby increasing academic growth and outcomes for students (Nye, Konstantopoulos & Hedges, 2004; Darling-Hammond, 2000; Hanuschek, 2011; Rockoff, 2004). The Polk County disquisitioner believes isolating collaborative practice as a means of increasing student academic

preparedness was not only the correct choice for the overall initiative design, but an instrumental element to the overall success of the initiative.

As previously shown, collaborative practice within and between schools in the Polk County Schools context yielded positive outcomes. It provided depth to overall content understanding for all participants while illuminating potential deficit areas in practice. These insights provided a clearer picture of the experience students undergo as they transition from eighth to ninth grade. Additionally, lessons learned from collaborative practices allowed for participants to make meaningful changes to instruction that hold real world implications for students in improving their overall academic preparedness.

Despite the overall success of focusing on collaboration as a means of building teacher capacity, there were also setbacks. Primarily, the prevailing isolationist mindset of participating teachers represented a major obstacle to developing collaborative practice. As many researchers have cited, teacher isolationism has become a major issue in the field of education and runs contradictory to proven professional growth models involving the development of professional learning communities (Chang, 2009; Davis, 1986; Dworkin, 2009; Fullan, 2007). As previously stated, data collected from the Polk County Schools setting showed significant struggles in developing collaborative practices. In particular, a major challenge was establishing collaborative practice between school buildings that had never previously engaged in the practice.

School leaders attempting to develop collaborative inquiry teams should pay careful attention to best practice in developing a culture of professional learning among those involved. Establishing buy-in through collective goal setting, consensus building, established group norms, and a commitment to continuous improvement are critical to breaking professional isolationism

(Dufour et al., 2010). In particular, developing a collective commitment is critically important to unifying teachers participating in collaborative practices. Developing a consensus about values "creates commitment to where the organization is going and how it is going to get there" (Kouzes & Posner, 1996. P. 105). Developing this shared commitment breaks down isolationism and provides a unified set of beliefs and promotes team interdependence for professional growth

Building content capacity through standards and learning progressions

The second major focus area of the initiative was building teacher capacity to engage in working with standards. Specifically, the initiative asked teachers to identify which standards were most critical to increasing student academic preparedness as they transitioned from eighth to ninth grade. Additionally, teachers were asked to describe and assess learning progressions that must occur for students to be successful in the identified critical standard areas.

The overall aim of having teachers work closely with standards and learning progressions was to increase teacher effectiveness. This increase in teacher knowledge and skills represents a critical prerequisite element to improved classroom teaching. In previous sections, we have highlighted these elements and conceptualized them in a model that reflects an increase in overall teacher effectiveness (see figure 3). As a result, working to align standards through learning progressions provided the substance to collaborative practice needed to improve overall student preparedness.

As previously detailed, the vertical collaborative inquiry team in the Polk County Schools setting was successful in developing a shared understanding of learning progressions for identified critical standard areas. Through the work of the team, two areas emerged as exerting influence on the overall outcomes related to the team's ability to accomplish this goal including:

(1) data literacy skills, and (2) outside support. The following sections will briefly describe each influence and propose recommendations for future leaders in addressing each.

Data literacy skills. One lesson learned from the process of identifying critical standards came in the arena of working with data. The disquisitioner assumed participating teachers in the initiative possessed the knowledge and skills necessary to digest and break down raw data. When teachers were first presented with goal summary data (see figure 4), they struggled to describe nuances associated with the data as it was presented. The disquisitioner addressed this issue through the inclusion of the district Testing/Accountability Director for assistance in breaking down data points and describing their relationship to one another. As a result, future leaders should consider data literacy skills of teachers involved in the initiative process and provide appropriate training prior to engagement in data-based decision making processes.

Outside support. Much of the initiative in the Polk County Schools setting was undertaken with little to no involvement by outside expertise or support of any kind. While this was not intentional by design, the absence of critical resources that outside "experts" could have provided presented a challenge to the overall initiative implementation. The disquisitioner discovered that the expertise needed to accomplish the overall scope of the initiative were more than they possessed individually. Thankfully, the initiative as a whole was a success, but would have benefited greatly from outside expertise in a number of areas. Therefore, future leaders should conduct a self-assessment of the specific knowledge and skills needed to accomplish an initiative of this level of complexity. Outside expertise should be utilized to fill in the gaps of the initiative facilitator.

Conclusions & Recommendations: Rutherford

Collaboration proved to be beneficial for fifth and sixth grade teachers in Rutherford County Schools. Teachers indicated a strong positive self-efficacy regarding collaboration following the improvement initiative. Efforts to facilitate collaboration for fifth and sixth grade teachers produced opportunities for capacity building. Once collaborative practices were established, teachers were able to work with data and the standards in an effective and efficient manner. The following sections describe conclusions and recommendations for each of the overall goals of the initiative including: (1) Effective collaboration of math teachers within and across schools, and (2) math teachers demonstrating an increased understanding of learning progressions between fifth and sixth grade.

Building collaborative capacity among math teachers

VCIT members demonstrated effective collaboration practices within and across schools. As previously stated, Briscoe and Peters (1996) assert the importance of teacher collaboration as it leads to increased student outcomes and greater job satisfaction. Collaborating with math teachers vertically provided an opportunity for teachers to examine data, identify critical standards, and develop an increased understanding of learning progressions between grade level standards. The process of identifying critical standards was a pleasant and valuable experience for teachers. Teachers were able to successfully identify critical standards as a result of the improvement initiative. The disquisitioner found that teachers need specific data literacy training in order to engage in the process of critical standard identification. Furthermore, teachers created extension activities to bridge the critical standard as it builds from fifth to sixth grade. Without effective collaboration practices, the aforementioned tasks could not have occurred.

Building content capacity through standards and learning progressions

Math teachers demonstrated an increased understanding of the learning progressions between context specific grade levels. Learning progressions are defined as the pathways students travel as they progress toward mastery of a given skill ("Standards Aligned System", n.d.). Teachers experience an increased knowledge of learning progressions. This knowledge fueled teachers' efforts to make connections between standards, and develop extension activities. Fortunately, teachers took ownership of the processes used to identify learning progressions.

Collecting, reviewing, and analyzing data served as the foundation of this improvement initiative. Leaders considering vertical teaming will benefit from a commitment to data-driven decision making. Although time and effort invested exposing teachers to data can be formidable, the disquisitioner feels that it is necessary and worthwhile.

District level support was an important component in the success of the initiative. Leadership stimulates a culture that is conducive of professional learning communities, evidenced by collaborative conversations and inquiry (Earl & Timperley, 2008). The two aforementioned goals were met, in part, due to district involvement. The disquisitioner involved the participating district leaders early in the initiative formation process and tasked them with the initiative design. District leaders were able to provide their expertise with regards to curriculum, data analysis, and educational leadership. Each meeting contained segments that were led by differing members of the design team. The collective talents of the individuals involved enhanced the level of professional development for teachers through a more thorough examination of the available data and standards. These collective talents also contributed to work sessions that were meaningful and efficient.

Based upon the experience with district involvement, the disquisitioner in the Rutherford County Schools setting strongly recommends including district level experts when implementing an initiative such as this one. Such inclusion allows for facilitators to focus on their area of expertise. This practice is both more beneficial for participants and more efficient in that tasks are separated to leaders across their specific areas of expertise.

Combined Leadership Lessons Learned

At its heart, this disquisition was aimed at increasing student preparedness to engage math content as they transitioned between grade levels and schools. The complexity surrounding this initiative was quite daunting as efforts to remedy such a problem were filled with roadblocks and challenges. As a result of the disquisition process in both settings, two main themes emerged as combined leadership considerations: (1) the power of distributed leadership, and (2) the importance of leadership for social justice. The following sections describe each leadership lesson learned and discuss implications for current and future leaders.

Distributed leadership

Spreading tasks across multiple leaders or participants creates a distributed leadership approach. Spillane, Halverson, & Diamond (2004) advocate the importance of viewing leadership as a practice distributed over leaders, followers, and their situation as opposed to any one individual's skill, cognition, ability, or charisma used in practice. In our context, spreading the responsibility of leadership across multiple formal leaders, followers, and the situational context brought about an enhanced ability to complete various leadership tasks. This approach highlights the, "interdependencies among the constituting elements-leaders, followers, and situation-of leadership activity" (Spillane, Halverson & Diamond, 2004). The design of this

initiative lends itself well to a distributed leadership model due to the desire to have multiple human inputs including administrators, curriculum specialists, and teachers.

Leadership for Social Justice

The last several years have been a time of great emphasis concerning issues of social justice in the field of educational leadership (Niesche & Keddie, 2016). Moreover, Niesche & Keddie (2016) argue that school leaders in education play an important role in making gains towards greater social equity and justice. The implications of social justice for this improvement initiative are significant. The vertical inquiry teams formed as part of this effort, increased teachers' capacity to better serve their students. The aim is to increase the academic preparedness of students, especially those who struggle, as they transition to a new grade level and a new school.

Teachers have long placed the blame concerning a lack of academic success on students. Peterson et al. (2011) concluded placing the blame on students "appeared to be a way of teachers distancing themselves from poor student outcomes and attributing the responsibility as being foremost with the students" (p. 8). The disquisitioners chose not to place blame on students but instead focus efforts on those areas that schools and teachers can have a positive impact.

Some pundits might point towards increased test scores or better student performance based on any combination of classroom assessments as a cause to celebrate the efforts made through this initiative. However, we prefer to view the larger implications for the students and society as a whole. It is important for educational leaders to understand that, "Leadership can play an active role in articulating goals that do not simply comply with broader performative measures, but engage with these measures in ways that do not compromise public goals" (Niesche & Keddie, 2016). The desire is for students to be better prepared for their subsequent

grade level. Increased academic preparedness may lend itself to enhanced mastery of the standards taught (Lamidi, Oyelekan, & Olorundare, 2015). Better academic performance typically yields better career prospects and a higher salary. The benefit for students may be monumental. Students who are better prepared contribute significantly to the economy and society as a whole (Ceci, Ginther, Kahn, and Williams, 2014). Our work has the potential to have major positive impacts for society.

The initiative as outlined in this paper was designed to better prepare students for their subsequent grade level in mathematics. The gains made by the teachers have the potential to drive better instruction to their respective students. All students, regardless of race, color, religion, gender identity, ethnicity, ancestry, national origin, sexual orientation, age or disability, within the reach of these teachers have the opportunity to benefit from the growth of their teachers.

Combined Implications for Future Leaders

We feel the results of this disquisition hold several implications for educational leaders. The first of which is that this study represents a financially feasible way of addressing an organizational issue. There are many programs available to educational leaders aimed at the professional development of staff members. These programs are often costly and time consuming making them difficult to implement. Furthermore, small, rural districts, such as the districts involved in this study, do not have abundant financial resources to engage in such programs. This study provides a research based framework for enacting meaningful organizational change and promoting professional development on a scale that potentially meets or exceeds that of available cost-prohibitive programs.

Additionally, the fundamental nature of the establishment of collaborative inquiry teams holds the potential to have lasting effects beyond that of traditional professional development programs. While traditional professional development is often targeted at a specific skill and is usually delivered on a needed basis, engagement in collaborative inquiry teams is an ongoing process where participating members work together "in recurring cycles of collective inquiry and action research" (DuFour et al., 2010). Finally, this study illustrates the customizable nature of collaborative inquiry teams. While readily available professional programs are often aimed at singular goals, this study and its framework allow for flexibility and adaptivity that allow for the development of target goals that are uniquely related to institutional needs.

Another major implication of this study is the potential impact it may have on an organization's culture. The foundational framework of this study was that of developing a professional learning community among participants. DuFour et al. (2010) defines this process as systematic in nature and asks teachers to work together in teams to analyze and improve their classroom practice, engaging in an ongoing cycle of questions that promote deep team learning. This study has highlighted many elements of such an effort including successes and potential setbacks. This study has also shown the tremendous benefits of collaborative practices through its overall success progressing towards the desired state of academic preparedness for students transitioning between grade levels and schools.

Future Improvement Cycles

As previously discussed, this disquisition utilized the Plan-Do-Study-Act cycle as an improvement model for leaders. One of the core components of this model is its inherent iterative design (see Figure 8). The scope of this disquisition allowed for the description and analysis of the first cycle of the improvement initiative. However, disquisitioners in both settings

have extended the improvement initiative well beyond the first cycle. Langley et al. (2009) cites that decision makers are faced with a choice of whether to "adopt, adapt or abandon" their change initiative based upon results from each cycle (p. 147). In the subsequent sections, disquisitioners in each setting will discuss their respective choices as well as implications related to their decision.

Polk County Schools

As a result of the first improvement cycle, the disquisitioner in Polk County Schools chose to adapt the overall improvement initiative. Data emerging from the first cycle suggested that, with adjustments, vertical collaborative inquiry teams hold the potential to have a meaningful positive impact on student academic preparedness as well as overall student achievement. Consequently, the PCS disquisitioner chose to make adjustments to the overall change strategy and begin a second cycle.

One of the central lessons learned from the first cycle of the initiative was that time should be taken to allow for the development of a culture of professional learning among VCIT members. In the first cycle, the explicit acknowledgement of elements of a professional learning community (PLC) was restricted to the first meeting. The disquisitioner then attempted to embed those elements into the subsequent work of the VCIT as they began to work with math standards. VCIT team members struggled to work collaboratively throughout the rest of the change initiative. As a result, the second cycle in the PCS setting has included much more explicit emphasis on professional learning community development.

Additionally, several participants during the first cycle remarked that they were not familiar with the standards of their corresponding grade level. Many ninth grade teachers did not fully understand the standards addressed at the eighth grade level. Additionally, eighth grade

teachers were unfamiliar ninth grade math standards. For the second cycle, participants have engaged in a study of all eighth and ninth grade standards in order to more clearly understand the learning progressions that take place across all math standards. This work has also served to align teaching terminology being used in various classrooms, allowing for clearer horizontal and vertical alignment. Though the second cycle is not complete at the time of this publication, this work will hopefully result in a smoother transition for students moving from eighth to ninth grade as well as an increase in overall student preparedness and academic achievement in math.

Rutherford County Schools

Teachers in this initiative continue to build their capacity to collaborate and develop learning progressions vertically between standards. As fifth and sixth grade teachers grow closer professionally, new ideas are constantly being developed and shared with the team. Fruitful discussions such as creating more fifth grade student interest in the middle school campus are taking place amongst teachers. Teachers are also developing tools to ease communication about specific students to aid with the transitional struggles that some students face as they enter middle school. What started as a concern over under-prepared students in mathematics has now evolved into a concern of multiple areas of need for students.

The disquisitioner plans to use the methods and strategies employed in this improvement initiative as a template for teacher capacity building in other subject areas. Given the success of the improvement initiative in mathematics, it seems appropriate to expand into other subject areas.

In Summary

Vertical collaborative inquiry teams have the potential to mitigate the problem of under-preparedness of some students in mathematics across transitions. Whether transitioning from

elementary school to middle school or middle school to high school, students deserve educators willing to explore viable, sound, and research-based solutions aimed towards the ultimate goal- Student success. The disquisitioners feel that all students can be successful regardless of background or ability. It is within this frame of social justice that the disquisitioners sought to pursue this improvement initiative. Process measures were developed to provide a pathway for achieving short-term and long-term outcome goals. The disquisitioners sought to increase teacher capacity for utilizing effective collaborative practices and an increased understanding of learning progressions between grade level standards.

Our desire is that the knowledge gained through this disquisition will benefit other educational leaders by providing the information necessary to embark on initiatives similar to the one described in this document. We challenge educational leaders to employ research-based efforts to curb deficits in teacher collaboration. Such efforts create opportunities to address a multitude of challenges including critical standard identification. We feel that the processes described in this document allow for increasing teachers' effectiveness on students.

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LIST OF APPENDICES

Appendix A

PROJECT CHARTER (draft)

Polk County Schools

1. General Project Information				
Project Name:	**Increasing Instrucitonal Capacity Through Vertical Teaming**			
2. Project Design Team				
	Name	**Position**	**Location**	
Project Leader:	Brandon Schweitzer	Assistant Principal	PCHS	
Team Members:	[redacted]	Principal	PCHS	
	[redacted]	Principal	PCMS	
	[redacted]	Middle School Curriculum Coordinator	PCMS	
	[redacted]	Director of Curriculum and Instruciton	District Office	

3. Stakeholders

8th and 9th grade math teachers will be involved in the initiatve. A collaborative environment will be developed as a foundation for teachers to share best practices, resources and general craft knowledge

4. Project Scope

INTENT *What is the rationale for this cycle?*

Students are entering 9th grade math courses lacking the prerequisite skills needed to be successful.

BACKGROUND *What is the current state of knowledge on the topic?*

Math teachers in the 9th grade indicate that large amounts of time is spent re-teaching materal at the beginning of each course that is thought to be covered in previous grades. Initial data shows increased placement in remedial math courses in 9th grade, suggesting academic underpreparedness. Additionally, there are no collaborative structures established between grade levels and varying levels of collaboration inside of grade levels.

AIM *What do we wish to accomplish through this cycle?*

The purpose of this intiative is to improve student overall readiness upon entering math classes in the 9th grade through the establishment of a vertical team between 8th and 9th grade teachers

PERFORMANCE MEASURE GOALS

Goal	Proposed Measures
Math teachers within and across schools will effectivelly collaborate	Survey, Observations, Attendance Logs, Interview results
Teachers will identify critical learning standards needed to arrive prepared for the next grade level	Survey, Observations, Artifacts, Interview results
Teachers will develop learning progressions for identified critical standards	Interview results, Observations, Artifacts

DELIVERABLES

1) List of critical standards identified through analysis of current data
2) Curriculum map aligning 8th grade math curriculum with 9th grade math curriculum in critical standards areas

Appendix A (Continued)

PROJECT CHARTER (draft)

Polk County Schools

PROJECT MILESTONES	
START DATE	November 23, 2015
PLANNING	November – December 2015
IMPLEMENTATION	January 18, 2016 – April 11, 2016
END DATE	April 11, 2016

5. INITIAL ACTIVITY *(proposed initial steps taken by the project design team)*

- Review charge statement with design team
- Discuss and frame problem
- Conduct scan of literature and identify potential resources
- Discuss district vs school level project coordination
- Review initial data (collect additional data if needed)

6. POTENTIAL CYCLES

	CYCLE 1	CYCLE 2
Plan	How can vertical teams combat underpreparedness across grade level / school transition in math?	How can vertical teams be used to build instructional capacity among participating teachers?
Do	Implement vertical teaming initiative	Establish vertical team norms for collaboration as well as meeting times and potential media for communication
Study	How has vertical teams influenced teachers levels of understanding of cross grade level curriculum and expectations?	How has instructional practice changed as a result of vertical teaming?
Act	Revise and adjust vertical team process in order to respond to emergent themes	Revise and adjust vertical team process in order to respond to emergent themes

7. DESIGN TEAM PROJECT SIGN-OFF

	Name	Position	Location	Signature
Project Leader:	Brandon Schweitzer	Assistant Principal	PCHS	
Team Members:	[redacted]	Principal	PCHS	
	[redacted]	Principal	PCMS	
	[redacted]	Middle School Curriculum Coordinator	PCMS	
	[redacted]	Director of Curriculum and Instruciton	District Office	

Appendix B

School Improvement Charter

General Description (What Are We Trying to Accomplish?)

Within the next six months, we will implement procedures and practices that foster collaboration and teamwork between fifth and sixth grade teachers.

Expected Outcomes and Measures (How Will We Know That a Change Is an Improvement?)

- Monthly fifth and sixth grade math PLC meetings
- Teachers will create a vertically aligned fifth and sixth grade math curriculum
- Teachers will develop collaborative assessments on overlapping standards

Performance Measures and Goals

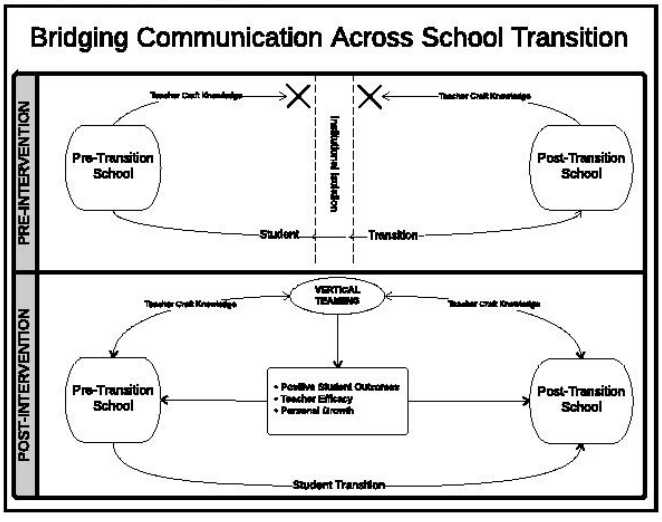
Measure	Goal (prediction)
1. Meeting attendance	85%
2. Percentage of common standards that are aligned	100%
3. Student proficiency rate on common assessment on overlapping standards	85%

Guidance

The general boundaries of the project include:

- An overarching, fully focused commitment to improving student outcomes
- A commitment by the design team to see the project through to completion
- Teachers participate with fidelity
- Formative measures will be in place to assess and inform program needs
- An initial PD date and time to kickoff the project

Conceptual Framework



Design Team Members

Kevin Bailey, Assistant Principal, R-S Middle School

[redacted] Director of Secondary Education, RCS

[redacted]rector of Elementary Education, RCS

[redacted]r, Director of Middle Grades Education, RCS

[redacted], Elementary Curriculum Specialist

[redacted]ddle Grades Curriculum Specialist

[redacted] Sixth Grade Math Teacher

[redacted], Fifth Grade Math Teacher

Appendix C

Goal Setting

1. **With regards to helping students experience success across the transition:**

We are good at...

-preparing students for blocking
-basic organizational habits
-teaching accountability on the student, not the parents
-teaching skills for OUR grade level
-helping students transition to computer use
-counselor and teacher support for students
-afterschool tutoring/flexible period academic support
-SSMT
-Rising 6th graders orientation (students and parents)
-supporting families

We need to improve...
-Looking at standards above and below us
-Terminology - assessments/resources often use different terminology (MAP, EOG, Eureka Math, etc.)
-integrating the foundations of technology programs used at middle school (CANVAS)
-vertical alignment→ consistency across the strands
-consistency across the district with tools and resources
-digital citizenship
-parental involvement at the middle school

2. **With regards to working with other teachers across the transition:**

We are good at...
-professional development for our teachers
-Math collaborative
-Rare contact with teachers regarding individual students

PD2

Appendix C (continued)

Goal Setting

We need to improve...
-making TIME and OPPORTUNITIES for consistent collaboration

3. With regards to understanding the standards across the transition:

We are good at...
-Math collaborative
-Exploring Eureka Math in middle and high school
-Goal Summary Report data by domain (school & district data)
-Schoolnet used for tests - instant feedback by standard

We need to improve...
-learning foundational standards/skills/concepts and upcoming standards/skills

Based on this information, our goals should be:

-learning progressions
-identifying critical areas (understanding alignment) at each grade level
-growing all levels of students (higher level students' growth especially)
-open communication about individual student needs between elementary and middle
-creating activities that immerse elementary students, families, teachers and administrators into middle school environment
-promotion of middle school image to students and families

PD2

Appendix D

Rutherford County Schools

Our Vision
All Rutherford County students will graduate prepared for college and career success.

District PLC-Data Review Protocol (Math)

Individual Reflections: Review the data and write your first thoughts.

What do you wonder about the data?	What questions do you have?

What does this data make you think about in terms of your own practice?

Small Group Discussions:

Share what you noticed about your district's /school's data. What parts of the data caught your attention?	Where do the data indicate success? Where do the data indicate areas in need of support or change?	What can you infer from the data regarding student learning?	Based on the data, in what areas does elementary math have a positive impact on middle school math scores?	In what areas would improvement in elementary school learning lead to potential improvement in middle school learning?	In what areas/domains does middle school math (grades 6-8) have a positive impact on Math I scores? In what areas would improvement in middle school math grades (6-8) lead to potential improvement in Math I?

Appendix E

5th Grade Standard	Extension Activities	6th Grade Standard
	comparing part to part scenarios (ratios) with part to whole (fractions) examples: story problem comparing boys to girls (ratios) compared with a story problem of boys compared to the whole class (fraction). Activities where students discover similarities and differences between ratios vs fractions	CCSS.MATH.CONTENT.6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
CCSS.MATH.CONTENT.5.OA.B.3 Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.	Introduce the vocabulary related to ratios when working on patterns/tables.	CCSS.MATH.CONTENT.6.RP.A.3.A Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.
	Introduce the vocabulary related to rates when working on word problems.	CCSS.MATH.CONTENT.6.RP.A.3.B Solve unit rate problems including those involving unit pricing and constant speed.For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?
CCSS.MATH.CONTENT.5.NBT.B.7 Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.	Extending fraction to decimal conversion to percentages as well; teaching students to find their "percentage correct" on assessments by converting fractions to hundredths example: 18 out 20 questions correct (18/20) x 5/5 = 90/100 ---> 90% correct	CCSS.MATH.CONTENT.6.RP.A.3.C Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.
CCSS.MATH.CONTENT.5.MD.A.1 Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.	Using real world objects to gain foundation for different measurement systems : meter sticks, measuring cups, soda bottles with multple measurement labels, etc.	CCSS.MATH.CONTENT.6.RP.A.3.D Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

Appendix E (continued)

5th Grade Standard	Extension Activities	6th Grade Standard
CCSS.MATH.CONTENT.5.NF.B.7.A Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. For example, create a story context for (1/3) ÷ 4, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that (1/3) ÷ 4 = 1/12 because (1/12) × 4 = 1/3.	Take the whole number and put it over a 1 to show that a whole number can be written as a fraction; teach equivalent fractions and finding common denominators (sometimes it is easier to divide a fraction by a fraction by finding a common denominator	CCSS.MATH.CONTENT.6.NS.A. 1Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?.
CCSS.MATH.CONTENT.5.NF.B.7.B Interpret division of a whole number by a unit fraction, and compute such quotients.For example, create a story context for 4 ÷ (1/5), and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that 4 ÷ (1/5) = 20 because 20 × (1/5) = 4.	Divide a fraction by a fraction using a visual model. Write a story problem that corresponds with the problem.	
CCSS.MATH.CONTENT.5.NF.B.7.C Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. For example, how much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?	Divide a fraction by a fraction using a visual model. Write a story problem that corresponds with the problem.	

Appendix E (continued)

	Word problems involving temperature, bank accounts, elevation, football yardage to help students begin to understand integers	CCSS.MATH.CONTENT.6.NS.C.7.A Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. For example, interpret -3 > -7 as a statement that -3 is located to the right of -7 on a number line oriented from left to right.
CCSS.MATH.CONTENT.5.G.A.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).	Expose students to vocabulary abolute value- discuss distance from 0 on a number line. Expose students to all four quadrants on the coordinate plane.	CCSS.MATH.CONTENT.6.NS.C.8 Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

Appendix F

Default Question Block

Thank you for taking a moment to complete this survey regarding the current progress of your vertical teams. This survey should not take longer than 15 minutes to complete.

Survey responses are completely anonymous and respondents are encouraged to be as honest and thorough as possible in their responses. The information gained from this survey will be used to formatively assess the progress and facilitation of the vertical team meetings that have taken place to date.

Please click the forward arrow button below to begin the survey.

In which district are you currently part of the vertical teaming initiative?

- ○ Rutherford County
- ○ Polk County

Please select your job title:

- ○ Teacher
- ○ Administrator
- ○ District Administrator

Do you agree that you have learned more about effective collaboration than when you started this vertical teaming process in January?

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

Please describe/list characteristics or behaviors of effective collaborative teams learned from the professional development sessions provided....

Appendix F (continued)

Which of these characteristics/behaviors, if any, have you or your team members implemented/utilized during team meetings?

At this point in the vertical team meetings, how would you describe your ability to collaborate with other teachers?

Much weaker	Moderately weaker	Slightly weaker	No change	Slightly stronger	Moderately stronger	Much stronger
0 10	20	30	40	50	60	70	80	90	100

At this point in the vertical team meetings, have you been able to identify critical standards as areas of focus?

No ○ Yes ○

How were the critical standards identified by the team?

Appendix F (continued)

Do you agree that the standards identified by the team as critical are, indeed, the most critical? Why or Why not?

Please rate the degree to which you agree with the following statements about the facilitation of the vertical team meetings.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
	0	10	20	30	40	50	60	70	80	90	100
The number of meetings scheduled has been appropriate for the needs of the team											
Meetings have been scheduled as to minimize lost instructional time with students											
Meetings have been clearly planned (With a clearly identified focus or goal)											

Appendix F (continued)

Supportive materials have been provided for meetings

Teachers have been allowed to drive the direction of the team.

The facilitator has been responsive to the needs of the team

What suggestions do you have for improving the vertical teaming initiative?

What additional resources/support, if any, do you need to continue the work of the team?

Additional comments:

Appendix G

Study Interview Protocol

Institutions: _____

Interviewee (Title and Name): _____

Interviewer: _____

Survey Section Used:

_____ A: Interview Background

_____ B: Collaboration

_____ C: Working With Math Standards

_____ D: Leadership Processes

Other Topics Discussed:_____

_____

Documents Obtained: _____

_____

_____

Post Interview Comments or Leads:

_____

Appendix G (continued)

Teaching, Learning, and Assessment Interviews

Introductory Protocol

To facilitate our note-taking, we would like to audio tape our conversations today. Please sign the release form. For your information, only researchers on the project will be privy to the tapes which will be eventually destroyed after they are transcribed. In addition, you must sign a form devised to meet our human subject requirements. Essentially, this document states that: (1) all information will be held confidential, (2) your participation is voluntary and you may stop at any time if you feel uncomfortable, and (3) we do not intend to inflict any harm. Thank you for your agreeing to participate.

We have planned this interview to last no longer than forty five minutes. During this time, we have several questions that we would like to cover. If time begins to run short, it may be necessary to interrupt you in order to push ahead and complete this line of questioning.

Introduction

You have been asked to speak to us today as a participating member of the vertical teaming initiative put forth in Rutherford/Polk County. The purpose of the vertical team initiative is to build teacher capacity to effectively collaborate, identify math standards that students predominantly struggle in as an area of focus, and describe and assess the connection between grade level standards for the identified areas.

A. Interviewee Background

1) How long have you been ...

   _____ in your present position?

   _____ at this institution?

Interesting background information on interviewee:

2) What is your highest degree? _____

3) In the last two years, how many professional conference have you attended? _____

   Probes: How many were related to math or math instruction?

4) Have there been initiatives at your school, prior to this one, aimed at the same goals we discussed previously?

B. Collaboration

1) Before this school year, how often did you collaborate with colleagues regarding math instruction....

   _____ horizontally (inside of grade level)

   _____ vertically (between grade levels)

2) What are your feelings regarding collaborative practices in general?

Appendix G (continued)

Probes: Have these feeling changed as a result of the vertical team initiative this year? If so, how have they changed?

3) What challenges did you face when engaging in collaborative practices through the vertical team?

Probe: Were you able to overcome them? Individually? Collectively? How?

C. Working With Math Standards

1) Prior to this school year, how did you assess student learning in your classroom with regard to common core state standards?

Probes: What have you learned about assessing student learning through the vertical team initiative?

2) One of the goals of the vertical team was to identify critical standards as an area of focus. As a result of this initiative, how would you describe your ability to identify critical standards?

Probe: What did you use to identify critical standards?

3) Prior to this school year, how would you describe your level of familiarity with common core state standards as they related to the corresponding grade levels involved in your vertical team?

Probes: What is the benefit, if any, to understanding how standards relate to one another across grade levels?

D. Leadership Processes

1) Who was the facilitator of your vertical team? _____

2) How effective was your facilitator in establishing a learning community among the team?

3) Did your facilitator provide adequate resources for you to accomplish the goals set forth by the team?

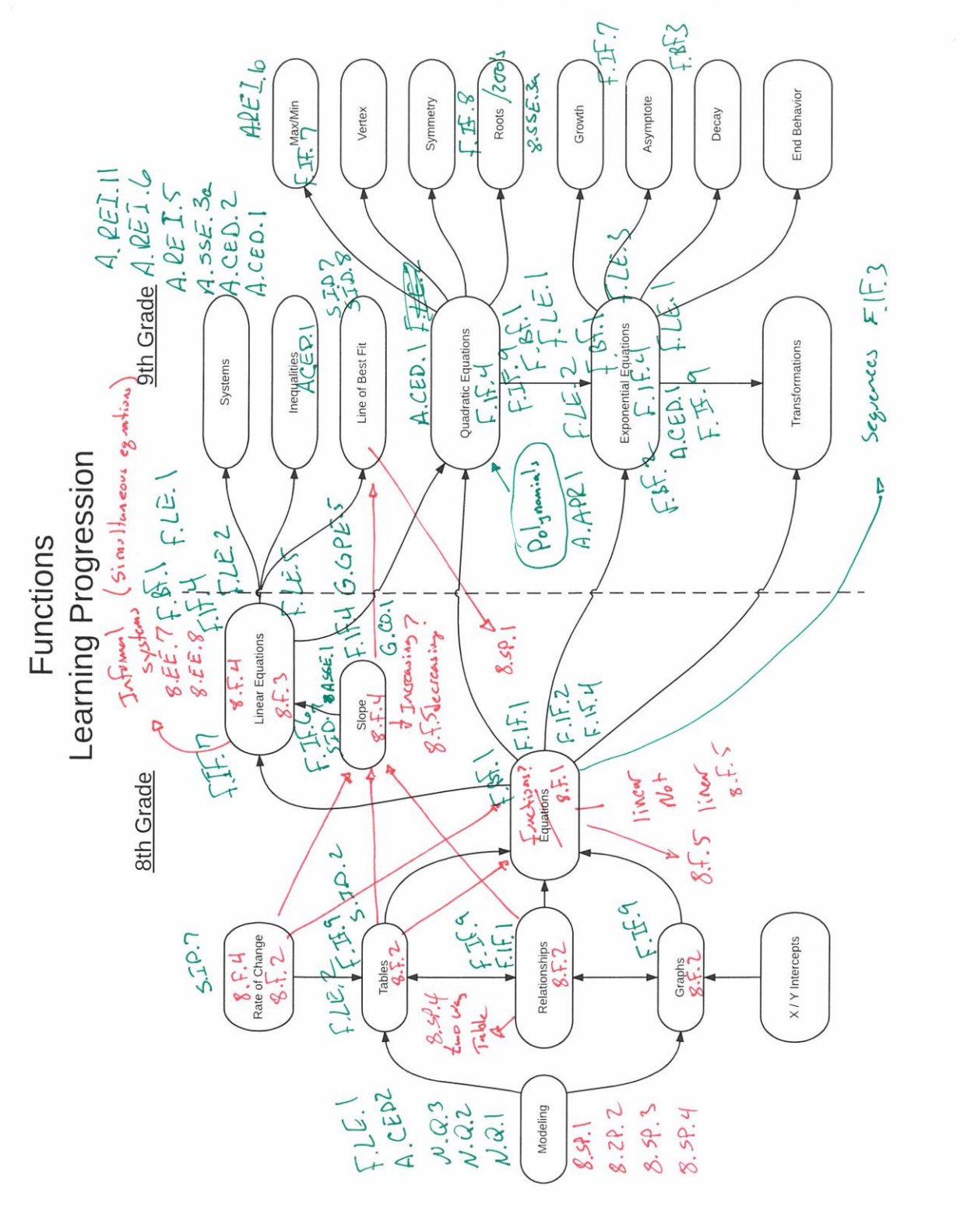
Probes: What kinds of resources were provided?

4) Did your facilitator make you feel like you were a valued member of the team?

Probes: Were they responsive to your suggestions and input? Did you have a part in decision making processes regarding the direction of the team?

Post Interview Comments and/or Observation

Appendix H


Functions
Learning Progression
8th Grade
9th Grade
Rate of Change
Linear Equations
Tables
Slope
Relationships
Functions?
Equations
Graphs
Modeling
X / Y Intercepts
Systems
Inequalities
Line of Best Fit
Quadratic Equations
Exponential Equations
Transformations
Max/Min
Vertex
Symmetry
Roots
Growth
Asymptote
Decay
End Behavior