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Psychometric Validation and Comparison of the Team Development Measure and Learning Community Concepts among High School Professional Learning Community Teams

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I am submitting herewith a dissertation written by Michael Kirkland entitled "Psychometric Validation and Comparison of the Team Development Measure and Learning Community Concepts among High School Professional Learning Community Teams." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Educational Psychology and Research.

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Psychometric Validation and Comparison of the Team Development Measure and Learning Community Concepts among High School Professional Learning Community Teams

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ABSTRACT

This study combined the existing Team Development Measure (TDM) and Learning Community Concepts (LCC) assessments, as the TDLCC, to assess and measure high school professional learning communities progress as teams. Additionally, this study applied Rasch modeling techniques to describe and assess the qualities of the TDLCC instrument as a tool for measuring the levels of team development within a particular set of high school PLC teams as well as the measurement of related characteristics of PLC teams. The TDLCC was administered to 52 high school teachers in 12 PLC teams. Analysis of the content validity and convergent validity of the TDLCC instrument resulted in statistically significant correlations between the TDM and LCC by utilizing average scores and Rasch methodology. Moreover, Rasch model analysis also provided insight into specific team attributes present in PLC teams. The findings suggested that teacher PLC teams in the participating school were in the early (i.e., second) stage of team development, with attributes evidenced that of building cohesiveness and communication skills. The study's results provide initial evidence of a psychometrically valid instrument for measuring teamness and learning community concepts of high school teacher PLCs.

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CHAPTER ONE: INTRODUCTION AND GENERAL INFORMATION

This first chapter introduces the study within the context of team development, specifically within Professional Learning Communities (PLCs). Previous attempts to assess the traditional elements and framework of team development and PLCs are reviewed. Subsequently, the research questions and the methodology that was utilized to respond to them are discussed in addition to the problem being explored. Additionally, this chapter addresses the current study's purpose, significance, assumptions, delimitations, and definitions of key study terms.

Background

Collaborative teams have become a critical component of modern organizations (Weiss & Hoegl, 2015). A team is a group of individuals intertwined to accomplish a common purpose or goal (DuFour, DuFour, Eaker, & Many, 2006). In educational settings, different forms of collaborative teams have been implemented as tools to shape team learning and student performance (Ronfeldt, Farmer, McQueen, & Grissom, 2015). More than 30 years ago, the professional learning community (PLC) model was introduced to educational organizations as a method to increase student performance through collaborative teams of educators (DuFour & Eaker, 1998). PLCs are "composed of collaborative teams whose members work interdependently to achieve common goals linked to the purpose of learning for all" (DuFour et al., 2006, p. 3).

The implementation of PLC teams in education has created a paradigm shift in which educators trade in their autonomy for a culture of sharing ideas and working together, focusing on the greater good of their students (Ronfeldt et al., 2015). Active participation, shared mission and vision, collaboration, commitment, and a desire to improve student achievement are just a

few of the central characteristics associated with effective PLCs (Blitz & Schulman, 2016; DuFour & Eaker, 1998; Tennessee Department of Education, 2017).

Educators learn by doing, reflecting, and discussing what they see in collaborative teams (Darling-Hammond & McLaughlin, 2011; DuFour et al., 2006). Given that the research suggests that collaboration amongst team members has positively impacted student achievement (Ronfeldt et al., 2015), the challenge for practitioners and policymakers is to realign existing policies and standards to promote collaboration in schools to support both teacher and student learning (Darling-Hammond & McLaughlin, 2011). Teacher learning derives from belonging to such organizations as professional learning communities (PLCs) and from reflective practices. PLCs come in many forms: teacher teams, leadership teams, teacher-to-teacher networks, school-to-school networks, and teacher involvement in various organizations (DuFour & Eaker, 1998). It is crucial for district leaders and administrators to establish these types of reflective practice into their organizations to increase student achievement (Darling-Hammond & McLaughlin, 2011; DuFour & Eaker, 1998; DuFour et al., 2006).

Professional Learning Communities in Tennessee Public Schools

In 2007, the National Assessment of Educational Progress (NAEP) showed Tennessee had the largest discrepancy between state exams and national norms. For example, on the Tennessee exam in reading and mathematics, 90% of eighth grade students scored proficient or advanced, whereas only 25% achieved proficient or advanced in reading and mathematics. The results of the NAEP exam motivated educational leaders and government officials to develop a plan of action to improve Tennessee schools (Nixon, 2011).

On March 29, 2010, Tennessee received the U.S. Department of Education's Race to the Top (RttT) grant. Later, the RttT was included in Tennessee's First to the Top (FttT) Act of

2010, which granted Tennessee $500 million to initiate education reform efforts during a four-year period. This initiative was designed to implement standards and assessments to foster college and career readiness, while developing, recruiting, retaining, and rewarding effective educators. The FttT also provided support to structure the state's data system to drive classroom instruction by utilizing student success and growth measures (U.S. Department of Education, 2010).

To mitigate Tennessee's educational deficiencies and to prepare students to be college and career ready, the Tennessee State Board of Education (SBOE) implemented a rigorous curriculum and raised graduation requirements so that students had to take a mathematics course each year as well as chemistry or physics (Nixon, 2011). Additionally, the TDOE revisited the 1992 Tennessee Professional Learning (TN PL) standards to aid in the school reform efforts.

In 2012, approximately 20 years after the implementation of the original adoption of the professional development policy, the TDOE readopted the TN PL standards. These standards include the learning community, leadership, resources, data management, learning design, implementation, and outcomes (Tennessee Department of Education, 2017).

The Tennessee Professional Learning Council, established by the TDOE, developed the Professional, Learning, Planning, and Evaluation Rubric (PLPER) to assist school districts as they outline and implement the TN PL standards. The PLPER was designed to be strictly voluntary and support professional learning programs intended for school districts to use and modify to fit individual needs. The PLPER breaks down the TN PL standards into four categories: Transforming, Performing, Developing, and Emerging. The TN PL standards with the PLPER are tools designed to help districts and school leaders maximize their resources to

develop and support educators to plan, implement, and measure professional learning (Tennessee Department of Education, 2017).

Statement of the Problem

Several problem areas of professional learning communities have been identified in the literature. Although the literature shows that in PLCs practitioners commonly obtain their goals and objectives, a rigorous evaluation to determine their efficacy is lacking (Blitz & Schulman, 2016). Similarly, there is limited research regarding the implementation of PLCs in a traditional high school environment (Wells & Feun, 2007).

This quantitative study investigated the extent to which one rural high school located in East Tennessee has been effective in implementing its countywide PLC initiative. Their process began in response to the FttT Act and the TN PL standards during the 2012-2013 school year. As part of the specific implementation, the school district designed its implementation based on two specific works: DuFour et al.'s (2006) *Learning by Doing: A Handbook for Professional Learning Communities at Work* and DuFour and Marzano's (2011) *Leaders of Learning*.

Based on DuFour et al. (2006) and DuFour and Marzano's (2011) suggestions, the district designed grade-level teams, course (content)-specific teams, vertical teams, and district teams to aid in the implementation of PLCs. Having a well-organized and effective team is one of the most important assets in running any program or school organization efficiently (Weiss & Hoegl, 2015). The execution of effective teamwork provides specific advantages when compared to employees working alone (Salas, Shuffler, Thayer, Bedwell, & Lazzara, 2015; Urias, 2009). Although teams are an essential component of PLCs and the number of research studies centered on teamwork is are increasing, evidence of psychometric properties is lacking in instruments assessing team development (Blitz & Schulman, 2016; Weiss & Hoegl, 2015).

Psychometric Properties of Previous Instruments

Researchers have made numerous attempts to assess PLCs (Brouwer et al., 2012; Gajda & Koliba, 2008; North Cascades and Olympic Science Partnership, 2008; Riskus, 2011; Stock et al., 2013; Syoivutz, 2002; Tseng & Kuo, 2010; Wells & Feun, 2007; Watts, 2010) from the perspective of team development using a variety of instruments; however, the formal psychometric properties of these instruments are lacking. Additionally, Blitz and Schulman (2016) and Weiss and Hoegl (2015) made a compelling argument for the need to develop or identify a team development measurement tool specific to PLCs in the field of education.

The Blitz and Schulman (2016) review found only 49 instruments available to assess PLCs. The review identified 31 quantitative (63.3%) and 18 qualitative (36.7%) instruments that measured the following PLC outcomes: belief, behavior/practice, and performance measures. The level of analysis consisted of the following variables: Teacher/Principal Level (n = 38, 77.5%), PLC Team Level (n = 10, 20.4%), and School/Student (n = 1, 2.04%).

The instruments found by Blitz and Schulman (2016) focused primarily on how teachers' perceptions and beliefs affect PLC outcomes and their PLC experience. Instruments that measure the PLC Team Level (i.e., team dynamics), including, but not limited to, communication, procedures, group norms, and leadership styles, are not as prevalent. Blitz and Schulman (2016) recommend utilizing an established instrument employed in other research fields to support new research evaluating PLCs and PLC teams.

Purpose of the Study

The Professional Learning Model has emphasized educational change that helps promote school improvement, staff development, and student performance (Hord, 1997). As PLC popularity increased, researchers, practitioners, administrators, and policymakers are searching

for ways to evaluate PLC performance (Blitz & Schulman, 2016). The study's purpose was to produce measures of "teamness" (i.e., the extent to which a team has developed integration), and then compare the stages of PLC team development achieved within a specific high school setting. The study utilized Rasch modeling to produce psychometric measures that were used in the comparison process. This information advances the current knowledge of the application of professional learning communities, group and team theory, and school improvement. This study also delivers the reader with insights into the theories and practices of the development and evolution of PLC teams.

Research Questions

To achieve this purpose, the current study addressed the following research questions:

1. To what extent does the content of Stock, Mahoney, and Carney's (2013) The Team Development Measure and the Wells and Feun (2007) Learning Community Concepts correspond to Hord's (1997) PLC dimensions?
2. To what extent does convergent validity exist for the teamness construct when applied to the Stock et al.'s (2013) The Team Development Measure and the Wells and Feun (2007) Learning Community Concepts instruments?
3. To what extent are team attributes present in one high school's PLC teams?
4. To what extent do the participants perceive the PLC implementation at their high school to be consistent with the PLC model? (Sub-Questions: Which learning community principles were implemented during the PLC team implementation process? Which learning community principles were most likely to occur or be rejected)?

Study Setting

This study was conducted at a high school serving rural students in grades 9 to 12 in the southeast region of Tennessee. The school opened in 1995 and has a teaching staff of 65, a support staff of 20, and four administrators. The school's total student enrollment is 1,087; 93% of the students are white, and 54% come from socioeconomically disadvantaged homes.

Each year the school is evaluated using the Tennessee Value-Added Assessment System (TVAAS) to assess all high schools based on dropout rates, attendance rates, and student performance on state exams (Sanders & Horn, 1998). The TVAAS assigns the following levels of school effectiveness, also referred to as value-added scores: "Level 5–Most Effective, Level 4—Above Average Effectiveness, Level 3—Average Effectiveness, Level 2—Approaching Average Effectiveness, and Level 1—Least Effective" (Tennessee Department of Education, 2016, p. 29).

During the 2014-2015 and 2015-2016 school years, the high school achieved the highest possible score on the TVAAS Composites: Literacy—5, Numeracy—5, Literacy and Numeracy—5, and Overall—5. During the 2014-2015 school year, the Tennessee Department of Education declared the school a Reward School for being in the top 5% of Tennessee schools with the highest success rates in the 2014-2015 school year. Also, the school received national recognition, including appearing on the 2014 and 2015 Best High School List in the *US News and World Report* and *Newsweek's* Best Schools in America List for 2014. These recognitions were based on performance levels on state assessments and college readiness.

However, in the 2016-2017 school year, the school fell below in the following TVAAS Composites: Literacy—3, Numeracy—2, Literacy and Numeracy—2, and Overall—2 and is no longer ranked as one of the nation's top high schools. In Algebra I, 54.8% of students were

classified as below basic. In Chemistry, 46.6% of the students were classified as below basic. In response, the school implemented PLCs to address declining student achievement.

According to the high school principal, from 2012-2017, PLC meetings consisted of only departmental meetings and faculty meetings. During the 2017-2018 school year, district leaders and the school's administration mandated that faculty and administrative members would meet once a week in teacher-to-teacher networks (i.e., course content teams) focused on diminishing achievement gaps and increasing students' academic performance. Teacher-to-teacher teams provide support for reflecting, examining, and sharing of information to develop new practices to be used in the classroom (Darling-Hammond & McLaughlin, 2011).

Theoretical Background: Communities of Practice

Communities of individuals have been forming units to share and learn from each other throughout the centuries (DuFour, 2004; Wenger-Trayner & Wenger-Trayner, 2015). Wenger-Trayner and Wenger-Trayner (2015) define a community of practice as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (p. 1). Members of a community of practice brought together by a common denominator meet regularly to learn from and support one another.

Domain, community, and practice are the three main traits that comprise a community of practice (Wenger-Trayner & Wenger-Trayner, 2015). First, the domain identifies the members' common interest and commitment to a purpose. Next, members who actively participate in discussions, events, sharing information, and working together are considered to be a community. This sense of community arises when members recognize that everyone has something to contribute. Finally, to meet the practice qualification, the group must "develop a

shared repertoire of resources: experiences, stories, tools, ways of addressing reoccurring problems" (Wenger-Trayner & Wenger-Trayner, 2015, p. 2).

Significance of the Study

With the high level of importance placed on collaborative teams (Weiss & Hoegl, 2015) to increase student achievement (DuFour & Eaker, 1998), few assessments exist that attempt to measure the development of PLC teams (Blitz & Schulman, 2016). Instruments of this nature are rarely found in PLC associated literature (Blitz & Schulman, 2016; Weiss & Hoegl, 2015). This research contributes to the body of knowledge in the field of education, specifically bolstering an understanding of how educators form teams within PLCs. Additionally, this study may improve the understanding of the implementation of PLCs in low-performing high schools in rural areas.

Delimitations of the Study

The study's results are not meant to be generalizable to Tennessee high-school educators. This school setting was included due to convenience, size of the faculty, and manageability of the study. By utilizing this high school, the information obtained from this study could provide an instrument and methodology supporting future studies seeking generalizability for team development in this type of setting. Additional limitations are addressed in Chapter Five.

Definitions of Key Terms

Community of Practice is defined as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (Wenger-Trayner & Wenger-Trayner, 2015, p. 1).

Professional Learning Communities (PLCs) are defined as being "composed of collaborative teams whose members work interdependently to achieve common goals linked to the purpose of learning for all" (DuFour et al., 2006, p. 3).

Teaching Teams are defined as "teachers from varying disciplines [who] are organized into core groups to share [the] instruction of a given community of learners" (Doda & Lounsbury, 1986).

A team is a group of individuals working interdependently to accomplish a common purpose or goal (DuFour, DuFour, Eaker, & Many, 2006).

Tennessee Value-Added Assessment System (TVAAS) is defined as "a statistical method of determining the effectiveness of school systems, schools, and teachers" (Sanders & Horn, 1998, p. 248).

Organization of the Study

Chapter One introduced the study problem, its context, four designated research questions, and the methodological components used to address study questions. This chapter also examined study limitations and key definitions. Chapter Two presents a review of the literature informing this study as well as the associated theoretical framework. Chapter Three illustrates details of the study's methodology as well as how it was administered and how the results were analyzed. Chapter Four delivers the findings from information collected from the TDLCC. Chapter Five provides a discussion of the results in detail preceded by the study's implications and recommendations for future research.

CHAPTER TWO: INTRODUCTION AND LITERATURE REVIEW

The literature review for the current research explores related theoretical frameworks, methodology, and the research base addressing relationships between team development and professional learning communities. Chapter Two provides a historical perspective of the factors and challenges of team development and PLCs, focusing on how teams and learning communities have affected secondary education. The chapter includes a review of team development theory and how the concept of teams expanded into professional learning communities. This discussion offers a basis of understanding the relevance of team development in PLCs. The convergence of team development theory and PLCs link the research agenda in this current study.

Theoretical Framework: Adult Learning and Communities of Practice

The literature involving PLC teams is built on a theoretical framework centered on student learning, continuous teacher education, and student achievement (Hord, 1997; Steyn, 2013). The theories of adult learning and the theory of community of practice contribute to the theoretical framework underlying PLC teams. The framework inspires professional development for educators through collaboration practices, data analysis, and solving problems to support students and their classroom environment. The integration of the two frameworks allows for a comprehensive understanding of PLC team development.

The focus on adult learning theories links directly to the role of teachers in PLCs as they seek to reflect and learn as a group. Malcom Knowles (1980) developed the concept of andragogy (i.e., the art and science of the advancement of adult learning). Although no adult learns exactly the same way, adult learning theories offer insight into the process and guidance to educators to provide support for their learners' needs (Knowles, 1980; The Teaching Excellence

in Adult Literacy Center, 2011). As reported by Steyn (2013), Knowles (1984) developed a set of common principles that reinforce adult learning:

1. "Adults' personalities, needs, learning styles, work, and life experiences influence their views on education, learning, and ultimately continuing professional development;
2. Adults want to understand why it is necessary to learn something and require their learning to be of value and meaningful;
3. Both physical and psychological changes need to be acknowledged in adult learning;
4. To support adult learning, social culture and social context need to be understood; and
5. Adults learn through experiences and approach learning in the form of problem-solving" (p. 280).

Table 2.1, adapted from The Teaching Excellence in Adult Literacy Center (2011), displays the set of assumptions from Knowles and implications that could be implemented to assist adult learners.

In conjunction with adult learning theory, Jean Lave and Etienne Wenger developed the idea of a community of practice (COP). COP is defined "as a condition for learning to occur that involves the creation and transfer of knowledge which is at the core of meaningful learning" (Steyn, 2013, p. 280). Within this concept, COP members in educational settings, brought together by a common denominator, meet regularly to learn from and support one another (Wenger-Trayner & Wenger-Trayner, 2015).

Community, domain, and practice are the three main traits that form a COP (Wenger-Trayner & Wenger-Trayner, 2015). First, the domain identifies the members' common interest and commitment to a purpose. Then, members actively participate in discussions, events, sharing information, and working together. Subsequently, a sense of community develops as

Table 2.1

Knowles' Assumptions and Implications for Practice (The Teaching Excellence in Adult Literacy Center, 2011).

Assumptions	**Implications**
Moves from dependency to increasing self-directedness as he/she matures and can direct his/her own learning	Set a cooperative climate for learning in the classroom
Draws on his/her accumulated reservoir of life experiences to aid learning	Assess the learner's specific needs and interests
Is ready to learn when he/she assumes new social or life roles	Develop learning objectives based on the learner's needs, interests, and skill levels
Is problem-centered and wants to apply new learning immediately and	Design sequential activities to achieve the objectives
Is motivated to learn by internal, rather than external, factors	Work collaboratively with the learner to select methods, materials, and resources for instruction and
	Evaluate the quality of the learning experience and make adjustments, as needed, while assessing needs for further learning

members come to recognize that all members of the team have something to contribute. Finally, to achieve the practice expectation, the group must "develop a shared repertoire of resources: experiences, stories, tools, ways of addressing reoccurring problems" (Wenger-Trayner & Wenger-Trayner, 2015, p. 2).

The theories of adult learning and community of practice jointly contribute to this study's theoretical framework. These theories consist of the concepts that are applicable to the current study and help explain the phenomenon of the development of PLC teams. In the following section, the researcher examines the context of PLC teams to focus and explain the factors that impact the development of PLC teams.

Professional Learning Communities: The Historical Perspective

There is a copious amount of literature on the topic of Professional Learning Communities. Researchers and practitioners have consistently endorsed PLCs as an effective technique to deliver professional development (PD), improve educator instructional practices, school culture, and student achievement (Blitz & Schulman, 2016; Choy, Chen, & Bugarin, 2006; DuFour et al., 2006).

During the 1960s, the education literature increased recognition regarding the benefits of teacher collaboration, shifting away from the traditional focus from teacher classroom autonomy. Previously, it was not common for educators to share instruction and management ideas or to assume active leadership roles outside of the classroom (Shmoop Editorial Team, 2008). However, improving educational practices began to garner attention due to the space race, the Civil Rights Act of 1964, as well as the Higher Education Act of 1965. Teachers were asked to think inventively, collaborate, and take steps to encourage student participation (Shmoop Editorial Team, 2008). Studies suggested that collaboration among team members allowed for

the beneficial development of team norms, improved communication skills, and less time spent on simple tasks (Fransen, Weinberger, & Kirschner, 2013).

A Nation at Risk

During 1980s, increased interest in the potential of teamwork began to grow primarily due to the hierarchical work processes found in industrial plant production models. During this time, research studies suggesting the benefits of production groups, project teams, and teacher teams emerged within the literature (Weiss & Hoegl, 2015). In April 1983, the National Commission on Excellence in Education (NCEE) published one of the most influential educational documents to date, *A Nation at Risk* (DuFour & Eaker, 1998). This document introduced and discussed key areas of weakness and the dramatic decline of the United States' educational system. For example, in its opening paragraph, the NCEE stated,

> Our nation is at risk. Our once unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competitors throughout the world….The educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a nation and a people…If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war…We have, in effect been committing an act of unthinking, unilateral educational disarmament. (DuFour & Eaker, 1998, pp. 2-3)

The Excellence Movement was initiated in response to *A Nation at Risk.* The Excellence Movement's main objective was to make American students globally competitive by designing the curriculum with rigorous standards (DuFour & Eaker, 1998).

During the 1990s through the early 2000s, the favorable aspects of teamwork received greater coverage, not only in business organizations but in scientific and educational organizations.

> Being a team player is now considered a virtue in itself in society, and most job advertisements emphasize the importance of the potential applicants' capacity for teamwork, no matter whether team is actually necessary and applied (to a greater extent) at the workplaces. (Weiss & Hoegl, 2015, p. 605)

No Child Left Behind

Eighteen years after the publication of *A Nation at Risk*, on January 8, 2002, President George W. Bush signed the No Child Left Behind Act (NCLB). According to President Bush, the main focus of NCLB was "to ensure that every child in every school must be performing at grade level in the basic subjects that are the key to all learning, reading and math" (Hayes & Urbanski, 2008, p. 10). NCLB introduced adequate yearly progress (AYP) as a measurement tool to be used as an assessment model to measure the degree to which and how schools were meeting their overall goals. AYP's focus was later changed to a more "flexible measure of student improvement known as the growth model" (Hayes & Urbanski, 2008, p. 2). This mandate required States to develop and implant standardized testing in core areas, such as Mathematics and English Language Arts. The proficiency rates for of the two exams, rates of schools' general student population, ethnic subgroups, and categorical subgroups (i.e., students from low-income families) were used in the AYP reports (Davidson, Reback, Rockoff, & Schwartz, 2015).

NCLB forced teachers to dedicate extra class time to for test preparation in an attempt to increase student's scores. Soon, criticism of the NCLB began due to "significant philosophical

differences to concerns about specific technical aspects of the legislation" (Hayes and Urbanski, 2008, p. 22). Additionally, the critics demanded a reauthorization of state assessments due to discrepancies between how States' calculated AYP scores (Davidson et al., 2015; Hayes & Urbanski, 2008).

Common Core State Standards

As the climate of school reform shifted from NCLB to Common Core State Standards (CCSS) in 2010, the United States education system had experienced multiple reform efforts to improve classroom practices and student learning, increasingly highlighting professional development (PD) a major focus. Mizell (2010) defines PD as a "strategy schools and school districts use to ensure that educators continue to strengthen their practice throughout their career" (p. 1). Government agencies, state departments of education, and school systems are working diligently to improve PD (Choy et al., 2006). In the current era of greater teacher accountability, teacher evaluations and high-stakes testing, the need for effective professional development (PD) is increasingly viewed as imperative for educators' success (Stahl, 2015) that can be utilized as a means to enhance classroom instruction and increase student achievement (Darling-Hammond, Hyler, & Gardner, 2017; DuFour & Eaker, 1998; Stahl, 2015; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007).

In 2015, the US News and World Report released a report indicating that the United States Congress had cut K-12 education resources by approximately 20% (Bidwell, 2015). As a result, many districts were finding it difficult to be able to invest resources into professional development (Stahl, 2015). For example, Kober, McIntosh, Rentner (2013) found 37 out of 40 state education agencies were having difficulty providing educators with proper professional development they needed to implement Common Core State Standards. Stahl (2015) suggests

that “schools must look for ways to provide sustained, job-embedded PD that will support high-level comprehension instruction and student achievement with their existing resources” (p. 327).

Traditionally, job-embedded in-service PD opportunities consist of short one-day or drop in workshops (Choy et al., 2006; Darling-Hammond et al., 2017), also known as continuing education, in-service, professional learning, staff development, teacher education, or teacher training (Mizell, 2010). Moreover, the traditional formats of PD often lacked the needed focus and time to affect classroom practices, teacher needs, and student outcomes (Choy et al., 2006). The literature suggested that educators need sustained, intensive, and beneficial PD with an adequate amount of time to learn new teaching strategies and skills needed to improve their classrooms (Maldonado, 2002).

In 2017, the Tennessee Department of Education and the Tennessee Education Research Alliance surveyed approximately 56% of Tennessee teachers and 60% of Tennessee administrators, which represented approximately 38,000 educators. The data collected indicated that teachers perceived that there were “relatively few opportunities for personalized professional learning” and “they take part at least once a month in a professional learning activity that they do not perceive to be helpful” (Tennessee Department of Education, 2017, p. 16).

Due to the limitations of the traditional format of PD, researchers and organizations began to develop best practices and guidelines for effective PD programs (Choy et al., 2006). For example, DuFour and Eaker (1998), and Stahl (2015) recommend using school-based PLCs to provide high-quality PD without exhausting valuable resources from local school districts. The Centre for Educational Research and Innovation (1998) suggested school officials should invest more resources in professional learning courses that are “coherent, comprehensive and consistent” with state and local policies; then educators will “be convinced of its importance” (p.

4). These models provided educators with new insights into the nature of PLCs. For example, the Tennessee PLC model framework incorporated several desirable characteristics found by Darling-Hammond et al. (2017) and Kennedy (2016).

Context of PLC Teams (PLC Standards, Design, and Team Models)

While the multiple frameworks underlie the broader aspects of PLCs, the context of PLC teams focuses on the specific traits and behaviors of team members. This section introduced the common qualities of professional learning community (PLC) teams. It also reflects the integration of a variety of theories and models encompassing the phenomenon of PLC teams and their favorable educational influences. Additionally, this section addresses the professional development design, national, state (Tennessee) and local level standards of professional learning, group and team models, and the professional learning community model.

Tennessee Professional Learning Standards

Under the First to the Top (FttT) Act guidelines, professional development, educator accountability, principal accountability, and school accountability were to be reformed in the state of Tennessee. The TDOE adopted a professional development policy (SBE Policy 5.200) in 1992, then revised it in 2002. Later in November 2011, the State Board of Education (SBE) Policy 5.200 was revisited to promote statewide adoption by the following organizations: Learning Forward Tennessee, Tennessee School Boards Association, Tennessee Organization of School Superintendents, Department of Education, State Board of Education, Tennessee Association of Colleges of Teacher Education, Tennessee ASCD, and SCORE (Tennessee State Board of Education, 2012).

Standards for Professional Learning

Learning Forward—The Professional Learning Association, a leader in the field of K12 professional learning, developed Standards for Professional Learning to strengthen the relationship between professional learning and student achievement. In 2001, Learning Forward and 40 leading educational associations and consortia, including state and local school board members, teachers, principals, and superintendents, reviewed the literature and research to form seven standards for professional learning (Learning Forward, 2011). Table 2.2 provides a brief description of those standards.

In 2012, approximately 20 years after the original state professional development policy was implemented, the TDOE adopted the Tennessee Professional Learning (TN PL) standards. These include the leadership, learning community, data management, resources, learning design, application and results. The Tennessee Professional Learning standards are outlined in the State Board of Education Policy 5.200 as follows:

- 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.

Table 2.2

Standards for Professional Learning. Adapted from Learning Forward (2011).

Standard	Description
Learning Communities	Professional learning that increases educator effectiveness and results for all students.
Leadership	Professional learning that increases educator effectiveness and results for all students.
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.

- Data—Professional learning that increases educator effectiveness and results for all students…uses a variety and types of students, educators, 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 adult learning to achieve its intended outcomes.
- Implementation—Professional learning that increases educator effectiveness and results for all students…integrates theories, research, and models of human learning to achieve its intended outcomes.
- Outcomes—Professional learning that increases educator effectiveness and results for all students…aligns its outcomes with educator performance and student curriculum standards. (Tennessee Department of Education, 2017, pp. 4-15)

The Tennessee Professional Learning Council developed the Professional, Learning, Planning, and Evaluation Rubric (PLPER) to assist school districts as they formulate and implement the TN PL standards. The PLPER was intended to be voluntary and support professional learning programs, allowing for modification to fit individual needs. The PLPER breaks down the TN PL standards into four categories: Transforming, Performing, Developing, and Emerging (Tennessee Department of Education, 2017). The Tennessee Department of Education (2017, p. 15) defines these terms as:

- Transforming—Evidence indicates positive, systemic changes in teaching and learning.
- Performing—Evidence indicates professional learning meets the standard and is producing positive results.

- Developing—Evidence indicates significant progress toward meeting the standard.
- Emerging—Evidence indicates beginning efforts toward meeting the standard.

Professional Development Design Framework

The professional development framework is structured to focus on best practices for teachers and student learning outcomes (Darling-Hammond et al., 2017; Mizell, 2010). For example, Darling-Hammond et al. (2017) examined literature regarding professional learning that displayed evidence of changing teacher practices and improving student outcomes in an effort to identify key characteristics of effective PD models. Thirty-five articles were reviewed using the following methodological criteria: experimental group design, comparison group design, or deconstruct student results with context variables, and student attributes. The articles were coded to find common themes, generating the following top characteristics of an effective PD (Darling-Hammond et al., 2017):

1. Is content-focused.
2. Incorporates active education.
3. Bolsters collaboration.
4. Incorporates effective practice models.
5. Offers coaching and expert support.
6. Provides feedback and reflection.
7. Is of sustained duration.

Kennedy (2016) conducted a review of experimental research related to PD to try to answer the overarching question of "How does professional development improve teaching?" The review found only 28 studies that meet five constraints: the study was about PD only, the study included evidence of student achievement, the study design controlled for motivation to

learn, the study followed teachers for at least one year, and the study's rules differed from the What Works Clearinghouse. The results showed that the following components are critical to the design of effective PD (Kennedy, 2016):

1. Focus on content knowledge
2. Collective participation
3. Total amount of contact hours with teachers
4. Coaches (i.e., someone to depend on or facilitate enactment)

Mizell (2010) claims the most effective PD incorporates teacher teams or learning teams to focus on student needs and outcomes.

> [A] leadership team analyzes student achievement data to identify learning problems common to students in a particular grade or class, determines which problems educators have the most difficulty addressing, and investigates what they need to know and do to be more successful in helping students overcome learning challenges. Next, all educators are organized into learning teams…Each team has a skilled facilitator to guide the team in establishing and pursuing learning goals. Teams meet during the workday at their school two or three times a week…In team learning, less experienced educators interact with and learn from more experienced educators on the team. As all educators on the team become more skillful, they reduce or eliminate variation in performance and begin to take collective responsibility for the success of all students. (Mizell, 2010)

Similarily, Mundry and Louck-Horsley (1999) claimed effective PD programs follow the Professional Development Design Framework (see Figure 2.1). Within this framework, PD programs address the goals and purposes, planning, and have ongoing reflections to make key adjustments to PD activities. Figure 2.1 displays the Professional Development Design

Framework that provides program developers an opportunity to reflect on and refine the components of an effective PD to achieve the desired goals and outcomes for educators and students (Mundry & Louck-Horsley, 1999). "While the design framework looks rational and analytical, professional development design is more art than science" (Loucks-Horsley, 2003, p. 62).

These include the following:

- Assess the context within which they are working.
- Draw upon the knowledge base on standards-based learning and teaching…professional devlopment, and educational change.
- Work with local clients to design and/or tailor the professional development program.
- Gather data, reflect on results, and make program improvments (Mundry & Louck-Horsley, 1999, p. 7).

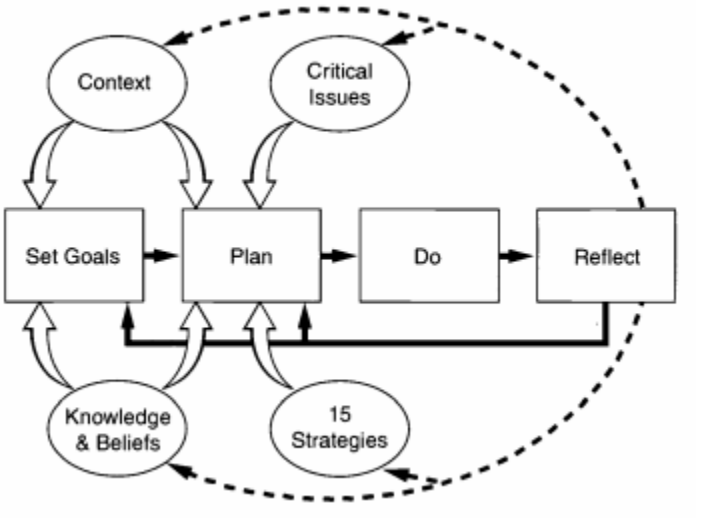

Figure 2.1. *Mundry and Louch-Horley's (1999) Professional Development Design Framework*

In the last 50 years, attempts have been made to link teacher PD with educational policies to make schools more efficient (Centre for Educational Research and Innovation, 1998). However, improving educational outcomes, policies, and practice has proven to be a challenging task (Darling-Hammond et al., 2017; Papay & Laski, 2018). Due to the discrepancies found among the educational systems, course standards, curriculums, and state assessments, PD activities must complement teachers' needs in order to provide adequate support, so they can implement the information into their classrooms. Teachers must also work together to ensure student achievement improves over time (Maldonado, 2002). Darling-Hammond et al. (2017) state:

> …[a] well-designed and implemented PD should be considered an essential component of a comprehensive system of teaching and learning that supports students to develop the knowledge, skills, and competencies they need to thrive in the 21st century. To ensure a coherent system that supports teachers across the entire professional continuum, professional learning should link to their experience in preparation and induction, as well as to teaching standards and evaluation. It should also bridge to leadership opportunities to ensure a comprehensive system focused on the growth and development of teachers. (Darling-Hammond et al., 2017, p. vii)

Team Models

In the social sciences, the input-process-output (IPO) model has been investigated and accepted across multiple disciplines as a framework for understanding the complexity of the group and team phenomena (Ilgen, Hollenbeck, Johnson, & Jundt, 2005; Reiter-Palmon, Sinha, Gevers Josette, Odobez, & Volpe, 2017). "The IPO model suggests that to understand teams and team functioning, attention must be given to the inputs into the team environment, the processes

that teams engage in, and the outputs of the team" (Reiter-Palmon et al., 2017, p. 3). The input variable of the IPO model includes environmental characteristics such as organizational context variables, including individual, group, and environmental factors. The second characteristic of the IPO model includes the process variables. These variables emerge from the interactions among the team members; for example, problem-solving activities, trust development activities, and conflict management activities. Subsequently, the third characteristic is the level of outcomes a team member is satisfied, level of performance, or level of turnover (Reiter-Palmo et al., 2017). Figure 2.2 illustrates the mapping process proposed by the IPO model.

The IPO model has had an authoritative impact on empirical research; however, "the convergence on consensus regarding the utility of IPO models as a guide to empirical research fails to capture the emerging consensus about teams as complex, adaptive systems" (Ilgen et al., 2005, pp. 519-520). Ilgen et al. (2005) claim the IPO model is inadequate for classifying teams in the following areas:

- Many of the factors that intervene and transmit the influence of inputs to outcomes are not processes.
- An IPO framework limits research by implying a single-cycle linear path from inputs through outcomes.

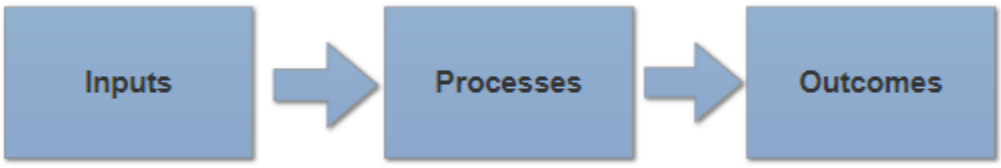

Figure 2.2. *Mapping of the IPO Model. Adapted from Ilgen et al. (2005) and Reiter-Palmon et al. (2017).*

- The IPO framework tends to suggest a linear progression of main effect influence proceeding from one category (I, P, or O) to the next (p. 520).

Ilgen et al. (2005) developed the IMOI model as an alternative to the IPO framework to describe the theoretical foundation relating social science and computer science to teamwork and teams. Figure 2.3 below displays the mapping of the IMOI model.

First, the researchers substituted an "M" for the "P" to create a "broader range of variables that are important mediational influences with explanatory power for explaining variability in team performance and viability" (Ilgen et al., 2005, p. 520). Next, they added an "I" to the end of the IPO model indicating that teams develop in a cyclical pattern over time (Ilgen et al., 2005). The input stage includes the composition of each team member (attitudes, skill sets, knowledge), team characteristics (interdependence, standardization, technology), and organizational context (culture) (Rosen et al., 2014). Team members begin to develop trust, feel competent to complete a given task, and have a sense of safety by not wanting to harm the team or individual's interests. "The levels of trust (or distrust) can be shaped by people's values, attitudes, and moods/emotions, as well as by previous experience" (Ilgen et al., 2005, pp. 522-523).

The mediator stage, also known as the behavioral realm (Ilgen et al., 2005), can be separated into physical distribution and behavioral dimensions. The behavioral dimensions include action processes (communication, leadership, performance monitoring, adaptation, and learning), transition processes (planning and goal specification), and interpersonal processes (conflict management and trust building) (Rosen et al., 2014).

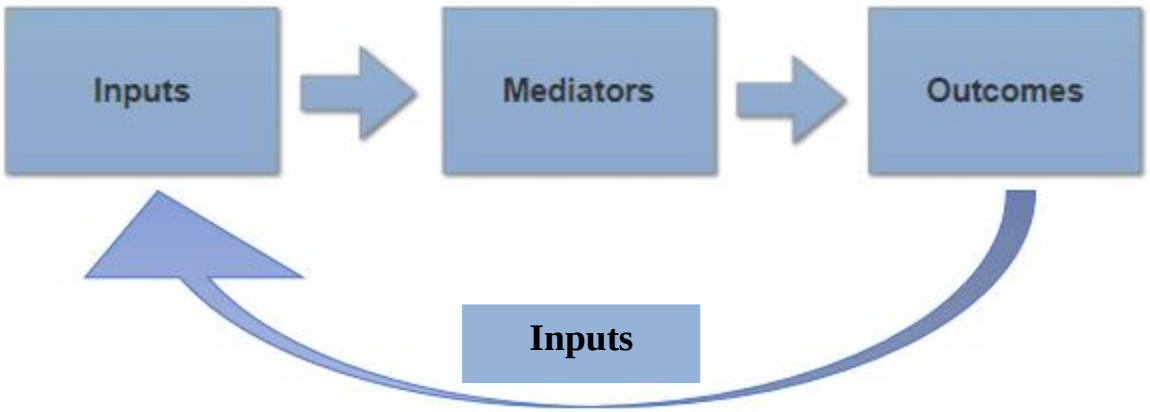

Figure 2.3. *Mapping of the Input-Mediator-Output-Input Model. Modified from Rosen , Dietz, Yang, Priebe, and Pronovost (2014).*

> The degree of behavioral specificity of expectations for effective teamwork has implications for observational methods and analysis techniques…emphasizing the detection of a priori defined patterns of interaction will be most relevant for areas of a team's work with defined behavioral expectations. (Rosen et al., 2014, p. 4)

Physical distribution primarily refers to the interaction of group members in various types of communication systems, such as face-to-face and electronic messages. Once the team has developed confidence and has experienced working together, it is able to produce some form of output (Ilgen et al., 2005). The team output stage has three categories: task efficiency, team learning, and affective outcomes. Task efficiency refers to the task outcomes (i.e., team response), member satisfaction, and viability. Team learning involves the interaction and attributes of individuals over time. The teams' effective outcomes are based on the levels of satisfaction inferred from the interaction data (Rosen et al., 2014).

Following the second input stage, the IMOI model cycles the team back to the beginning stage, the input stage. Thus, the team has completed at least one developmental cycle and is

ready to begin a new cycle (Rosen et al., 2014) or disband (Ilgen et al., 2005). Stages one through three of the IMOI model are consistent in the team literature. The final stage is absent from the empirical team literature (Ilgen et al., 2005). Yet, other models emphasize the existence of the finishing stage, referring to it as adjourning (Tuckman & Jensen, 1977) or completion (Gersick, 1988).

Tuckman and Jensen's (1977) model of group development was synthesized from the literature and is still dominant within the current literature. Similar to the IMO model, it also reflects a linear progressive model for identifying the five stages of group development: forming, storming, norming, performing, and adjourning (Fransen et al., 2013). Table 2.3 explains the characteristics for each of the five stages.

During 1980s, the idea of teamwork began to expand due to management innovations. "Specifically, teamwork was implemented in areas traditionally characterized by individualized

Table 2.3

Tuckman and Jensen's Five Stages of Group Development (Fransen et al., 2013)

Phase	Characteristics
Forming	Getting to know one another and the task at hand
Storming	Establishing positions on the task and roles within the group
Norming	Reaching consensus about group norms, goals, and strategies
Performing	Reaching conclusions and delivering results
Adjourning	Dismantling the group; reevaluation of team goals with respect to personal goals

and more hierarchical work processes, such as gastronomy or production plants" (Weiss & Hoegl, 2015, p. 603). During this time, a focus on production groups, project teams, and teacher teams emerged within the literature.

Consistent with Tuckman and Jensens' (1977) Five Stage Model of Group Development, George (1982) developed the Four Operational Phases for Interdisciplinary Teams in an educational setting. He conducted research consisting of more than 300 junior and middle schools that were having difficulty organizing instructional practices for teachers and students. Each school was arranged by interdisciplinary teams consisting of teachers and students (George, 1982). Table 2.4 explains the characteristics for each of the five stages.

Approximately 11 years later, Gersick (1988) developed a group development model coordinating the timing and mechanisms to the dynamic relationships formed by the group. She claimed, "Teams progressed in a pattern of 'punctuated equilibrium' through alternating inertia and revolution in the behaviors and themes through which they approached their work" (Gersick, 1988, p. 9). Punctuated equilibrium is a concept used in the field of natural history. It is defined as, "Systems progress through an alternation of stasis and sudden appearance—long periods of inertia, punctuated by concentrated, revolutionary periods of quantum change" (Gersick, 1988, p. 16).

Professional Learning Communities Model

Many United States school districts have adopted the professional learning community (PLC) framework as an approach to increase student learning outcomes through school improvement efforts and professional development strategies (DuFour & Eaker, 1998; Hord, 1997). In the PLC model, the community, parents, and principals must play a vital part in creating and maintaining a learning community (DuFour & Eaker, 1998). "PLCs operate under

Table 2.4

George's (1982) Four Operational Phases of Interdisciplinary Team Organization

Phase	Characteristics
Organization	• Teachers and students on the team are located together in the same area. • Teachers share the same schedule. • Subjects taught to the students on the team by the same combination of teachers.
Community	• Teachers and students become more aware of their new arrangement. • Goals must be set for its realization. • Activities conducted with commitment. • Team get-togethers are present.
Team Teaching	• Teams that are well organized and have a sense of who they are. • Strong team organizational skills and communication skills.
Governmental	• Everyone is involved. • Members are more motivated to have more responsibility for what affects their lives and the school experiences of their students. • Members explore new dimensions of professional effort. • Shared problem-solving and decision making. • Often weekly meetings of the program improvement council.

the assumption that the key to improved learning for students is continuous job-embedded learning for educators" (DuFour, DuFour, Eaker, Many, & Mattos, 2016, p. 10). The DuFour and Eakers' PLC model consist of six attributes:

- Shared mission, vision, and values
- Collective inquiry
- Collaborative teams
- Action orientation and experimentation
- Results orientation

In the mid-1990s, Shirley Hord (1997) established a PLC model similar to DuFour and Eaker's (1998). Even though the PLC models were similar in nature, Hord's PLC model focuses on reflective practice for collective learning (Hord, 1997, 2009), whereas Dufour and Eaker's PLC model involves the need for a cultural shift for the school to become a learning community (DuFour et al., 2016; DuFour & Eaker, 1998). Hord's (2009) PLC model contains six dimensions of PLCs:

- Shared beliefs, values, and a vision of what the school should be;
- Shared and supportive leadership where power, authority, and decision-making are distributed across the community;
- Supportive structural conditions, such as time, place, and resources;
- Supportive relational conditions that include respect and caring among the community, with trust as an imperative;
- Collective learning, intentionally determined, to address student needs and the increased effectiveness of the professionals; and

- Peers sharing their practice to gain feedback, and thus individual and organizational improvement (pp. 41-42).

Summary of Conceptual Frameworks

The conceptual frameworks of PLC teams are grounded in both the team and PLC literature. This section has attempted to describe the theoretical underpinnings of PLC teams in both the team and PLC literature. The frameworks discussed above "serve as the structure and support for the rationale for the study, the problem statement, the purpose, the significance, and the research questions" that were outlined in Chapter One (Grant & Osanloo, 2014, p. 12). These frameworks provide the foundation on which to build a more comprehensive understanding of the PLC team development process by integrating theoretical models from teams and PLCs.

School Professional Learning Community Composition

The composition of PLCs in high schools is often separated into subject areas, grade levels, the entire faculty, or by district units. Providing collaborative opportunities among various groups builds a foundation of respect among teachers, as well as an understanding of the value that each person brings to the school (Dowling-Hetherington, 2016). For example, to create a united mathematics department, the administrator could arrange workshops where educators can share ideas, worksheets, activities, and plans of study. It is important that each grade level be involved because mathematics builds upon itself. Continuity of terms, presentations, and methodology helps increase student success. It is also helpful in solidifying the group as they work.

Just as departments need to be unified, so do grade levels. Teachers have specific expectations for students based on their grade level and age. If the entire grade level agrees to,

understands, and implements the same behavior plans, grading system, and homework policy, students understand their expectations. Additionally, this allows students to view teachers as a whole solid unit that displays respectful behavior toward one another to meet the overarching goal of increasing student achievement (Dowling-Hetherington, 2016).

Roles in Professional Learning Communities

Educators and administrators must be encouraged to employ creative thought and share ideas in a PLC. Having shared values and vision aids administrators, educators, and students in identifying the most important goals and how to achieve them (DuFour & Eaker, 1998). This section explores the roles of the teacher facilitator, community stakeholders, and administration in PLCs.

The Team Teacher Facilitator

The facilitator has a pivotal role in the performance outcomes of a PLC (DuFour et al., 2006). An effective facilitator is a teacher, placed into a leadership role with no supervisory powers, who has built relationships with the other team members (Veenables, 2018). Facilitators designate meeting times and places and prepare an agenda to ensure that the group stays on task. They also provide materials, technology, or other necessary learning tools. Also, facilitators introduce and guide participants toward achieving specific goals and objectives through open-ended questions, reflective commentary, time management, and enforcing agreed-upon norms. Additionally, facilitators monitor the group's continued progress toward stated goals. This helps to ensure that the group members remain committed to their vision (Killion & Harrison, 2005) and focused on teaching and learning to increase students' achievement (Veenables, 2018).

Community Stakeholders

In 1995, the United States Congress adopted a national standard where all schools were required to promote parental involvement to increase student growth socially, emotionally, and academically (DuFour & Eaker, 1998). Parental involvement in schools is defined as a parent attending a meeting in general or parent-teacher meetings, attendance at a school function, or as a volunteer (Paine & McCann, 2009). Table 2.5 displays the three types of parent involvement in education.

Community and family involvement are understood to be imperative to the success of the school and children. In the literature, parental involvement is directly correlated with student achievement (Durisic & Bunijevac, 2017). The partnerships among schools, homes, and communities must be established through mutual trust and respect to form an effective PLC.

PLC participants should not only include educators, but also community stakeholders, parents, and students (DuFour & Eaker, 1998). Community (i.e., external) stakeholders are

Table 2.5

Parent Involvement in Education (Paine & McCann, 2009)

Type of Involvement	Characteristics
Parent Training	Promote the importance of education in your home How to discuss important issues with your child
Parent Support	Independent homework practices and efforts to help child
Parent Volunteering	Volunteering in classrooms and helping out with activities at school

invested in the school's and the students' outcomes but do not produce those outcomes directly (Paine & McCann, 2009). Since the goal of a PLC is to have continual improvement through collaboration and action, all parties associated with student growth and development should be included. Each participant brings a different knowledge base, skill set, and viewpoint. The key to a successful PLC is to combine each unique aspect and merge it into a cohesive unit with a specific purpose to enhance school performance and student success (DuFour et al., 2006; DuFour & Eaker, 1998).

Administrator

The school administrator is an important part of the development and sustainability of successful professional learning communities (DuFour & Eaker, 1998). The administrator impacts communication skills, authority perception, and educational values for providing appropriate and applicable learning opportunities (McEwan, 2003). Also, the administrator must find professional development opportunities that actively engages educators and promotes professional learning (Jones, Stall, & Yarbrough, 2013). This requires the administrator to have an in-depth understanding of adults learning theory (Knowles, 1980). Scaffolding prior knowledge, actively pursuing learning opportunities, and providing adequate time and technology to implement learning initiatives are ways to meet the needs of adult learners (Cherkowski, 2016).

Cherkowski (2016) encourages administrators to first focus on individuals, rather than large groups, when creating a PLC. This allows the administrator to genuinely listen to and address concerns, fears, and suggestions. A recent study by Allen, Grigsby, and Peters (2015) identified a positive correlation among transformational leadership and school climate. This suggests the faculty feels like the administration is supportive and concerned with their well-

being, which also illustrates how the morale of the school will increase. Even though their findings did not show a significant relationship between transformational leadership and student achievement, it "suggests that school administrators and teachers need to examine other potential factors when addressing school achievement for the purpose of improvement" (Allen et al., 2015, p. 19).

An effective school principal encourages student success by promoting a positive school culture conductive to student and teacher learning (Sorenson, Goldsmith, Mendez, & Maxwell, 2011, p. 23). The administrator needs to incorporate PD as method of sharing new ideas. PD would also be utilized as a means to challenge one another to think about new and exciting ways that will benefit students and teachers. The learning process should be a continuous part of an educator's career (DuFour & Eaker, 1998).

Holland (2008/2009) conducted a qualitative study to enhance understanding of the principal's role in teacher development. She interviewed seven principals who were part of reform efforts in their school to better understand the relationships between collaboration in schools and teacher's learning and professional growth. The study addressed what and how teachers learn and how they develop growth professionally. "The findings showed it was important for educators to learn how to interpret the behaviors and understand the values of students from other cultures" (Holland, 2008/2009, p. 18). It also identified that a principal's role in PD is to monitor the structures of the PD to the degree they are meaningful to its participants and delegate responsibility to other teachers (Holland, 2008/2009).

Before the principal can delegate responsibility, he or she must development a relationship with the individual teacher or as the group. "One of the most important of all the relational components is that of trust" (Edgerson & Kritsonis, 2006, p. 3). Relationships built on

trust involve: competence, confidence, expectations, honesty, openness, reliability, risk, and vulnerability (Brewster & Railsback, 2003).

Teachers can become frustrated with mandatory PLC's for a variety of reasons (DuFour & Eaker, 1998). "Principal leadership is imperative to overcoming the barriers associated with establishing PLCs because of their ability to manage resources and influence organizational expectations (DeMatthews, 2014, p. 178). First, the meetings are usually held after school, requiring teachers to work even longer hours without compensation. Next, committee members usually do not have the authority to make a decision and enforce it. The meeting leaders simply gather information and then, the administrator makes the final decision. Finally, many times, committee members feel like they do not get appreciated for their efforts by the other faculty members or the administration. To prevent or alleviate that frustration, the administrator can give the committee more authority in the decision-making process. He or she can listen to suggestions and ideas and offer praise as needed (Gorton & Alston, 2012).

Cherkowski (2016) encourages administrators to first focus on individuals, rather than large groups, when creating a PLC. This allows the administrator to genuinely listen to and address concerns, fears, and suggestions. A recent study by Allen et al. (2015) discovered a positive correlation between transformational leadership and school climate. This suggests the faculty feels like the administration is supportive and concerned with their well-being, which also illustrates how the morale of the school will increase. Even though their findings did not show a significant relationship between transformational leadership and student achievement, it "suggests that school administrators and teachers need to examine other potential factors when addressing school achievement for the purpose of improvement" (Allen et al., 2015, p. 19).

When teachers feel that they are being heard and are valued, then buy-in increases (DuFour & Eaker, 1998). Furthermore, administrators can increase teacher involvement by actively modeling the desired characteristics. For example, administrators can ask for feedback, work collaboratively with others, and expand educator responsibilities and leadership roles (Cherkowski, 2016).

Implementation of Professional Learning Communities

The school-wide implementation of professional learning communities (PLCs) presents many challenges. Jones et al. (2013) state that "It is more important for concepts like professional learning teams to be applied in schools rather than quickly using the verbiage" (p. 357). Many educators in schools where PLCs have been implemented feel collaboration and sharing information is not a reflective practice at their school (Jones et al., 2013). DuFour (2004) claims the utilization of the PLC model in a school district will require educators to focus on their learning as much as teaching, working collaboratively, and holding the team accountable for results.

PLC Building Blocks for Successful Implementation

DuFour and Eaker (1998) provide four building blocks (i.e., key characteristics) for successful implementation of PLCs: mission/vision, shared values, and common goals. The first building block requires that the PLC team members to form a clear vision for the organization. A vision statement is used to explain to others what the organization hopes to create and achieve. To be effective, the vision must be shared with and accepted by stakeholders, community members, and faculty members (Sorenson et al., 2011). DuFour and Eaker (1998) claimed that

> [t]he lack of a compelling vision for public continues to be a major obstacle in any effort to improve schools. Until educators can describe the school they are trying to create, it is

> impossible to develop policies, procedures, or programs that will help make that ideal a reality…Building a shared vision is the ongoing, never-ending, daily challenge confronting all who hope to create learning communities. (p. 64)

Research by Huffman (2001) offers some insights for schools developing a shared vision when establishing PLCs. Huffman (2001), along with the Southwest Educational Development Laboratory, conducted a five-year qualitative research study on the development of PLCs. The research sites included 18 elementary, middle, and high schools located in the southwest region of the United States. At each school, the researcher interviewed a principal and a teacher leader. The findings indicated that the purpose for developing a vison was student concerns, "raising test scores, demographic concerns, change issues and the importance of lifelong learning" (Huffman, 2001, p. 10). Next, the results were inconclusive on who handled the development of the vision statement except that mature schools included all the stakeholders in its creation. Huffman's (2001) last research question involving the development of the vision revealed many procedures. The mature schools "incorporated staff development sessions, multi-leveled discussions, regularly scheduled meetings" and time to voice concerns and reflections (Huffman, 2001, p. 15). Other schools used facilitators as change agents, leadership teams, and search conference (i.e., a revisiting strategy) to develop and clarify the vision of the school (Huffman, 2001).

DuFour and Eaker's (1998) second building block is for the PLC team to establish a clear mission or purpose of the school. Typically, mission statements contain the wording "all students can learn," followed by a justification of how it is taking place in the school. DuFour & Eaker's (1998) claim that the statement "all students can learn" is pointless, unless faculty members can answer two "questions: 'What is it we expect all students to learn?' and 'How will we respond when they do not learn?" (DuFour & Eaker, 1998, p. 85).

The first two building blocks focused on "*what* the school will become" and "*why* it exits" (DuFour & Eaker, 1998, p. 88). Once established, PLC teams turn their attention to the third building block—shared values. Similar to the definition of a team, successful PLCs have a "shared vision and values, a collective responsibility for student learning and ongoing professional learning that is collaborative and reflective" (Cherkowski, 2016, p. 532).

Finally, PLC teams must lay the fourth building block—goals. In this stage the team develops a common purpose and creates priorities (DuFour & Eaker, 1998). An effective team "must operate through the interdependent actions of individuals working toward a common goal—a set of actions and processes known as teamwork" (Salas et al., 2015, p. 599). Each team member has a specific skill set that influences team functionality (Stock et al., 2013). Characteristics of team effectiveness consist of group task design, group characteristics, and employee involvement context. Educators congregate into teams, also known as PLCs or PLC teams, to improve upon the foundation of their students' education (Cherkowski, 2016; DuFour & Eaker, 1998, Hord, 1997).

Similar to DuFour and Eaker (1998), Paris, Salas, and Cannon-Bowers (2000) divided teamwork into three categories: cognitions/knowledge, skills, and attitudes. The cognitions/knowledge category focused on how members envision their role in the team's mission and objectives. The skill category related to members' ability to do specific tasks, for example, performance, leadership, communication, etc. Attitudes focus on how participants envision their feelings and their trust in the other team members (Paris et al., 2000).

Similar to Paris et al. (2000), Rosen et al. (2014) suggested that team dynamics are formed by trust, diversity, team development, and conflict. Conflict, often ethical dilemmas or disagreements, occurs in most work environments. "Ethical dilemmas discussed in the

evaluation literature often focus on those that arise in the evaluation process and context, such as when evaluators are pressured to slant findings in one direction or another" (Urias, 2009, p. 587). Figure 2.4 displays elements of team dynamics from Paris et al. (2000) and Rosen et al. (2014).

The models of team development and PLCs focus on people and their behavior. Doda & Lounsbury (1986) defines teaching teams as educators that are organized into specific groups to share ideas about classroom instruction. The following categories of teacher teams have been found throughout the literature: same grade level, vertical (cross) grade level, management, school advisory groups, special services, interdisciplinary instructional, governance, instructional, planning, administrative, and social service teams (Vangrieken, Dochy, Raes, & Kyndt, 2013).

Similar to the team development and PLC framework, the terms associated with teaching teams include collaboration, community, and department (Vangrieken et al., 2013).

> Schools will improve for the benefit of every student only when every leader and every teacher is a member of one or more strong teams that create synergy in problem solving, provide emotional and practical support, distribute leadership to better tap the talents of members of the school community, and promote the interpersonal accountability that is necessary for continuous improvement. (Sparks, 2013, p. 28)

Sparks (2013) argues that if a school is truly going to continue to improve it most invest in teacher-to-teacher professional learning and collaboration. Teachers will need to do the following: have daily interactions among teachers to enhance lessons, strengthen their understanding of content, examine student work, analyze students' performance on various types of data, and collaboratively resolve common issues.

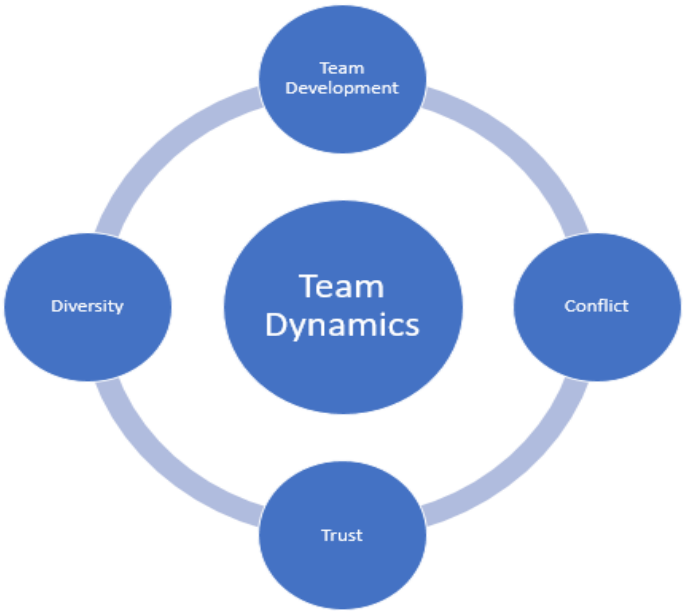

Figure 2.4. *Elements of Team Dynamics. Adapted from Rosen et al. (2014) and Paris et al. (2000).*

Team Measurement Instruments

Blitz and Schulman (2016) conducted an intensive search of the literature and found only 49 instruments that assess PLCs. The search identified 31 quantitative (63.3%) and 18 qualitative (36.7%) instruments that measure the following PLC outcomes: belief, behavior/practice, and performance measures. The level of data analysis consisted of the following variables: Teacher/Principal Level (n = 38, 77.5%), PLC Team Level (n = 10, 20.4%), and School/Student (n = 1, 2.04%).

The instruments found by Blitz and Schulman (2016) primarily focused on how teachers' perceptions and beliefs affect PLC outcomes and their PLC experience. Instruments that measure the PLC Team Levels, such as work methods, communication, group norms, and leadership styles, are not as common. However, "…assessing the relationship between team dynamics and how well PLC teams reach their goals can aid in designing and implementing

PLCs" (Blitz & Schulman, 2016, p. 4). Table 2.6 provides a brief description of the PLC assessments related to PLC team development. The table describes the study's characteristics; such as, scale description, questionnaire content, psychometric properties of the instrument, and any specific notes (e.g., merits, limitations of the study, and suggestions for future research).

Team Professional Development Outcomes

Learning Community Concepts Survey

The Learning Community Concepts (LCC) Survey was created by Wells and Feun (2007) to explore school team-level variables and team professional development outcomes. Its purpose was to examine the change efforts and the transition a high school makes in attempting to become a PLC. The instrument is used to provide information on how teams of educators function and collaborate in order to increase student achievement. The study's participants included six high schools with all male principals located in suburban districts in Michigan. The demographic characteristics for the sample included socioeconomic levels, student achievement, attending college, ethnicity, and location of district. The study's student population was between 1,250 and 1,800.

Wells and Feun (2007) developed the survey instrument based on Hord's (1997) PLC model and it produced both qualitative and quantitative information. The instrument contained 16 questions based on a 4-point Likert scale containing the following values: 1 = almost never, 2 = seldom, 3 = sometimes, and 4 = almost always. The Likert scale items allowed the researchers to rate the PLC principles implementation levels. The next section of the assessment used six open-ended questions where five questions were used describe the implementation process and the sixth question invited participants to give suggestions and comments related to the implementation process.

Though the procedure was not followed for establishing content validity, the researchers had experience working with Hord's (1997) PLC model and teaching about PLCs, which suggested an acceptable face validity. The authors argued that reliability of the survey was checked by a "check and balance between what participants said was occurring and what was actually occurring in their schools" (Wells & Feun, 2007, p. 148). The study revealed that the implementation process of PLCs at the high school level faced several challenges. The challenges included having preexisting negative cultures, and not having a conceptual understanding of PLCs. Additionally, the school leader interviews found "that the early days of transition to a learning community tend to focus on sharing materials and resources, whereas critical issues such as learning results or best practice are seldom discussed" (Wells & Feun, 2007, p. 141).

There were several limitations of the study. The study used a convenience sampling method to select the first six schools to complete a nine-day training session on PLCs. The sample size was low with only six participating schools, which were all located in suburban areas. Out of the six schools, only faculty members that attended the 9-day training were permitted to take the survey. Also, the final outcome of transformation in a PLC cannot be gauged by this instrument because it was given during the implementation process (Wells & Feun, 2007).

Professional Online Learning Community Survey

Tseng and Kuo (2010) developed the Professional Online Learning Community Survey to explore the self-regulatory mechanisms in professional online learning communities. This instrument was administered to teachers at a K-12 digital school in Taiwan. The instrument measures five constructs. Four constructs (community identity, interpersonal trust, social

awareness, and knowledge-sharing self-efficacy) are measured on a 7-point Likert scale, ranging from 1 = strongly disagree to 7 = strongly agree. The knowledge-sharing self-efficacy construct is measured on a 10-point Likert scale ranging from 0 = not at all confident to 10 = totally confident.

The content validity was established by three members of a K-12 digital school; construct validity was confirmed by a confirmatory factor analysis; the authors claimed that they achieved convergent validity by having factor loadings greater than 0.5; and discriminant validity was found by looking at the square root of variance extracted values. Cronbach's alpha was used to confirm the reliability of the instrument and each construct was statistically significant. The study revealed that the constructs of "community identity (0.91), interpersonal trust (0.91), social awareness (0.90), knowledge-sharing self-efficacy (0.91), and knowledge-sharing behavior (0.89)" (Blitz & Schulman, 2016, pp. D-43). These characteristics compels group members to "abide by the group norms and regulates their cognition, motivation, and behavior to share knowledge" (Tseng & Kuo, 2010, p. 1051).

Group Dynamics Outcomes

PLC Team Meeting Observation Guide

Watts (2010) developed a PLC team meeting observation guide by exploring the connection between PLCs and school-based change. The instrument provided a method to observe and interpret conversations through PLC team meetings (Blitz & Schulman, 2016). The study explored how DuFour and Eaker's (1998) PLC model, leadership, culture, and change influenced this relationship. This study incorporated multi-case study design that used mixed methodology to sample three K-9 school districts located in the United States. The data were collected using 24 semi-structured interviews, multiple observations, and a questionnaire. The

study utilized the Revised School Culture Elements Questionnaire (RSCEQ), which was reported to have displayed sufficient psychometric properties in past studies (Watts, 2010).

The study's results showed that a supportive and accessible leader is essential to the development of PLCs. The leader must foster a shared vision and commitment toward members of the PLC. Also, the findings revealed that it is important to embed a common time for educators to team teach and collaborate during the teachers' daily work schedules if PLCs are going to evolve (Watts, 2010).

PLC Team Meeting Observation Instrument

Brouwer, Brekelmans, Nieuwenhuis, and Simons (2012) created the PLC team meeting observation instrument to explore variables related to group dynamics outcomes. The authors conducted a mixed methods study designed to examine how communities of practice occur in a secondary school setting and to illustrate the relationship between the community of practice and the teacher team diversity. The participants consisted of seven teacher teams from one grade level in a secondary school setting located in the Netherlands.

The authors created the PLC team meeting observation instrument to measure teachers' perceptions based on the teacher community model. A principal component analysis was conducted on the 15-item instrument, which found mutual engagement, shared repertoire, and joint enterprise produced high reliabilities. Brouwer et al. (2012) also created an observation instrument to assess video observation of the teams.

Based on the results from calculating Cohen's d, the quantitative findings suggested that community of practices occur moderately within the school. Similarly, the mean scores showed modest results for teacher teams in demonstrating the community of practice dimensions, mutual

engagement is moderate, and shared repertoire was limited. The qualitative results showed mutual engagement and collaborative processes were strong.

The study also found that four out of five diversity characteristics related to community of practice. The findings suggest that the school administration needs to build communities of practice that benefit and grow from the diversity among teams. These results provided a "snapshot measurement," and the authors suggest that "[f]uture research is recommended to focus on the development of communities of practice in the workforce" (Brouwer et al., 2012, p. 346).

Group Dynamics Processes and Outcomes

Artifacts: Quick Check Form and Norm Review

Riskus (2011) conducted an action research project centered on increasing collaboration among five middle school teachers working together in an interdisciplinary team. He designed the Quick Check Form and Norm Review instrument to be utilized during PLC meetings to review and assess how teams were collaborating and establishing norms. This instrument has team-level variables that could be used to assess group dynamics processes and group dynamics outcomes (Blitz & Schulman, 2016).

The teacher team participated in an 8-week PD initiative to collaborate and develop with instructional learning tools to promote student and teacher learning (Riskus, 2011). Riskus (2011) used a mixed methods design to generate a research journal, surveys, artifacts, interviews, and transcriptions to look at group dynamic processes (Blitz & Schulman, 2016). From the quantitative data collected, the researcher created the Professional Development in Effective Collaboration Survey. It consisted of 3-point Likert-scale questions, rated as 1 = very ineffective to 4 = very effective. Descriptive statistics were used to analyze the quantitative data. The

researcher categorized and coded the qualitative data from the research journals, artifacts, interviews, and open-ended survey questions (Riskus, 2011). The validity and reliability were not confirmed in this study.

The study's research findings for this study concluded that collaboration among middle school teacher teams contributed to positive interactions. Also, the study found that teachers began to value collaboration efforts when they connected professional and instructional learning to their students and individual classrooms (Riskus, 2011).

Professional Learning Communities Observation Guide

The North Cascades and Olympic Science Partnership (NCOSP) developed the Professional Learning Communities Observation Guide (PLCOG) around three important elements of a PLC: shared vision and working methods, working together, and reflective dialogue (North Cascades and Olympic Science Partnership, 2008). "The goal is for the elements of effective PLCs included in the observation guide to empower groups to move from supportive practices to developmental practices" (Blitz & Schulman, 2016, pp. D-47). According to Blitz and Schulman (2016), the PLCOG has been used in science PLCs to assess development and progress. However, the validity and reliability have not been formally verified for the PLCOG. The availability of information on how the instrument was constructed is limited.

Teacher Collaboration Assessment Rubric

Gajda and Koliba (2008) developed the Teacher Collaboration Improvement Framework (TCIF) as an assessment rubric to aid in evaluating secondary school level teacher collaboration. The TCIF contains six stages of teacher collaboration: "(a) raise collaboration literacy, (b) identify and inventory communities of practice (COP), (c) reconfigure teacher teams, (d) assess

quality of collaboration, (e) make corrections, and (f) recognize accomplishments" (Gajda & Koliba, 2008, p. 135).

During a 5-year time period, the instrument was utilized and modified to meet the needs of two high school improvement initiatives. Although the instrument has not been formally validated, it was adapted from the Teacher Collaboration Assessment Survey (Blitz & Schulman, 2016). During the first secondary school initiative, 11 leadership teams representing more than 500 teachers completed the study group process. The second initiative consisted of eight schools representing 350 teachers (Gajda & Koliba, 2008). The study's findings revealed "that school leaders must inspect what expect. Creating space, time, structure, and training for teacher collaboration is important, but administrators must also be able to make judgments about team quality and performance" (Gaida & Koliba, 2008, p. 150).

Team Instructional Practice Survey

Supovitz (2002) constructed the Team Instructional Practice Survey (TIPS) to observe team instructional practices in an educational setting. The instrument was used to look at team-level parameters associated with group dynamics processes and group dynamics outcomes. This instrument also looked at teacher/principal-level variables associated with instructional practices outcomes (Blitz & Schulman, 2016).

The TIPS were constructed from the following three survey scales: School Culture Scales, Instructional Practice Scales, and Team Instructional Practice Scales. Each scale showed strong construct validity through the use of confirmatory factor analysis (Supovitz, 2002). The reliability of the instrument displayed statistically significant findings for each factor: "Academic Preparation Strategies (0.87), Student Grouping Strategies (0.73), and Collective Team Practices (0.82)" (Blitz & Schulman, 2016, pp. D-50).

There were approximately 268 teams of elementary, middle, and high school teachers that participated in the research study. Supovitz (2002) used descriptive statistics to show mean comparisons of team-based and non-team-based responses. Also, the t-test and Chi Square test were used to make comparisons on grade level and instructional practice scales. The T-test showed that high school teams were significantly higher than the other schools on student grouping strategies. Next, the author found strong correlations between team-based schooling and Grade 4 Writing, Grade 4 Citizenship, Grade 6 Writing, Grade 6 Mathematics, Grade 6 Science, Grade 6 Citizenship, Grade 7 Writing, Grade 7 Mathematics, Grade 7 Science, and Grade 8 Citizenship. As stated earlier in this section, these instruments addressed within these studies are summarized in Table 2.6 below.

Table 2.6

Available PLC Assessments. Adapted from Blitz & Schulman (2016).

Scale Description	**Content**	**Properties**	**Notes (Merits, Limitations and suggestions)**
Citation: (Wells & Feun, 2007) **Name:** Learning Community Concepts Survey **By:** Caryn Wells (Oakland University) and Lindson Feun (Oakland University) **Year:** 2007 **Goal(s):** Assessing teachers and administrators' perception of the implementation process of a learning community. **Target Population(s):** Middle and High Schools **Methodology:** Mixed Methods **Team-level Variables:** Team professional development outcomes	**Items:** 16 Likert scale items followed by a clarification opportunity to describe the meaning of the rating on the degree of PLC implementation 6 open-ended questions for general comments to describe the implementation process in their school **Responses:** Selected response options from a list of Likert scale items (i.e., 1=almost never, 4=almost always) **Scoring:** Conventional scoring methods (i.e., only descriptive statistics)	**Face Validity:** Established from the literature on PLCs	Used convenience sampling method Used small sample size Does not cover broad range of the content related to PLCs Not very good reliability and validity evidence

Table 2.6. Continued.

Scale Description	Content	Properties	Notes (Merits, Limitations and suggestions)
Citation: Tseng & Kuo (2010) **Name:** Professional Online Learning Community Survey **By:** Fan Chuan Tseng and Feng Yank Kuo **Year:** 2010 **Goal:** Assess the self-regulatory mechanisms in a professional online learning community **Target Population/s:** educators interested in PD and educational issues **Team-level Variables:** Team PD outcomes	**Items:** 24 Likert scale items **Responses:** one correct or incorrect response for each question. **Scoring:** Conventional scoring methods, structural equation analysis, confirmatory factor analysis	**Content Validity:** Established by three members of a K-12 Digital School. Construct Validity: Confirmed by confirmatory factor analysis. Convergent Validity: Instrument had factor loadings greater than 0.5. Discriminant Validity: Found by taking the square root of variance extracted values. **Reliability:** confirmed by using Cronbach's alpha. The constructs included: community identity (0.91), interpersonal trust (0.91), social awareness (0.90), knowledge-sharing self-efficacy (0.91), and knowledge-sharing behavior (0.89).	There are several other dimensions to knowledge sharing self-efficacy. Failure to demonstrate the statistical significance of trust and knowledge-sharing behavior. Convenience sampling method was used at only one site.

Table 2.6. Continued.

Scale Description	Content	Properties	Notes (Merits, Limitations and suggestions)
Citation: (Watts, 2010) **Name:** PLC Team Meeting Observation Guide **By**: Aileen Watts **Year:** 2010 **Goals:** Assess and analyze PLC development over time **Target Population/s:** PLCs **Methodology:** Mixed Methods **Team-level Variables:** Group dynamics outcomes	**Qualitative Data:** Interviews, observations, and historical documents **Quantitative Data:** Utilized School Culture Elements Questionnaire **Items:** 20 Likert scale items **Response:** Selected response options from a list of Likert scale items (i.e., 1=Strongly Disagree to 4=Strongly Agree) **Scoring:** Conventional scoring methods (i.e., only descriptive statistics)	**Validity:** No formal validity information was collected. **Reliability:** No formal reliability information was collected.	Qualitative Research is the main instrument of data collection which means the data will be viewed through the Watts' perceptions and values. Case Study Research design limits the generalizability of its findings.

Table 2.6. Continued.

Scale Description	Content	Properties	Notes (Merits, Limitations and suggestions)
Citation: (Brouwer et al., 2012) **Name:** PLC Team Meeting Observation Instrument **By**: Patricia Brouwer, Mieke Brekelmans, Loek Nieuwenhuis, & Robert-Jan Simons **Year:** 2012 **Goals:** Explore to Communities of practice in the workplace **Target Population/s:** Secondary School Educators **Methodology:** Mixed Methods **Team-level Variables:** Group dynamics outcomes	**Qualitative Data:** observations **Quantitative Data:** Utilized Admiraal & Lockhorst (2010) Questionnaire **Items:** 20 Likert scale items **Response:** Mutual engagement was measured with four indicators. The other questions were based on a three point Likert scale. **Scoring:** Conventional scoring methods (i.e., only descriptive statistics)	**Construct Validity:** No formal validity information was collected but the observation instrument is considered sufficient because it is established by Admiraal & Lochorst's (2010) model of teacher communities. **Reliability:** Inter-rater agreement between two raters with coefficient kappa = 0.60.	Case Study Design Small scale study with only seven teams participated in the study Snapshot measurement - the degree of factors were measured at a specific time Generalizability of findings are limited

Table 2.6. Continued.

Scale Description	**Content**	**Properties**	**Notes (Merits, Limitations and suggestions)**
Citation: (Riskus, 2011) **Name:** Artifacts: Quick Check Form and Norm Review & Professional Learning Community Research Journal **By**: A. Michael Riskus **Year:** 2011 **Goals:** Assess the extent to which PLCs have established norms **Target Population/s:** PLCs **Methodology:** Mixed Methods **Team-level Variables:** Group dynamics processes and group dynamics outcomes	**Qualitative Data:** Interviews, research journal, transcription **Quantitative Data:** Utilized Professional Development in Effective Collaboration Survey **Items: 3** Likert scale items **Response:** Selected response options from a list of Likert scale items (i.e., 1=very ineffective to 4=very effective) **Scoring:** Conventional scoring methods (i.e., only descriptive statistics)	**Validity:** No formal validity information was collected. **Reliability:** No formal reliability information was collected.	Qualitative Research is the main instrument of data collection Case Study Research design limits the generalizability of its findings. Small population size

Table 2.6. Continued.

Scale Description	**Content**	**Properties**	**Notes (Merits, Limitations and suggestions)**
Citation: (North Cascades and Olympic Science Partnership, 2008) **Name:** Professional Learning Communities Observation Guide **By**: NCOSP **Year:** 2008 **Goals: To guide groups from supportive practices to developmental practices** **Target Population/s:** PLCs **Methodology:** NA **Team-level Variables:** Group dynamics processes	**Qualitative Data:** NA **Quantitative Data:** NA **Items:** NA **Response:** NA **Scoring:** NA	**Validity:** No formal validity information was collected. **Reliability:** No formal reliability information was collected.	NA

Table 2.6. Continued.

Scale Description	Content	Properties	Notes (Merits, Limitations and suggestions)
Citation: (Gajda & Koliba, 2008) **Name:** Teacher Collaboration Assessment Rubric **By**: Rebecca Woodland (formerly Rebecca Gajda) and Christopher J. Koliba **Year:** 2008 **Goals: To assess teacher collaboration in various grade levels** **Target Population/s:** Secondary Educators **Methodology:** Mixed Methods **Team-level Variables:** Group dynamics processes	**Qualitative Data:** classroom observations and student work **Quantitative Data:** teachers' summative test scores and observational checklists **Items:** NA **Response:** NA **Scoring:** Conventional scoring methods (i.e., only descriptive statistics)	**Validity:** No formal validity information was collected. **Reliability:** No formal reliability information was collected.	No limitations were listed in the study.

Table 2.6. Continued.

Scale Description	Content	Properties	Notes (Merits, Limitations and suggestions)
Citation: (Supovitz, 2002) **Name:** Team Instructional Practice Survey **By**: Jonathan A. Supovitz **Year:** 2002 **Goals:** Examine team instructional practices of educators **Target Population/s:** **Methodology:** **Team-level Variables:** Group dynamics processes	**Qualitative Data:** NA **Quantitative Data:** School Culture Scales, Instructional Practice Scales, and Team Instructional Practice Scales **Items:** 59 questions **Response:** Selected response options from a list of Likert scale items **Scoring:** Conventional scoring methods (i.e., only descriptive statistics), T-Test, Chi Square Test, Correlation	**Validity:** Factor analyses showed strong construct validity **Reliability:** Factors were statistically significant: Academic Preparation Strategies (0.87), Student Grouping Strategies (0.73), and Collective Team Practices (0.82)	No limitations were stated in the report.

Summary of Literature Review

An abundance of research literature exists on professional learning communities and team development. This literature review focused on the historical perspectives in addition to the current research in both fields of study. The association between teacher collaboration and student achievement is evidenced in the literature provided. "Although calls for collaboration have become widespread, few large-scale studies have investigated how these calls have been taken up in practice" (Ronfeldt et al., 2015, p. 475).

Professional learning communities have been credited for increasing student achievement and teacher effectiveness (DuFour & Eaker, 1998). Successful PLCs have demonstrated that

> (1) creating a shared vision for learning set the foundations for school improvement; (2) establishing a more personal approach to learning was important for creating a climate of hope and trust among the teachers; and (3) publicly sharing professional learning was intentionally modeled for the teachers and staff. (Cherkowski, 2016, p. 530)

These successful PLCs consist of participants who are willing to work toward identified goals by creating a plan and then making a commitment to follow the plan.

PLCs provide opportunities for increased collaboration, a platform for relevant professional development, and an avenue for maintaining connections with like-minded professionals. In a school where successful PLCs are the norm, the possibilities are endless. In those schools, the emphasis is on student learning and mastery rather than simply checking off a content standards list (DuFour & Eaker, 1998). However, through the literature review, validated assessment that directly targeted PLC teams and measuring their team development were not found. Thus, the purpose of study is to produce measures of teamness within PLC

teams, then compare the stages of team development. The following chapter describes the development and methodology for the TDLCC instrument.

CHAPTER THREE: METHODS

In the previous chapters, the foundation to the research study was presented, including the research problem, purpose, identification of key study terms, and the research questions that drove data collection and analysis. In addition, a literature review related to the major variables of the study was presented on team development and PLCs, establishing the study's framework. The purpose of this section is to describe the research study's methods. It includes a synopsis of the study problem, the study's purpose and objectives, a population and setting description, instrument adoption, research design, procedure, and data analysis.

Review of the Problem

Chapter Two introduced and included a review the current literature related to team development in PLCs and, more specifically, to the principal problem of team development within PLCs in K-12 education. In the past 30 years, the development of the PLC model has highlighted the importance on the culture of collaboration among teams of educators (DuFour & Eaker, 1998; Ronfeldt et al., 2015). Even though DuFour and Eaker (1998) and Hord (1997) argued that collaborative teams are a vital component of their PLC models, the literature reflects a limited number of assessment tools with documented psychometric properties to evaluate team-level variables and the performance of PLCs (Blitz & Schulman, 2016). Conversely, the review of research over the same period has shown a significantly larger focus on teamwork (Weiss & Hoegl, 2015).

Across the United States, school districts are dedicating time and resources to implement educational teams (i.e., grade-level groups or content area teams) to promote a common vision and focus (Richardson, 2005). Unfortunately, PLCs are not easily implemented and require a change in the school's culture where teachers are accustomed to working alone (Richardson,

2005; Ronfeld et al., 2015). As educators transform their environment from isolation to collaboration, an instrument designed to provide a baseline measure for properly assessing the team's growth is needed. Weiss and Hoegl (2015) state that there is a need to create such an instrument using quantitative methodology that produces strong psychometric properties.

Many researchers have created instruments to assess aspects of PLCs. However, the reliability and validity of the psychometric properties of these instruments based on empirical evidence has eluded the educational discipline (Blitz & Schulman, 2016). In general, these instruments focus on specific PLC team-level variables, such as team professional development outcomes (Tseng & Kuo, 2010; Wells & Feun, 2007), group dynamics outcomes (Brouwer et al., 2012; Riskus, 2011; Watts, 2010), and group dynamics processes (Gajda & Koliba, 2008; North Cascades and Olympic Science Partnership, 2008; Riskus, 2011; Supovitz, 2002). These instruments do not address the overall team development of a PLC.

Beebe et al. (2018) recognized the Team Development Measure (TDM) (Stock et al., 2013) as a possible instrument to "measure team building, team cohesiveness, and team effectiveness" (p. 22). The TDM assessment was utilized in this study to measure educators' perceptions of team development within PLC teams. In addition, it allowed PLC team members to understand the characteristics of teamwork present within their PLC.

Study Purpose and Research Questions

The study's purpose was to produce measures of teamness, then compare the stages of team development within a high school environment. In addition, the study utilized Rasch modeling techniques to describe and assess the qualities associated with the levels of team development within a particular PLC team and to identify important characteristics of the measurement of this PLC team. The study was guided by the following four research questions:

1. To what extent does the content of Stock et al.'s (2013) The Team Development Measure and the Wells and Feun's (2007) Measuring Learning Community Concepts correspond to the goals and objectives of PLCs?
2. To what extent does convergent validity exist for the teamness construct when applied to the Stock et al. (2013) The Team Development Measure and the Wells and Feun (2007) Learning Community Concepts instruments?
3. To what extent are team attributes present in PLC teams?
4. To what extent do the participants perceive the PLC implementation at their high school to be consistent with the PLC model?

Research Design

The survey research design (Colton & Covert, 2007) used in this study collected data regarding teachers' perceptions of PLC experiences. These data informed systematic information needed to investigate how high school teachers perceive their experiences within a PLC team. Data were collected using Qualtrics (Qualtrics, 2018) as the online survey platform. The team members were asked to answer six demographic, 47 Likert scale items with four response options and seven open-ended questions. The survey research design has potential to collect data from a large number of PLC team members. Potentially, the data collected could contain a social desirability bias.

Study Population

The study's population was a convenience sample of all secondary-level teachers at a mid-sized rural high school located in Tennessee's eastern region. This setting contains 13 horizontal PLC teams consisting of 62 teachers and four administrators. The entire teaching staff formed the sampling frame for this study, with the exception of the three Geometry PLC team

members. The Geometry PLC team was comprised of two teachers and the researcher. These teachers were not asked to participate as a result of their relationship with the researcher. An email was sent inviting the remaining 12 PLC teams consisting 59 individuals to participate anonymously in a survey.

Study and Data Collection Procedures

First, the principal investigator submitted all of the research materials to the University of Tennessee's Institutional Review Board (IRB) for ethical approval. Written consent from the high school principal and the school district's Board of Education was submitted along with the IRB documents (see Appendices B and C). Copies of the IRB approval letter were delivered to both parties before administering the survey.

Additionally, the ethical guidelines identified by the IRB and the American Psychological Association were followed strictly to ensure fair treatment of all the participants. Once the study was granted IRB approval, each participant of a PLC team was emailed a survey completion request. The email provided participants with an introduction to the study and a confidentiality statement. To ensure participant confidentiality, names were not collected. Additionally, the consent form explained that participation was not mandatory, the level of risk associated with the current study was minimal, and the benefit from participation in the current study was an increase in the quality of team development and PLCs.

Participants had an opportunity to utilize a school computer or personal electronic device to access the survey link. The school computer did not store any personal information or data. After the participants completed the survey, the collected data were assessed by the principal investigator. To ensure the safety of the data, the responses were kept in an electronic database

located on a computer that was password-protected. No references linked the participants to the survey in written or verbal form.

In an effort to receive an adequate response rate, the administration at the high school allowed allotted time to complete the survey during a teacher in-service meeting held in the school library during a workday. The library contained approximately 80 computers for the participants to utilize. Due to the study's nature and data collection location, the researcher did not include a participation incentive.

Software Used for Data Collection and Analysis

Responses were collected using Qualtrics (Qualtrics, 2018), an online survey platform. The information was then downloaded into a Microsoft Excel 2016 (Microsoft Corporation, 2018) file for descriptive statistics and the initial recoding of variables. First, the Microsoft Excel 2016 data file was uploaded into the SPSS software package to carry out the Bivariate Correlation Analysis. Second, the psychometric analysis was conducted by uploading the Microsoft Excel 2016 data file into the Winsteps software (Linacre, 2018) to conduct the validity analyses followed by a transformation of ordinal numeric results into an interval score using Rasch methodology.

Sample Size Considerations

This study utilized the Rasch Rating Scale model (Andrich, 1978), also known as the polytomous Rasch model, to analyze the Team Development Measure (Stock et al., 2013) results. Although sample sizes greater than or equal to 100 are recommended for Rasch modeling to acquire robust item parameter estimates; small samples of less than or equal to 50 could be used for investigative purposes (Chen et al., 2014). This section highlights the

recommendations from various leaders in the field of Rasch modeling techniques for using a small sample size to assess item characteristics.

Linacre (1994) recommended that researchers conduct a Rasch analysis for exploratory work when using a small sample size. For polytomies (i.e., Likert scale items), he recommended that a study have a minimum of 27 to 61 participants to produce a stable item calibrations within ±1 logit and a 99% confidence interval. Additionally, since the Rasch model is symmetric in nature, the instrument should have "as many items for a stable person as you need persons for a stable item measure" (Linacre, 1994, p. 328). Since the TDM is a 31-item questionnaire and was completed by a population size of 59, the researcher hypothesized that the analysis would produce a reasonable target and fit to yield statistically stable measures.

In 1999, Linacre developed eight guidelines for investigating the context of Rasch analysis. His first guideline stated, "[a]t least 10 observations of each category" are needed to provide a valid measurement (p. 108). For example, a response category of a Likert scale item would need chosen at least 10 observations. When the item response category is low the step calibration category is unstable. The existence or nonexistence of an observation (i.e., item response) can affect the overall scale structure of the instrument (Linacre, 1999).

Bond and Fox (2001) recommended the rating scale analysis needs a sample size large enough so that each of the response options (e.g., SD, D, A, and SA) has an opportunity to be selected and to ensure there are proportionately more participants to acquire the same frequency of data collected for each response category (Bond & Fox, 2001). Based on their recommendation, using a population of 59 individuals for this study, approximately 14.75 participants were needed to respond to each of the item categories represented. Following those guidelines ensured greater measurement precision (i.e., smaller error estimates) with less

variance of the 59 responses across the four Likert scale response categories. If the results did not meet Bond and Fox's recommendation, the researcher would have needed to find a larger sample size or reduce the types of Likert scale values.

Although the Rasch model produces larger standard errors, weaker fit analysis, and less robust estimates for data collection error when using small sample sizes (Linacre, 1994), many researchers encourage its use for preliminary or exploratory purposes (Chen et al., 2014; Linacre, 1994). Boon and Noltemeyer (2017) suggest this technique can allow "researchers and practitioners to target instruction/intervention because the expected performance of a person on an item can be inferred from each person's ability measure and the difficulty of items which are expressed on the same scale" (p. 3).

Instrumentation of the TDLCC

This section addresses the combination of two existing survey instruments to form the Team Development and Learning Community Concepts (TDLCC) assessment. The TDLCC provides data regarding team development and the degree of implementation of PLC teams. The instruments to be included are the Team Development Measure (Stock et al., 2013) and Measuring Learning Community Concepts (Wells & Feun, 2007). The 58-item TDLCC assessment includes four teacher demographic questions, 47 Likert scale items, and seven open-ended questions.

Team Development Measure

Stock et al. developed the Team Development Measure (TDM) in 2013. The assessment has 31 Likert scaled items with four response options ranging from strongly disagree to strongly agree. The instrument was constructed using a Promax Exploratory Factor Analysis and the Rasch rating scale measurement model.

The TDM was designed primarily as a quality improvement tool to investigate how team dynamics affect clinical outcomes. Specifically, it was created to assess the level on a scale of "teamness" a group of health care professionals had achieved (Stock et al., 2013). It has been used in more than 90 team evaluations with more than 650 team members.

Components of Team Development: Measuring Teamness. Stock et al. (2013) reported that the TDM produced a "Rasch person reliability of 0.95 and an overall Cronbach's alpha equal to 0.97" (p. 691). In the Promax Exploratory Factor Analysis the items were viewed as ordered categorical variables (i.e., ordinal variables). It found "four sub-domains with the following mean item difficulty scores: cohesion = 40.5 (*SD* = 2.68); communication = 49.3 (*SD* = 2.78); roles and goals clarity = 52.7 (*SD* = 2.74); and team primacy = 53.3 (*SD* = 1.06)" (p. 691). The results suggested that cohesiveness is a primary construct of team dynamics, communication, roles and goals clarity, and team primacy (Stock et al., 2013). Table 3.1 contains a description of the four components needed to identify highly effective teamwork.

Stages of Team Development. The scale of teamness provides a measure of the components necessary to identify stages of teamwork and how strongly the team components are in place (Beebe et al., 2018; Stock et al., 2013). The teamness scale was based on the construction of the eight stages of team development utilizing four components (cohesiveness, communication, role and goals clarity, and team primacy) and two levels of solidification (in place and firmly in place). The rationale of the two levels of solidification was based on how the participants answered "agreed" or "agree strongly" on the TDM. For example, the team that responds "agreed" is less "in place" than a team that responds as "strongly agree" (Stock et al., 2013).

Next, the application of a Rasch rating scale measurement model is utilized to express the

Table 3.1

Components of Highly Effective Teamwork (Stock et al., 2013)

Component	Meaning/Description
Cohesiveness	Oneness or working together
Communication	Participation, discussion, problem-solving, and making decisions
Roles and Goals Clarity	Comprehension of the roles, goals, and expectations of each member
Team Primacy	Achievement of the entire team is more important than others.

dataset in interval terms on a linear scale rather than ordinal terms. First, the participants' responses to the Likert items are added together to form sum scores ranging from 31 to 124. Then, each individual's summated score is converted using Rasch modeling techniques to transform the item responses to a scale of 0 to 100. Theoretically, the scores increase linearly from 0 to 100, with 100 classified as the highest functioning team (Stock et al., 2013). Table 3.2 displays the stages, score range, components present, and the solidification of team development. Due to some item-response variables being classified as more difficult than others, the interval values in the score range column are inconsistent. The authors claim the combinations of difficult item responses are harder for participants to answer than item domains.

Table 3.2

Stages of Team Development (Stock et al., 2013, p. 698)

Stage	Score Range	Components Present	Solidification
Pre-Team	0-36	None to building cohesiveness	Initial development
1	37–46	Cohesiveness	In Place
2	47–54	Communication	
3	55–57	Role and goal clarity	
4	58–63	Team primacy	
5	64–69	Cohesiveness	Firmly in place
6	70–77	Communication	
7	78–80	Role and goal clarity	
8	81–86	Team primacy	
Fully developed	87-100	Everything	

Learning Community Concepts

Wells and Feun's (2007) Learning Community Concepts (LCC) instrument aligns with Hord's (1997) five dimensions of a learning community: supportive and collaborative leadership, collective creativity, common vision and values, supportive conditions, and unified personal practice. The questionnaire was designed to allow participants to comment on the implementation process of learning communities' concepts.

The LCC has two sections designed to gather quantitative and qualitative information. The first section of the LCC has 16 Likert scale items ranging from 4 (almost always) to 1 (almost never) and six open-ended questions. Formal construct validity of the LCC was not established. Later, the instrument was field tested and satisfactory results were found. Thus, no required alterations of the instrument were needed (Wells & Feun, 2007).

Several limitations were presented in Wells and Feun's (2007) study. They utilized a minimal sample size of six high schools and a non-random sample of participants who completed PLC training. Also, the instrument only "captured the feelings, attitudes, and perceptions early in the implementation process" and cannot be used to draw conclusions about the final phases of the PLC transformation (Wells & Feun, 2007, p. 149).

Wells and Feun's (2007) findings were consistent with the literature that concluded high schools face many challenges in fully implementing PLC concepts. Their results indicated that educators typically wanted to work together, but they "expressed that they were not trained to know how to work together; they were peers of one another, and now they had to engage in difficult conversations that disrupted the status quo of the school" (Wells & Feun, 2007, p. 156).

Statistical Methods

The statistical methods used in this study are outlined for each research question. After the data collection, a series of data cleaning procedures (Tabachnick & Fidell, 2014) were conducted following Morrow and Skolits' (2017) *Twelve Steps of Data Cleaning: Strategies for Dealing with Dirty Evaluation Data*. These procedures ensured that the data were ready for analyzing. Based on the participant's response, a score was assigned to the Likert scale items. The TDM has four reverse scored items (i.e., items 3, 15, 16, and 27) and were recoded before the remaining components of the data cleaning process were conducted (Morrow & Skolits, 2017). Reverse scored items are the questions or statements in the questionnaire that are worded negatively or oppositely in nature (Józsa & Morgan, 2017). The following scores are assigned to those items: Strongly Disagree = 4, Disagree = 3, Agree = 2, and Strongly Agree = 1. The four statements on the TDM that are reverse coded have an opposite direction of meaning from the other statements. For example, item three states: "Team members talk about other team members behind their back." A response of option 4, "Strongly Agree," suggests a negative reaction, as the participant strongly agrees that the team was talking about each other behind their backs. Thus, the direction of those items were reverse coded to align the directional meaning of the other statements.

After the data cleaning procedures were completed, the four research questions associated with the study were analyzed using the following statistical methods.

Research Question 1: To what extent does the content of the Team Development Measure (Stock et al., 2013) and the Learning Community Concepts (Wells & Feun, 2007) correspond to the goals and objectives of PLCs?

The aim of the first research question was to establish content validity evidence that the TDM and LCC correspond with the goals and objectives of PLCs. First, the assessments' questions were inspected to determine the degree to which they corresponded with the goals and objectives of PLCs. The assessment items were mapped to determine if the TDM and LCC domains were relevant to the goals and objectives of PLCs. This process aided in determining whether the TDM could be used as an effective tool in an educational setting.

Research Question 2: To what extent does convergent validity exist for the teamness construct when applied to the Team Development Measure (Stock et. al., 2013) and the Learning Community Concepts (Wells & Feun, 2007) instruments?

The aim of the second research question was to examine the evidence of convergent validity by calculating the correlation between the scores of the TDM and LCC (Cohen, 1988). The study followed the steps outlined by Swank and Mullen (2017) and Tabachnick and Fidell (2014).

First, an appropriate statistical test for answering the question was determined to be a Bivariate Correlation Analysis. The Pearson product-moment correlation was utilized to determine the validity correlation coefficients to determine the strength and direction of the relationships between the two instruments (Tabachnick & Fidell, 2014). This study followed the guidelines developed by Cohen (1988) to interpret the strength of the relationship among the correlation coefficients (i.e., Pearson's r). Cohen's (1988) recommendations are stated in Table 3.3.

Before the analysis was conducted, the assumptions of bivariate normality, linearity, and no significant outliers were required to be verified for the Pearson product-moment correlation to provide a valid result (Swank & Mullen, 2017). As suggested by Swank and Mullan (2017) and

Table 3.3

Guidelines for Pearson Correlations

Correlation Coefficient Value	Type of Correlation
$0.1<\|r\|<0.3$	Small/Weak Correlation
$0.3<\|r\|<0.5$	Medium/Moderate Correlation
$\|r\|>0.5$	Large/Strong Correlation

Tabachnick and Fidell (2014), before any analyses of data occurs, the Shapiro-Wilk test for normality and various scatterplots were used to test the data for normality and linearity. Originally, the Shapiro-Wilk test was restricted for use with sample sizes of less than 50 participants; however, due to advancements in the algorithm, it can be used for sample sizes in the range of $3 \leq n \leq 5000$ (Razali & Wah, 2011). If the p-value of the Shapiro-Wilk test is greater than 0.05, the data set is classified as normal (Tabachnick & Fidell, 2014). Visual inspection of a scatterplot provided evidence of a linear relationship. If a linear relationship between the TDM and LCC was found, the assumption of linearity was not violated, and the study could move to test for outliers. In the case of non-linearity, data transformations or a choice of a non-parametric test (e.g., Spearman's rank-order correlation) may need to be considered (Swank & Mullen, 2017).

The outliers can be observed from the scatterplot created when testing for linearity. If outliers are found, data entry errors or measurement errors will be checked. Typically, outliers are ± 3.29 standard deviations from the mean (Tabachnick & Fidell, 2014). If the data reveal an outlier without any type of error, there is not a recommended procedure (Swank & Mullen, 2017). If necessary, the researcher will observe both cases to keep and remove the outliers. If outliers were found, they were winsorized, meaning they were changed to three standard

deviations from the mean (Tabachnick & Fidell, 2014). Due to the nature of the Likert scale data, a response of 4 or strongly agree may have $z > 3.29$ but it is a valid response and would not be classified as an outlier.

Research Question 3: To what extent are team attributes present in PLC teams?

The aim of the third research question was to utilize the TDM (Stock et al., 2013) to provide a measure of teamness and determine where on a scale of teamness each member of a PLC team had reached. The procedure followed the same procedure that Stock et al. (2013) used to develop *The Stages of Team Development* (see Table 3.2).

Once the data were collected, each of the 31 items was examined. A response frequency table was created using individual team members' responses. The frequency table included both the question and the number of respondents, as well as the percentage. Items were added by degree of difficulty within the item response frequency table. On the TDM the easiest Likert scale item was "strongly agree" and the hardest item was "strongly disagree." Those items were compared to the Stock et al. (2013) *Stages of Team Development*.

Additionally, each item frequency table was ordered by the mean score for each item (i.e., highest to lowest values). This process provided a method to visualize the data to determine where the PLC team members began to indicate "disagree" or "strongly disagree." The top portion of the frequency table displayed items on which the participants agreed. Conversely, the bottom portion of the table displayed responses of disagreement. This process determined the extent to which each of the four components of team development (i.e., cohesiveness, communication, roles and goals clarity, and team primacy) was in place based on Stock et al.'s (2013) recommendations. A histogram was created to show the number of PLC team members who scored at various levels of team development.

Next, the Pearson model reliability and Cronbach's alpha were examined using the Winsteps software (Linacre, 2018). The measurement properties of the TDM were evaluated using Rasch analysis theory, which involves determining the Chi-square goodness of fit statistics (Bond & Fox, 2001; Boone, Staver, & Yale, 2014). If the Chi-square statistic was nonsignificant, the items were considered to be a good fit and the difficulty and person location parameters could be estimated. Also, the INFIT and OUTFIT statistics were analyzed to determine item and person statistics that were inconsistent with the Rasch theory. The fit statistics needed to be in the range of 0.5 to 1.5 to be accepted (Bond & Fox, 2001; Boone et al., 2014).

In addition, the item information was examined visually through the developmental pathway displayed by a Wright variable map (Bond & Fox, 2001; Boone et al., 2014). These measures were used to examine the information and to identify any discrepancies in the 31-item TDM assessment regarding the participants' ability levels. This information determined the fit for the TDM in an educational setting. Thus, this procedure also allowed for refinements or deletions of the 31 existing items to produce a stronger instrument to assess PLC teams.

Research Question 4: To what extent do the participants perceive the PLC implementation at their high school to be consistent with the PLC model?

The aim of the fourth research question was to utilize the LCC (Wells & Feun, 2007) to determine to what extent the participants perceived the PLC implementation at their high school to be consistent with the PLC model. The data collected from the LCC, a mixed-method survey, provided information used to gain a more in-depth understanding of the PLC team's implementation process. Once the data were collected, descriptive statistics were calculated for each Likert scale item, and the open-ended questions were examined with the intent of

developing themes from the data (Flick, 2014). A priori coding was conducted based on the research of Wells and Feun (2007) and Wells and Feun (2013). The codes from the data collection were based on individual experiences, collaborative viewpoints, and issue-oriented perspectives regarding working in a high school PLC team setting.

Chapter Three Summary

Chapter Three is comprised of the methods used for developing the TDLCC instrument. In summary, this research study is focused on four main questions: (1) To what extent does the content of Stock, Mahoney, and Carney's (2013) The Team Development Measure and the Wells and Feun (2007) Learning Community Concepts correspond to Hord's (1997) PLC dimensions?; (2) To what extent does convergent validity exist for the teamness construct when applied to the Stock et al.'s (2013) The Team Development Measure and the Wells and Feun (2007) Learning Community Concepts instruments?; (3) To what extent are team attributes present in one high school's PLC teams?; and (4) To what extent do the participants perceive the PLC implementation at their high school to be consistent with the PLC model?

The TDLCC can be potentially used a tool for assessing PLC team members perceptions and understandings of the extent that attributes of teamness and PLC concepts are present within their team. The TDLCC items were written by Stock et al. (2013) and Wells and Feun (2007) using Likert scale items and open-ended questions. The primary data analyses included the Rasch Rating Scale Model to the dataset to construct measures of the latent construct (e.g., the amount of teamness). When the item fit statistics are acceptable, the quantity of the latent construct is transformed from Likert scale responses into linear measures on the 0-100 scale (Bond & Fox, 2001; Boone et al., 2017, Stock et al., 2013). This enables PLC team members to

comprehend that there is a range of teamness perceptions within PLC teams and "can help teams determine what strategies can improve their team functioning" (Stock et al., 2013, p. 699).

CHAPTER FOUR: RESULTS

This chapter reveals the data collection findings and statistical analysis procedures as described in Chapter Three. The chapter's introduction begins with the sample description followed by the data cleaning procedures prior the quantitative analysis.

Sample Description and Data Cleaning

The study's setting consisted of 59 teachers representing 12 PLC teams in a rural school district located in East Tennessee. After the initial inspection of the data, 52 participants who finished the survey produced an approximate response rate of 88%. Gender and educational attainment of the participants are shown in Table 4.1. The participants self-reported as being 50% female and 44.2% male ranging from three to 39 years of teaching experience (M = 14.59; SD = 9.18). About 83% (n = 43) of the survey respondents primarily have a bachelor's or master's degree with only one person having a Doctor of Philosophy or Doctor of Education degree.

Next, the data were examined and cleaned following the procedures outlined by Morrow and Skolits (2017). The data cleaning process was administered prior to any analyses that addressed the research questions. After importing the information into Microsoft Excel (Microsoft Corporation, 2018) from Qualtrics (2018), a frequency analysis was conducted on each of the TDLCC subscales, namely the TDM and LCC. Appendix B and Appendix C illustrate each of the subscale's frequencies and percentages. During the initial inspection of the data, seven of the 59 participants were deleted due to their responding to less than 50% of the questionnaire (Bennett, 2011).

Coding Errors. The initial frequency analysis identified six partially completed responses in the dataset. The following questions contain missing data entries: TDM3, TDM11,

Table 4.1

Gender and Educational Attainment of PLC Team Members

Teachers	**Count**	**Percentage**
Gender		
Female	26	50.00
Male	23	44.23
Prefer not to answer	3	5.77
Total	52	100
Educational Attainment		
Some College, No Degree	1	1.92
Associate's Degree (e.g., AA, AS)	1	1.92
Bachelor's Degree (e.g., BA, BS)	26	50.00
Master's Degree (e.g., MA, MS, MEd)	17	32.69
Educational Specialist (Ed.S)	6	11.54
Doctor of Philosophy or Doctor of Education (Ph.D or Ed.D)	1	1.92
Total	52	100

TDM16, TDM24, TDM28, and the LCC8. Since the missing data accounted for less than 5% of data located in those variables, these data entries were kept blank during the analysis (Morrow & Skolits, 2017).

Reverse Coding of Variables. This section summarizes the recoding of variables before the planned analyses. The TDM section of the TDLCC contains four items that needed to be recoded, namely, TDM3, TDM15, TDM16, and TDM27. These four questions needed to be coded differently due to an opposite direction of meaning than the other statements in the TDM (Józsa & Morgan, 2017). Through the recoding process, the following values were assigned to those items: Strongly Disagree = 4, Disagree = 3, Agree = 2, and Strongly Agree = 1.

Outliers. In this section, the TDM and LCC were cleaned for outliers. According to Tabachnick and Fidell (2014), if any of the z-scores were outside the range of -3.29 and +3.29 standard deviations from the mean, they can be classified as an outlier. In Appendix D each row

of the table contains the participant's overall TDM and LCC item average and z-score. There were no changes to the original variables, as no item had z-scores outside of the boundaries of -3.29 and +3.29.

Research question 1. To what extent does the content of Stock et al.'s (2013) The Team Development Measure and the Wells and Feun (2007) Learning Community Concepts correspond to Hord's (1997) PLC dimensions?

The aim of the first research question was to examine the TDM and LCC relative to their content validity in relationship to Hord's (1997) PLC dimensions. Content validity is defined "by the clarity with which the content domains of a measure are defined" (Fitzpatrick, 1983, p. 9). Through a vast literature review on PLCs, Hord (1997) determined that educators operate along five key dimensions: (1) supportive and shared leadership, (2) shared values and vision, (3) collective creativity, (4) supportive conditions, and (5) shared personal practice. The goals and objectives of PLCs are "where the professionals come together to learn for improvement within a community setting" (Morrissey, 2000, p. 31). There are distinct parallels between the content domains of the TDM and LCC with the five dimensions of PLCs.

Parallels between the TDM, LCC, and PLCs

The LCC assessment was aligned with Hord's (1997) five dimensions of PLCs. The questionnaire was designed for participants to respond about the implementation process of learning community concepts and the challenges in implementing PLCs within their school. The construct validity was determined by Wells and Feun (2007) whom has taught about PLCs.

Although the process for establishing content validity was not followed, the feedback from professors familiar with Hord's work on PLCs indicated strong agreement regarding

> the quality of the questions that measured the five dimensions of PLC implementation. (Blitz & Schulman, 2016, pp. D-42)

Consequently, the LCC instrument was field-tested by Wells & Feun (2007) in one high school and was utilized in six high schools. Additionally, between 2007-2016, the instrument was administered to educators in at least 20 middle and high schools (Blitz & Schulman, 2016). The following is a concise description of the four domains of the TDM and its parallels within professional learning communities' dimensions.

Cohesiveness

Team cohesiveness is the binding factor that holds the unit together and is essential to the development of the team (Stock et al., 2013). When the unit is cohesive, it will build a collaborative culture that embraces *shared personal practices* among the members of the team that supports one another (Cherkowski, 2016). The *supportive conditions* in a collaborative environment include "interactions, and shared understandings are the life force that energizes and connects individuals and forms cohesive learning communities" (Dietz, 2009, p. 5). Similarly, within a *supportive and shared leadership* structure each member of the team participates equally without one member dominating the group.

Communication

Communication procedures are some of the most important *supportive conditions* needed for school improvement (Hord, 1997). McEwan (2003) suggests communication is one of the most powerful traits of an educator. Facilitation and communication skills are essential to establish a PLC (Dietz, 2009), and without these characteristics the information is often distorted and "change efforts are doomed to fail" (DuFour & Eaker, 1998, p. 51). Similarly, within the s*upportive and shared leadership* dimension, communication is vital to build strong relationships

between stakeholders to build a *shared personal practice* and to have *collective creativity* among the group (Morrissey, 2000). In a PLC, leaders should demonstrate and provide a sense of commitment toward shared leadership by providing teachers with shared responsibilities that will positively impact student achievement outcomes (DuFour & Eaker, 1998).

Roles and Goals

The *supportive and shared leadership* and *collective creativity* dimensions describe the structures present when the administrators and teachers grow and work collaboratively to reach a common goal that supports school improvement (Hord, 1997). Within these dimensions, the team's goals are clearly stated without any confusion. The principal "delegate[s] authority, develop[s] collaborative decision-making processes, and step[s] back from being the central problem-solver" (DuFour & Eaker, 1998, p. 186). Individual team members have a specific role and unique skill set that influences the development of the team (Stock et al., 2013). Within PLCs, team members are encouraged to engage in creative thought and share ideas among the group. Having *shared values and vision* aids administrators, educators, and students in identifying the most important goals and how to achieve them (DuFour & Eaker, 1998).

Team Primacy

PLC team primacy contains each of Hord's (1997) five PLC dimensions. The underpinnings that hold PLCs together are based on the relationships and progress made among teachers and administrators. Progression is achieved when teachers and administrators develop a foundation based on collaborative teamwork to meet the common goal of student achievement (DuFour & Eaker, 1998; Morrissey, 2000). DuFour et al. (2006) suggest that collaborative culture is a systematic process where PLC teams search interdependently to find the best outcomes for their school and students.

Content Validity

The aim of Research Question 1 was to show the relevance of the content of the TDM and LLC in relation to Hord's (1997) dimensions of PLCs. The review and synthesis of the PLC and team literature combined to produce qualitative grounding evidence to support the relationship between the TDM and LCC domains to Hord's (1997) dimensions of PLCs. Figure 4.1 displays the framework and the interrelationships of the four content domains of the TDM (i.e., cohesion, communication, roles and goals, and team primacy) and Hord's (1997) five dimensions of PLCs. A user of such instruments has logical support for the claim that participants' performance on the TDM and LCC assessments provides revealing results in regard to the dimensions of PLCs (Fitzpatrick, 1983). Furthermore, the mapping of Hord's (1997) PLC dimensions to the TDM and LCC domains demonstrated evidence and relevance that the TDM domains are related to the PLC constructs.

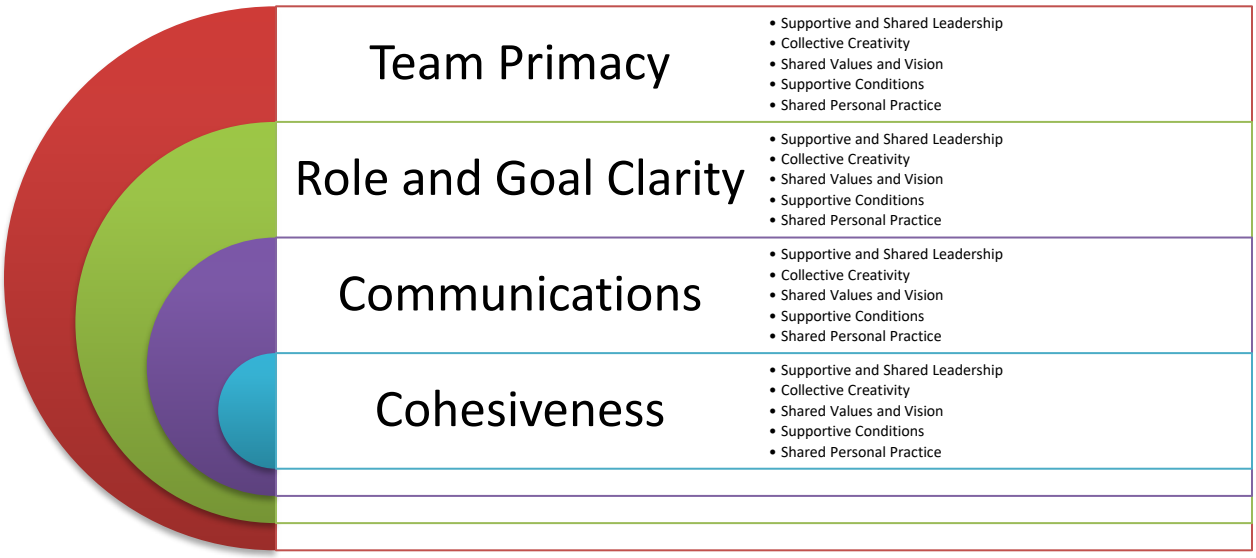

Figure 4.1. *Interrelationships of the Content Domains of the TDM and Hord's (1997) five dimensions of PLCs.*

Research Question 2: To what extent does convergent validity exist for the teamness construct when applied to the Stock et al. (2013) The Team Development Measure and the Wells and Feun (2007) Learning Community Concepts instruments?

This research question sought to investigate the convergent validity of the Stock et al. (2013) TDM and the Wells and Feun (2007) LCC instruments in PLC teams. In the original work of Stock et al. (2013) and Wells and Feun (2007), the authors used the Rasch rating scale measurement model to produce measures of team development, as well as an overall average score to determine the implementation level of PLCs, respectively. Therefore, both statistical techniques (i.e., Rasch rescale measures and the overall averages) were compared to determine the convergent validity of the TDM and LCC instruments.

Bivariate correlation data analysis was used to establish validity evidence based on the relationship between the two instruments (Laerd Statistics, 2018; Swank & Mullen, 2017; Tabachnick & Fidell, 2014). Prior to the analysis, the test assumptions for the bivariate correlation of the average measures and Rasch rescale measures were verified by observing the following: Bivariate normality and linearity, and no significant outliers were found.

Average TDM and Average LCC Measures

In the original work of Wells and Feun (2007), the authors used an overall average score to determine the PLC's implementation level. In this section, the overall averages of the TDM and LCC were compared and analyzed to determine if convergent validity among between the two instruments.

Descriptive Statistics of the Average Measures

The descriptive statistics for the average measures of the TDM and LCC are summarized in Appendix E and Appendix F, respectfully. The distribution of the average measures was

examined visually using histograms (see Appendix G and Appendix H) and Q-Q plots (see Appendix I and Appendix J) to determine the degree in which the assumption of normality was met. The two histograms appeared to follow the normal distribution, which suggests that normality is not a concern of the analysis and the Q-Q plots have points adhering closely to the diagonal line (Tabachnick & Fidell, 2014). Additionally, the average TDM scores exhibited skewness (0.321, SE = 0.330), kurtosis (0.896, SE = 0.65), and Shapiro-Wilk test of normality (S-W = 0.969, 52, p = 0.187) and the average LCC scores presented skewness (-0.76, SE = 0.333), kurtosis (-0.106, SE = 0.65), and Shapiro-Wilk test of normality (S-W = 0.982, 52, p = 0.624). The average LCC scores had slight negative skewness, indicating that teachers endorsed the questions associated with learning community concepts more toward "almost always" than "almost never." The skewness and kurtosis values being less than |2| (Tabachnick & Fidell, 2014), as well as the findings from the Shapiro-Wilk's test ($p > 0.5$) (Laerd Statistics, 2018), indicated that the dataset is approximately normally distributed.

Convergent Validity of the Average Measures

Preliminary analyses showed the relationship between the average TDM and average LCC scores to be linear with both variables normally distributed, as assessed by Shapiro-Wilk's test ($p > 0.5$), and there were no outliers. A bivariate Pearson's product-moment correlation was carried out to investigate the relationship between the average TDM scores and the average LCC scores. The scatterplot between the variables identified a moderate positive linear relationship, which was confirmed with a Pearson's correlation coefficient of 0.44. This bivariate correlation model showed a statistically significant, moderately positive correlation between average TDM and average LCC scores in PLC teams, $r(50) = .44$, $p < 0.01$, with the average TDM scores statistically explaining 20% of the variability in the average LCC scores.

The results support the convergent validity of the subscales of the TDLCC. The relationship of the average TDM and average LCC scores were in the moderate range. This suggest that the subscales are not measurements of the same construct but are related constructs. Since $0.10 < r < 0.95$ (Carlson & Herdman, 2012), the data contributes to the literature and should be used to assist in future research of team development and PLC implementation.

TDM and LCC Rasch Measures

Prior to the analysis to determine convergence of the TDM and LCC Rasch Measures, similar to Stock et al. (2013), each of the scores of the instruments were converted using the Rasch rating scale measure model. This model was utilized to convert Likert scale items to measures between 0-100. In this section, the Rasch measures of the TDM and LCC were calculated and rescaled to determine the convergent validity of the instruments. The Rasch analysis was conducted by applying the computer package Winsteps Version 3.91.2 to examine how well the observed PLC team data fit the measurement model. In this study, teamness was classified as the latent trait of focus and was measured based on logit scores. Those raw scores were converted into linear logit scales scores (i.e., measures of teamness) and then related to the levels of team development.

Team Development Measure – Rasch Analysis

Testing Rasch Model Fit

After the data cleaning stages, responses from 52 teachers to the 31 items in the TDM were analyzed using Winsteps. The program was used to report the chi-square fit statistics as two chi-square ratios (i.e., the Infit Mean Square Statistic (MSNQ) and the Outfit Mean Square Statistic (MSNQ) to understand how well the data will fit the Rasch model. Infit statistics are used as a diagnostic tool to describe how close the item measures are to the person measures.

Similarly, Outfit statistics are used as a diagnostic tool to describe the distance between item measures and person measures (Bond & Fox, 2001; Boone et al. (2014).

First, the analysis of Item Outfit MSNQ was conducted and four items (1, 3, 15, and 31) were identified as having Mean Square (MSNQ) statistics values greater than the threshold of 1.4, which is suggested by Wright and Linacre (1994). Further investigation of the Z-Standardized (ZSTD) (i.e., unit normal deviates, also known as z-scores) values for the MSNQ items suggested that two (1 and 15) items were within the range of |2|, which is an acceptable range (Boone et al., 2014; Wright & Linacre, 1994). However, items 3 and 31, with ZSTD of 2.5 and 2.8 respectfully, were interpreted as having less compatibility with the teamness model (Boone et al., 2014). Since items 3 and 31 failed to meet the criteria as described by Boone et al. (2014) and Wright and Linacre (1994), the items were deleted from the item list for the next analysis.

The second Rasch analysis was performed after the removal of aforementioned items. This procedure of Item Outfit MSNQ detected all items had MSNQ statistics less than 1.4; which is in acceptable range (Wright & Linacre, 1994).

Subsequent analysis identified the observation of the person outfit MNSQ, Person outfit ZSTD, and individual Z-residuals greater than three identified eight individuals (4, 5, 7, 28, 30, 31, 35, and 42) as outfitting persons having idiosyncratic answers. Following the removal of these eight individuals, an additional Rasch analysis was administered with the remaining sample size of 44 participants and the item misfit statistics were at an acceptable level.

Reliability of Rasch Model

Following the Rasch screening process, the Rasch reliability statistics (see Appendix K), person outfit and infit plots (see Appendix Q and Appendix R), and item outfit and infit plots

(see Appendix S and Appendix T) were examined to evaluate the fit of the TDM in the context of PLC teams. The person reliability of 0.96, which is comparable to the Cronbach alpha (0.97) and is calculated using classical test theory within the Winsteps program, showed a strong relationship (Cohen, 1988). In the Rasch analysis, the person separation index is defined as a ratio between the person variance and error variance (Bond & Fox, 2001; Boone et al., 2014). The noted person separation index of 4.63 is greater than 3, which suggests a sufficient level of separation (Duncan, Bode, Lai, & Perera, 2003). Moreover, Winsteps output provided person reliability and item reliability measures at acceptable measures greater than 0.6 (Bond & Fox, 2001; Boone et al., 2014), namely at 0.96 and 0.63, respectively. The item separation index of 1.32 is less than 1.5, which is identified as a less productive measurement. However, it is greater than 0.8, which is accepted with a value of item reliability between 0.6 and 0.8 (Bond & Fox, 2001).

Rescale Person Measures

With agreements on model fit and acceptable level of measures, final person measures were created by utilizing the UIMEAN and USCALE functions in the Winsteps program. The UIMEAN assigns a numerical value to the non-extreme cases for each person and the USCALE changes the number of reported user-scaled units per logit (Linacre, 2018). Initial person measures were identified using a logit scale that ranged from low to high with the value 0 being the theoretical mean location for item difficulty. Thus, person measure data for this study were rescaled from the original logit scale to linear scale ranging from 0-100 using the UIMEAN = 45.5778 and USCALE = 4.9474. The average TDM rescale measure was 55.82 (*SD* = 15.66).

Learning Community Concepts—Rasch Analysis

A Rasch model analysis was administered by using the computer package Winsteps Version 3.91.2 by examining the degree to which the observed PLC team data fit the measurement model. The implementation process was defined as the latent trait of focus and was measured based on logit scores, then converted into linear logit scales scores.

Testing Rasch Model Fit

After the initial data cleaning process, responses from 52 teachers to the 16 items on the LCC were analyzed using Winsteps. Multiple fit statistics were provided by the program to assess the model fit for the study. First, the analysis of Item Outfit MSNQ was conducted and item 1 and item 10 were identified as having a Mean Square (MSNQ) statistics value greater than 1.4, as suggested by Wright and Linacre (1994). Furthermore, the investigation of Z-Standardized (ZSTD) values revealed item 1 had ZSTD = 2.9, which was outside the suggested range of |2|. According to Boone et al. (2014), these items are less compatible with the model and were deleted from the item list for the next analysis.

After removing these items, a second Rasch analysis was performed. This attempt found the analysis of Item Outfit MSNQ had item 2 and item 9 were identified as having MSNQ statistics equal to 1.7; which is greater than 1.4 (Wright and Linacre. 1994). However, the investigation of the Z-Standardized (ZSTD) values for the MSNQ items were found to have an acceptable level (i.e., < 2) (Bond & Fox, 2001; Boone et al., 2014).

Preceding the analysis, the observation of the person outfit MNSQ, person outfit ZSTD, and individual Z-residuals greater than two, identified five individuals (18, 25, 27, 41, and 50) as outfitting persons having idiosyncratic answers. Following the removal of these five individuals,

an additional Rasch analysis was conducted and item misfit statistics were found to have an acceptable level.

Reliability of Rasch Model

Following the Rasch screening process, the Rasch reliability statistics (see Appendix L), person outfit and infit plots (see Appendix U and Appendix V), and item outfit and infit plots (see Appendix W and Appendix X) were examined to evaluate the fit of the LCC in the context of PLC teams. The person reliability of 0.82, which is comparable to the Cronbach alpha (0.87) and is calculated using classical test theory within the Winsteps program, showed a strong relationship (Cohen, 1988). Also, the item reliability had similar results at 0.80.

In the Rasch analysis, the person separation index identifies a measure of ratio between the person variance and error variance (Bond & Fox, 2001; Boone et al., 2014). The observed person separation index of 2.14 and the item separation index of 2.01 are less than the acceptable level of 3. Since both measures are greater than 0.8 and each has a reliability measure between 0.6 and 0.8, those measures are accepted with the model (Bond & Fox, 2001).

Rescale Person Measures

With agreements on model fit and acceptable levels of Rasch reliability statistics, final person measures were created for further analysis. Initial person measures were created utilizing a linear logit scale which ranged from low to high with the value 0 being the theoretical mean location for item difficulty. Therefore, person measure data for this study were rescaled from the original logit scale to a user-friendly, but still linear, scale ranging from 0-100 using the UIMEAN = 47.4393 and USCALE = 8.1872. The average LCC rescale measure was 58.55 (*SD* = 12.02).

Descriptive Statistics of the Rasch Rescale Items

The average TDM Rasch Rescale measure was 55.82 (*SD* = 15.66) and the average LCC rescale measure was 58.55 (SD = 12.02). The distributional shape of the TDM Rescale scores and the LCC Rescale scores was examined using histograms (see Appendix M and Appendix N) and Q-Q plots (see Appendix O and Appendix P) to determine the degree to which the assumption of normality was met. Additionally, the average TDM Rescale scores exhibited skewness (1.10, SE = 0.33), kurtosis (1.83, SE = 1.67), and Shapiro-Wilk test of normality (S-W = 0.93, 52, $p = 0.006$), and the LCC Rescale scores presented skewness (1.66, SE = 0.33), kurtosis (3.04, SE = 0.65), and Shapiro-Wilk test of normality (S-W = 0.836, 52, $p = 0.000$). Since the kurtosis value of the of the LCC Rescale scores were greater than the |2| (Tabachnick & Fidell, 2014), as well as the findings from both of the variables' Shapiro-Wilk's test ($p < 0.5$) (Laerd Statistics, 2018) the assumption of normality was not met.

Convergent Validity of the Rasch Rescale Measures

The preliminary analyses revealed that the relationship between the TDM rescales scores and the LCC rescale scores did not meet the assumption of normality needed for the Pearson's product-moment correlation analysis. Statistical textbooks vary in opinions about the procedures necessary to utilize non-normal data (Field, 2000; Laerd Statistics, 2018; Tabachnick & Fidell, 2014). For example, Field (2000) claims the Pearson's product-moment correlation is robust to deviations from normality, where as Tabachnick and Fidell (2014) recommend using Spearman's rank-order correlation as a possible analysis. As a result of the discrepancies in the literature, both the Pearson's product-moment correlation and Spearman's rank-order correlation were conducted.

First, a Bivariate Pearson's product-moment correlation was conducted to examine the relationship between the TDM rescale scores and the LCC rescale scores consisting of 52 PLC team members. There was a statistically significant, moderate positive correlation between TDM rescale scores and the LCC rescale scores in PLC teams, *r(50) = .43, p < 0.01, 95% CI [0.17, 0.69]* with the TDM rescale scores statistically explaining 18% of the variability in the LCC rescale scores.

Additionally, a Spearman's rank-order correlation was conducted to examine the relationship between the TDM rescale scores and the LCC rescale scores consisting of 52 PLC team members. There was a statistically significant, moderate positive correlation between the TDM rescale scores and the LCC rescale scores in PLC teams, *r(50) = .42, p < 0.01, Fisher's Z 95% CI [0.16, 0.63].*

The aim of this research question sought to explore the convergent validity of the measures produced by Stock et al.'s (2013) TDM and the Wells and Feun's (2007) LCC instruments in PLC teams. The data were analyzed from 52 PLC team members from a high school in a rural school district. As hypothesized, moderate and significant positive correlations were found between the TDM and LCC instruments. These findings provide support for using the TDM as a valid tool to measure PLC team development in high schools.

In recent reviews of PLC instruments (Blitz & Schulman, 2016; Brouwer et al., 2012; Gajida & Koliba, 2008; North Cascades and Olympic Science Partnership, Supovitz, 2002; 2008; Riskus, 2011; Tseng & Kuo, 2010; Watts, 2010; Wells & Feun, 2007), evidence of convergent validity had not been reported or found. In this study, the correlations between the TDM and LCC measures were between 0.42 and 0.44 with CIs [0.17, 0.69] and [0.16, 0.63], respectfully.

These findings support the hypothesis that the both instruments could be utilized as measures of PLC team development.

The literature on levels of convergent validity vary in opinions about the thresholds necessary to properly interpret research findings (Carlson & Herdman, 2012; Lewis, Huebner, Malone, & Valois, 2011; Reschly & Betts, 2009). For example, Carlson and Herdman (2012) recommend "Convergent validities above $r = 0.70$ are recommended, whereas those below $r = 0.50$ should be avoided" (p . 17). However, authors such as Lewis et al. (2011) and Reschly and Betts (2009) provided range values between 0.24 to 0.43 and 0.25 to 0.57, respectively. The correlations found in this study were weak (ranging from 0.42 and 0.44) but were statistically significant. The study's findings reinforce the hypothesis that the TDM is measuring a construct related to PLC team development.

Research Question 3: To what extent are team attributes present in PLC teams?

In this study, the TDM was employed to assist in the determination of team attributes within PLC teams. First, an item response frequency table (see Table 4.2) was created using individual team member's responses. The frequency table included both the question and the number of respondents, and the percentage. The item response frequency table (see Table 4.2) provided a visual to inspect the degree of difficulty of each TDM item. On the TDM the easiest Likert scale item is "strongly agree" and the hardest item is "strongly disagree."

Additionally, the item frequency table provided a method to visualize the data to determine where the PLC team members begin to indicate "disagree" or "strongly disagree." The top 10% of the frequency table displayed items one, two, and 19 where the PLC team participants were in agreement. These items correspond to two components of team development, namely, communication and roles and goals clarity. Conversely, the bottom 10%

Table 4.2

TDM Response Frequency Table

	Team Attribute	N	Mean	Std. Deviation	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)
1. Team members say what they really mean.	Communication	52	3.13	0.658	27%	62%	10%	2%
2. Team members say what they really think.	Communication	52	3.13	0.658	27%	62%	10%	2%
19. The goals of the team are clearly understood by all team members.	Goals and Means	52	3.12	0.548	21%	69%	10%	0%
26. I am allowed to use my unique personal skills and abilities for the benefit of the team.	Cohesiveness	52	3.10	0.534	19%	71%	10%	0%
5. All team members feel free to share their ideas with the team.	Cohesiveness	52	3.08	0.589	21%	65%	13%	0%
7. The team practices tolerance flexibility and appreciation of the unique differences between team members.	Cohesiveness	52	3.06	0.539	17%	71%	12%	0%
8. The team handles conflicts in a calm caring and healing manner.	Communication	52	3.06	0.502	15%	75%	10%	0%
17. Roles and responsibilities of individual team members are clearly understood by all members of the team.	Role Clarity	52	3.06	0.502	15%	75%	10%	0%

Table 4.2. Continued.

	Team Attribute	N	Mean	Std. Deviation	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)
21. I am happy with the outcomes of the team's work so far.	Goals and Means	52	3.06	0.574	19%	67%	13%	0%
28. Information that is important for the team to have is openly shared by and with all team members.	Communication	51	3.04	0.488	14%	76%	10%	0%
24. I have a clear understanding of what other team members expect of me as a team member.	Role Clarity	51	3.04	0.528	16%	73%	12%	0%
22. I enjoy being in the company of the other members of the team.	Cohesiveness	52	3.04	0.625	17%	73%	6%	4%
30. When team problems arise the team openly explores options to solve them.	Communication	52	3.04	0.522	13%	79%	6%	2%
15. There is confusion about what the work is that the team should be doing.	Goals and Means	52	3.04	0.625	0%	17%	62%	21%
11. In this team, members support, nurture and care for each other.	Cohesiveness	51	3.02	0.547	16%	71%	14%	0%
13. As a team we come up with creative solutions to problems.	Cohesiveness	52	3.02	0.505	13%	75%	12%	0%

Table 4.2. Continued.

	Team Attribute	N	Mean	Std. Deviation	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)
12. The team has agreed upon clear criteria for evaluating the outcomes of the team's effort.	Goals and Means	52	2.98	0.610	15%	69%	13%	2%
29. All individuals on this team feel free to suggest ways to improve how the team functions.	Cohesiveness	52	2.98	0.577	15%	67%	17%	0%
6. All team members feel free to express their feelings with the team.	Cohesiveness	52	2.96	0.713	21%	56%	21%	2%
4. All team members participate in making decisions about the work of the team.	Communication	52	2.96	0.625	15%	67%	15%	2%
16. There is confusion about how to accomplish the work of the team.	Goals and Means	51	2.96	0.662	2%	18%	63%	18%
10. The team openly discusses decisions that affect the work of the team before they are made.	Communication	52	2.94	0.461	8%	79%	13%	0%
14. In the team there is more of a WE feeling than a ME feeling.	Cohesiveness	52	2.90	0.634	13%	65%	19%	2%
25. The work I do on this team is valued by the other team members.	Cohesiveness	52	2.88	0.615	10%	73%	13%	4%

Table 4.2. Continued.

	Team Attribute	N	Mean	Std. Deviation	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)
23. This team is a personally meaningful experience for me.	Cohesiveness	52	2.79	0.605	6%	71%	19%	4%
3. Team members talk about other team members behind their back.	Communication	51	2.78	0.856	8%	25%	47%	20%
31. On this team the person who takes the lead differs depending on who is best suited for the task.	Role Clarity	52	2.77	0.675	10%	62%	25%	4%
18. All team members place the accomplishments of the team ahead of their own individual accomplishments.	Role Clarity	52	2.77	0.731	12%	60%	23%	6%
20. All team members define the goals of the team as more important than their own personal goals.	Role Clarity	52	2.65	0.653	4%	63%	27%	6%
27. Some members of this team resist being led.	Role Clarity	52	2.54	0.779	10%	35%	48%	8%

of the table displayed items 18, 20, and 27 where the participants disagreed. These items relate to the roles and goals clarity component of team development.

Team Attributes Present in PLC Teams

After the Rasch rescale process described above was completed, descriptive statistics of the respondent's score on the latent construct was calculated. The average Rasch measures for the 52 participants were 53.28 (*SD* = 11.08). According to Stock et al.'s (2013) Stages of Team Development, the participating PLC teams would be classified in the second stage of team development, meaning the PLC teams have in place the attributes of building cohesiveness and communication skills. As illustrated in Table 4.3, approximately 94% of the PLC teams (*n* = 11) were classified has having cohesiveness, communication, role and goal clarity, and team primacy in place. Only one PLC team (6%) had the team attributes of cohesiveness and communication firmly in place.

Research Question 4. To what extent do the participants perceive the PLC implementation at their high school to be consistent with the PLC model?

This research question's purpose is to capture the perceptions of PLC team members' experiences implementing PLC concepts at their high school. This study followed the numeric boundaries for the levels of PLC implementation by Wells and Feun (2007) as well as the methodology of utilizing the mean scores of the Likert scale items. Table 4.4 and Table 4.5 show the PLC team members' responses to the LCC in ranked order. Based on Wells and Feun's (2007) classification of tiers, the top tier was between 3.0 to 3.99 or between *sometimes* to *almost always*, and the middle tier were between 2.70 to 2.98 (Wells & Feun, 2007). The bottom tier was absent in the current study.

Table 4.3

TDM Response Frequency Table

Stage	Score Range	Number of Teams	Number of Participants	Percentage of Teams	Components Present	Solidification
Pre-Team	0-36				None to building Cohesiveness	Initial Development
1	37-46	3	7	13.46	Cohesiveness	
2	47-54	5	30	57.69	Communication	
3	55-57	2	8	15.38	Role and Goal Clarity	
4	58-63	1	4	7.69	Team Primacy	In Place
5	64-69				Cohesiveness	
6	70-77	1	3	5.77	Communication	
7	78-80				Role and Goal Clarity	
8	81-86				Team Primacy	
Fully Developed	87-100				Everything	Firmly in Place

Level of PLC Implementation

Quantitative Results

This study's results revealed that the school's level of implementation (i.e., overall score) (M = 3.16, SD = 0.19) was located in the top tier and was slightly higher than the *sometimes* ranking. Additionally, the findings indicated the highest level of agreement was in *collaboration*. Table 4.4 shows the first-tier responses were between the average of 3.0 to 3.99 or between *sometimes* to *almost always*. The data suggested that educators generally collaborated within PLC teams *to achieve a common goal for student learning*.

The second-tier responses (see Table 4.5) show a level of implementation between the averages of 2.70 to 2.98 or between *seldom* to less than *sometimes*. The findings suggest that the teachers seldom modify their teaching style based on other opinions. Also, teachers are not as likely to *develop common assessments* and *compare student learning results* with the other teachers. Additionally, while working in PLC teams, they seldom *develop a plan of assistance for the students who are not effectively learning the materi*al.

Qualitative Results

In addition to the collected Likert scale items, teachers at the high school were asked seven open-ended questions. The rationale of this analysis was to establish how the participants described events occurring during the implementation process and compare those with the PLC characteristics as defined by Hord (1997). A priori coding from Wells and Feun (2007) and Wells and Feun (2013) was applied to identify the data's common themes (Flick, 2014). The responses from the qualitative questions are represented as themes associated with Hord's (1997) Dimensions of PLCs. Abbreviated responses are presented in Appendix Q with common themes from the LCC open-ended questions.

Table 4.4

First-Tier Responses

	Mean	N	SD	Almost Never (%)	Seldom (%)	Sometimes (%)	Almost Always (%)
10. The extent to which you work together to achieve a common goal for student learning.	3.42	52	0.94	7.69	7.69	19.23	65.38
2. The extent to which you discuss what and when you want to teach various concepts in the curriculum.	3.37	52	0.95	3.85	7.69	36.54	51.92
1. The extent to which you meet with the teachers who teach the same course.	3.35	52	0.95	7.69	9.62	23.08	59.61
12. The extent to which you have a shared vision about where you are headed with regard to student learning.	3.33	52	0.74	1.92	9.62	42.31	46.15
3. The extent to which you discuss what and when you want to teach various concepts in the curriculum.	3.27	52	0.82	3.85	11.54	38.46	46.15
8. The extent to which you learn something useful from other members of your department in these meetings.	3.27	52	0.6	0	7.69	57.69	34.62
14. The extent you and the other teachers are in agreement with administrators about the use of common assessments.	3.27	52	0.69	1.92	7.69	51.92	38.46
15. The extent to which you and the other teachers are in agreement with administrators about the need to collaborate.	3.27	52	0.66	0	11.54	50	38.46

Table 4.4. Continued.

	Mean	N	SD	Almost Never (%)	Seldom (%)	Sometimes (%)	Almost Always (%)
13. The extent to which you and the other teachers are in agreement with administration about what should be happening with a learning community.	3.21	52	0.78	3.85	9.62	48.08	38.46
11. The extent to which you are seeking new teaching methods, testing those methods, and reflecting on the results.	3.19	52	0.79	3.85	11.54	46.15	38.46
16. The extent to which you and the other teachers are in agreement with administrators about what should be done with students who are not learning.	3.06	52	0.78	3.85	15.38	51.92	28.85
7. The extent to which you develop a plan of assistance for the students who are not effectively learning the material.	3	52	0.74	3.85	15.38	57.69	23.08

Table 4.5

Second-Tier Responses

	Mean	N	SD	Almost Never (%)	Seldom (%)	Sometimes (%)	Almost Always (%)
9. The extent to which you are changing the way you teach, based on your work with other teachers.	2.98	51	0.73	5.88	9.8	64.71	19.61
5. The extent to which you examine and compare student-learning results.	2.92	52	0.76	5.77	15.38	59.62	19.23
6. The extent to which you develop a plan of assistance for the students who are not effectively learning the material.	2.88	52	0.83	3.85	28.85	42.31	0.25
4. The extent to which you develop common assessments for this course.	2.81	52	0.93	11.54	19.23	46.15	23.08

Theme: Dimensions Toward Developing a Learning Community

The teachers in the PLC teams identified two of Hord's (1997) Dimensions of PLCs, *shared personal practice* and *supportive conditions*, as key attributes of what works well when developing a learning community. The teachers reported that "communication and common plan times with other subject areas" have been beneficial in the development of PLCs. Other comments included that teachers were able to "communicate with one another and build relationships through simply talking to one another each day"; "working with members of my department and grade area to share ideas and plan lessons"; and "subject-level PLCs have proven much more applicable to daily planning and incorporation in the classroom." Collaboration opportunities among PLC team members help to build an environment that supports a foundation of respect among team members, in addition to an understanding of what each team member brings to the group (Dowling-Hetherington, 2016).

Theme: Benefits of Implementing Professional Learning Community Teams

Comments from PLC team members regarding the benefits of implementing a professional learning community team included *collaboration*, *sharing ideas*, and being *content specific*. The PLC team members listed *collaboration* as a major benefit of a learning community. Their responses are in line with research identifying the connection between a collaborative culture and a successful PLC (DuFour & Eaker, 1998; Ronfeldt et al., 2015). The teachers reported the following: "Each grade [level] meets with the people in their subject area to collaborate and develop lesson plans and share data," and, "We are working together to implement and develop new ways of learning in our subject areas." Collaboration among PLC team members allows the team to improve team norms, communication skills, and spend less time on simple teacher responsibilities (Fransen et al., 2013).

Additionally, PLC team members included *sharing ideas* as a benefit of PLC implementation. Sharing ideas and working collaboratively are central components of effective PLCs (Blitz & Schulman, 2016; DuFour & Eaker, 1998; Tennessee Department of Education, 2017). The team members stated, "We team teach and share materials"; "We maintain a common curriculum [and] discuss methods to raise standardized test scores and scores on the ACT"; and "Our school has taken a giant step in the correct direction by having each subject meet weekly to discuss common lesson plans and assessments. It ensures that no one is being left behind in regard to missing a state standard." These statements confirm the team members' commitment and interest in a specific topic to promote student growth.

Furthermore, the participants perceive that *content specific* PLC team meetings are essential through the implementation process. Being content focused is an essential characteristic in effective teacher professional development (Darling-Hammond et al., 2017). PLC team members' comments included: "Subject-level PLCs have proven much more applicable to daily planning and incorporation in the classroom"; "Each grade meets with the people in their subject area to collaborate and develop lesson plans and share data"; and "Communities work to maintain a common curriculum, discuss methods to raise standardized test scores and scores on the ACT."

Theme: Challenges Encountered in Developing a PLC

Similar to Wells and Feun (2007), the teachers in this study described that *teacher buy-in* and *collaboration* efforts were the biggest challenges to implement in PLCs. *Teacher buy-in* can be increased when the educator feels they are recognized and understood within the group (DuFour & Eaker, 1998). The participants identified concerns and frustrations when developing a common plan to implement PLCs. Comments included: "Some members want to keep the

status quo and not change," and "Some team members resist being led by others, especially if they perceive a superiority over that leading member."

Additionally, the teachers expressed concerns regarding collaboration and communication efforts. Even though collaborative efforts are at the center of PLCs, they are often the most difficult to implement (Hord, 1997; Wells & Feun, 2007). The teachers reported concerns and frustrations that suggested a culture within the school that was resistant to implementing PLCs. Some comments include: "Communication is always a challenge"; "Communication with administration is extremely limited"; "Long-time members' ideas trump new members' ideas; long-timers already have a plan, everyone capitulates to that"; "Not all teachers are held to the same expectations"; and "Some departments have teachers that are self-centered and not willing to work with others in a meaningful way."

Subsequently, PLC team members described passive-aggressive behaviors toward one another. Comments include: "Our team meets unwillingly once a month. It is a gripe session"; "Some faculty members are more difficult to work with and we find it hard to collaborate"; and "Drama." Also, the level of expectations seems to vary depending on the PLC team. Comments included: "Not all teachers are held to the same expectations," and "Making sure the individual teachers are responsible for their own parts of their content PLCs."

Summary of PLC Team Members' Perceptions of Their PLC Implementation

The survey results from the LCC provided a picture of how PLC team members perceived the change efforts and transition efforts in implementing PLCs in a high school (Wells & Feun, 2007; Wells & Feun, 2013). Comparable to the results of Wells and Feun (2007) and Wells and Feun (2013), the findings of this study revealed that PLC implementation is not an easy process, and educational change takes time to fully implement (Richardson, 2005; Ronfeld

et al., 2015). The PLC team members reported that they collaborate to work toward increasing student achievement.

Even though teachers displayed signs of frustration, the study found essential elements of Hord's (1997) PLC dimensions were present at the high school. The quantitative and qualitative information indicated the PLC implementation was successful. One participant stated, "CULTURE IS EVERYTHING. If our school does not have a collaborative, trusting, and hardworking culture, then no amount of talk or planning will change anything. We need to be DOERS. Culture, charisma, collaboration, creativity, communication. Lots of Cs, but I believe in every one of them."

CHAPTER FIVE: DISCUSSION

The purpose of this study was to illustrate how the TDM and LCC assessments can be used in high school PLCs to broaden the body of knowledge and contribute to PLC and team development literature. Chapter Five includes a discussion of the major findings as they are discussed in the literature on team development and PLCs. This chapter concludes with the limitations related to this study, in addition to future research recommendations, a number of implications for PLCs and team development, and a final summary.

Summary of Study Purpose, Research Questions, and Methodology

Throughout the previous 50 years, the literature has increased in educational policies that support learning communities in fostering efficient schools that focus on effective teacher practices and student learning (Blitz & Schulman, 2016; Centre for Educational Research and Innovation, 1998; DuFour et al., 2006; Hord, 1997; Reed, Salen, & Bagher, 2003; Weiss et al., 1980). It is essential that educators possess the qualities associated with team development if they are to effectively implement the PLC model (DuFour, 2004).

The discussion section and future research recommendations are stated to help address the research questions:

Research Question 1: To what extent does the content of Stock et al.'s (2013) The Team Development Measure and the Wells and Feun (2007) Learning Community Concepts correspond to Hord's (1997) PLC dimensions?

Research Question 2: To what extent does convergent validity exist for the teamness construct when applied to Stock et al.'s (2013) The Team Development Measure and the Wells and Feun (2007) Learning Community Concepts instruments?

Research Question 3: To what extent are team attributes present in PLC teams?

Research Question 4: To what extent do the participants perceive the PLC implementation at their high school to be consistent with the PLC model?

Study Conclusions and Interpretation of the Findings

This study assessed the psychometric properties of a measure associated with levels of team development within PLC teams. The study's purpose was to recount the results of Rasch analysis to identify levels of team development in high school PLC teams. Psychometric analysis was performed on both the TDM and the LCC to determine the performance of the instruments among high school PLC teams.

Situation of Self

The stimulus behind conducting this research study was to gain an in-depth understanding and provide a measure of teamness and the implementation process of PLC teams. The innerworkings and the process of team dynamics and PLCs have always been intriguing to me. Throughout my educational career, I have been a part of PLCs and sharing ideas to help promote and increase student's academic performance.

Since I was in elementary school, I have always enjoyed the educational process. First, I followed a non-traditional educational path by earning a welding certification from Tennessee College of Applied Technology in Athens, Tennessee. When I started college, I chose to major in mathematics because the subject matter was interesting. I transferred from a community college to Tennessee Wesleyan College and began to integrate my interest in mathematics with education. I have pursued a Master's in Mathematics and am currently in the Ph.D. program for Evaluation, Measurement, and Statistics at the University of Tennessee. Also, I believe that education is ongoing. I learn from my students, my co-workers, my family, and my friends.

That knowledge does not simply come from books, but from experiences, conversations, and observations.

I have been in education for 16 years from being a coach to a lead teacher, I have had opportunities to actively participate as part of a team; as well as manage a team. I have served as a teacher with the majority of the participants of this study. Yet, as the researcher of this study, I had to distance myself from the participants, so they would not feel obligated or threatened to complete the survey. By doing this, I strongly believe the participants answered the questions honestly without bias. Additionally, since I was the Geometry PLC team leader, I choose to omit the Geometry PLC team members from participating in this study due to biases.

Implementation and Results of the TDLCC

This study found strong psychometric properties between the two subscales of the TDLCC (i.e., TDM and LCC), thus providing a reliable instrument for measuring PLC team members' team development perceptions and their perceptions of implementing learning community concepts. Therefore, in light of this study's results, the TDLCC can be utilized as a tool for assessing the implementation of PLC teams among their members and principals to understand the extent of teamness (i.e., attributes of team development) present within each group of teachers. The following subsections are summaries of the findings found in Chapter Four.

Content Validity Evidence

Each of the subscales (i.e., the TDM and LCC) of the TDLCC was validated by Stock et al. (2013) and Wells and Feun (2007), respectively. Similary, this study's results identified evidence of validity and reliability in assessing PLC team development. First, the content validity was examined by comparing the descriptions of the four domains of the TDM and how

they were paralleled within professional learning communities' dimensions. Furthermore, the Rasch analysis provided a person reliability measure of 0.96. This evidence suggests these items on the TDLCC provide reasonable content coverage of PLC teams with accuracy.

Convergent Validity Evidence

Prior to performing Pearson's product-moment correlation and Spearman's rank-order correlation to determine the convergent validity, the test assumptions were examined for linearity and normality. Shapiro-Wilk statistic assessed the normality of distribution of the average scores to conclude nonsignificant results (i.e., significant value greater than 0.05) that indicate normality (Laerd Statistics, 2018; Pallant, 2010). However, the assumption for normality on the Rasch rescale measures did not meet the requirements as measured by the Shapiro-Wilk test of normality ($p = 0.000$) (Laerd Statistics, 2018; Pallant, 2010). Due to the inconsistencies found in the literature (Field, 2000; Laerd Statistics, 2018; Pallant, 2010; Tabachnick & Fidell, 2014), the Pearson's product-moment correlation and Spearman's rank-order correlation were conducted to determine the relationship between the Rasch rescale measures.

Pearson's product-moment correlation and Spearman's rank-order correlation were conducted to examine the measure of association between the TDM and LCC. Modeling techniques for the Pearson's product-moment correlation first examined the average scores, followed by a second model examining the Rasch rescale scores. Furthermore, a Spearman's rank-order analysis was conducted to examine the association of the Rasch rescale scores. All models were significant; however, the Pearson's product-moment correlation explained the most variance ($R^2 = 19.36\%$, $p < 0.01$) followed by the Pearson's product-moment correlation of the Rasch rescale scores ($R^2 = 18.5\%$, $p < 0.01$), and the Spearman's rank-order correlation of the Rasch rescale scores explained the least variance ($R^2 = 17.6\%$, $p < 0.01$). This demonstrated

evidence of validity of the measures of the two scale scores, thus showing a relationship between the variables of team development and the characteristics of learning communities (Laerd Statistics, 2018; Tabachnick & Fidell, 2014).

The study hypothesized that the TDM would be positively related to the LCC in showing a relationship between team development and PLCs. Support for this hypothesis was illustrated in the findings of content validity and the statistically significant correlations between the TDM and LCC.

Presence of Team Attributes

The TDM section of the TDLCC was utilized to assess the presence of team attributes within PLC teams. The participants agreed that the team attributes of communication and roles and goals clarity were present in their PLC teams by ranking questions one, two, and 19 in the top 10%. Conversely, the participants disagreed that the team attribute of roles and goals clarity were present within their PLC team by ranking questions 18, 20, and 27 in the bottom 10%.

Furthermore, Rasch analysis along with Stock et al.'s (2013) Stages of Team Development classified the participating school as being in the second stage of team development, with attributes of building cohesiveness and communication skills (M = 53.28, SD = 11.08). One PLC team was classified in the sixth stage of team development, with team attributes of cohesiveness and communication firmly in place. The remaining 11 teams were between the first and fourth stages of team development, with team attributes of cohesiveness, communication, roles and goals clarity, and team primacy in place.

Perception of PLC Implementation

The LCC section of the TDLCC was applied to assess the implementation of PLC teams and to highlight which categories of Hord's (1997) Dimensions of PLCs were present. Similar to

Wells and Feun (2007), the overall results provided a picture of the complexities and difficulties of implementing PLC concepts at the high school level. The findings revealed PLC team members' perceptions of the implementation process. The quantitative data results suggested that PLC teams are slightly above average (M = 3.16, SD = 0.19). The PLC teams claimed that *working together to achieve a common goal for student learning* was ranked the highest response option. In relation to Hord's (1997) Dimensions of PLCs, the participants suggested that *shared personal practice* and *supportive conditions* were positive influences in developing a learning community. Embedded within those dimensions, the PLC teams displayed traits of communication and collaboration. One PLC team member stated, "*Subject-level PLCs have proven much more applicable to daily planning and incorporation in the classroom."*

Discussion of the Findings

While there are PLC studies spanning five decades., the TDLCC assessment has addressed several shortcomings addressed to the development of PLC teams. This study was intended to explore and produce measures of teamness throughout the implementation process of PLC teams. The study's preliminary work indicates that the TDM and LCC are acceptable instruments to measure team development within PLC teams. This study's contributions have been organized by (1) identifying a relationship with psychometric support between team development and learning community constructs, (2) application of TDM and LCC during the implantation process of PLCs.

Research question one and question two were formulated to examine the relationship between the constructs of teamness and professional learning concepts to determine how they interrelate within PLC teams. The findings of the content validity and convergent validity

provided statistically significant evidence identifying a relationship between the constructs of team development and the qualities of learning communities.

Though this conclusion is not consistent in the literature, the theoretical proposition connected with the affiliation between the constructs are strongly grounded in the underpinnings of PLC teams. This study offers empirical evidence to support the claims of Darling-Hammond & McLaughlin (2011), DuFour et al., (2006), DuFour & Eaker, (1998), Ronfeldt et al., (2015) and Sparks (2013) that PLCs and team development are deeply intertwined. These findings offer psychometric support into justifying the relationship between team development and learning community concepts. Thus, this study both affirms a relationship with team development and learning community concepts, as well as revealed the complexity of the two constructs than was discussed in the literature.

Furthermore, this study sought to apply the TDM and LCC to assess the levels of teamness and levels of the implementation of the PLCs. The findings helped to determine if a group of teachers (i.e., a PLC) preform as a team and how well PLCs are implemented. The TDM findings suggest that the school's level of team development was in the second stage; whereas, the LCC revealed that the implementation level was slightly above average.

The findings suggest that the school is in the forming and storming stages of Tuckman and Jensens' (1977) Five Stages of Group Development and in the mediator stage of the IMOI model (Ilgen et al., 2005; Rosen et al., 2014). During these stages, participants begin to include action processes (i.e., adaptation, communication, learning, leadership, and performance monitoring), interpersonal processes (i.e., trust building and conflict management), and transition processes (goal specification and planning) (Rosen et al., 2014).

Additionally, the findings of the PCL implementation echoed the findings of Archer (2017), DuFour and Eaker (1998), Huffman (2001), Wells and Feun (2007), and Wells and Feun (2013) reporting that the implementation of PLCs is a difficult task. The participants identified the following challenges: scheduling PLC meetings during after school hours, limited participation, and that all educators were not subject to the same standards. Research advocates school administration play a strong role in leading change in order for PLCs to be effective (DuFour & Eaker, 1998; Jones et al., 2013; McEwan, 2003). Even though the administration's role was not part of this study, several participants suggested that leadership needed to provide a stronger vison of how PLCs should appear for all PLC teams.

In conclusion, the findings support the claim that teamness and learning community concepts have a significant positive relationship. The results were consistent with the research, this study offers empirical evidence of support with to a concept that has not been psychometrically tested. Additionally, it is vital to understand that the key feature of these findings captured how the respondents perceived their experience during the implementation of PLC teams. The progression through Stock et al.'s (2013) Team Development Scale, as well as, Wells and Feun (2007) implementation stages is a movement in the development of the overall team's beliefs and perceptions of becoming a developed PLC team.

Study Limitations

The findings of the current study provided preliminary evidence that the TDLCC is a reliable and valid instrument. Although this suggests that the instrument can be utilized in the field of education, there are three key limitations of the study.

The study's major limitation was that the assumptions of the Rasch rating scale model were not conducted. Thus, the following assumptions were claimed to be valid prior to

conducting the analysis: "(a) the latent trait θ is a scalar; thus the latent trait is unidimensional, (b) the examinees are independent, and (c) the items are locally independent" (Estrada, Nava-Munos, Abreu, 2018, p.2). Additionally, "limitations of the Rasch model include the need for a large number of observations or replications to estimate the parameters of the model," which were not met for this study (Stock et al., 2013, p. 699). The study had 52 educators complete the TDLCC. Therefore, there is a need to investigate the psychometric properties and the assumptions of the Rasch rating scale model with a larger sample size of PLC teams. The findings from a larger population size may produce more robust Rasch measures (Bond & Fox, 2001; Boone et al., 2014).

Also, the possibility of the results containing a social desirability bias was identified as a limitation of the study. This type of bias may occur when the participants responded to the TDLCC with the same opinion that that may viewed as favorable by others. If such a bias existed for this study, it could have interfered with the interpretation of the findings of the average tendencies and Rasch measures. For example, when asked the question "Team members talk about other team members behind their back." the participant may feel obligated or pressured to respond in the same manner as they feel the team would respond.

Also, the findings of the study may be limited by the degree to which PLC team members understood the questions on the TDLCC and to the extent of how they honestly answered those questions. Based qualitative findings from the LCC, I feel the participants provided honest and reliable information regarding their experiences in PLC teams. The participants responses encompassed both positive and negative reflections of implementing PLC concepts. Similar to Wells and Feun's (2013) findings, the themes ranged from signs of frustration, embracing change, and the optimistic aspects of PLCs.

Implications

This study illuminates the vital role of teamness within the PLC process. The TDLCC assessment merged the TDM and LCC to address the research questions for the current study. It served as an assessment tool to measure team development (i.e., teamness) and determine the extent of implementation of a learning community in a high school setting. Assessment of PLC teams provides an opportunity to measure and determine how each team is perceived within their school's culture. This study garnered the team interactions and team culture that would improve the PLC team process.

Despite the limitations of this study, assessments for educators and education researchers to use in examining teamness within PLCs are limited. Both assessments provided different lenses through which to assess the level of PLC team implementation. A psychometric analysis was conducted as the first step in determining if the TDM and LCC were valid and reliable instruments for understanding PLC team development in a rural high school population. This work provides the groundwork for future studies in professional development interventions for educators to improve the implementation of PLCs and team development.

Improving the understanding of PLC team development and assessment accuracy can have several practical applications. These preliminary results have real-world inferences in the education field and team development. The current study indicated that the TDM and LCC had strong psychometric properties, suggesting that they are valid assessments within the field of education. The TDM assessment is a potential tool for supporting PLC team members in understanding the scope of teamness (i.e., attributes of teamwork) that is present within their PLC teams. This assessment can help identify the degree to which PLC teams and individuals falls on Stock et al.'s (2013) team development scale as shown in Table 4.3. The team

development scale provides the participants with their current stage and components of team development that are needed for highly effective teamwork (Stock et al., 2013).

The current study established that the TDM and LCC had strong psychometric properties, suggesting they are valid assessments within the field of education. These preliminary results have real-world inferences in the education field and team development. Improving the understanding of PLC team development and assessment accuracy can have several practical applications. The TDM assessment is a potential tool for assisting and advancing PLC team members in understanding the extent of teamness (i.e., attributes of teamwork) that is present within their PLC teams by finding a measure of teamness. Similar to Stock et. al (2013), this assessment can help identify where teams and team participants can be improved.

Future Research

The study established preliminary evidence for content validity, reliability, and convergent validity for the TDM and LCC assessments in high school PLC teams. This study proposes that the TDM is an acceptable measure of team development in this population. At the closure of this study, future research in PLC team development could go in many directions. First, given the small population utilized, pursuing a similar study with a larger number of participants to produce more robust Rasch measures would be beneficial (Bond & Fox, 2001; Bond et al., 2014; Stock et al., 2013).

Furthermore, future research is necessary to confirm and validate the findings of this study and be classified into three major areas; (1) Additional testing for item stability and validity, (2) Comparison of rural and urban PLC teams from different school districts, and (3) Longitudinal studies over various time intervals.

A future direction worth exploring is the extent of how team context issues impact the outcomes of team development. The current study is limited by only comparing content specific PLC teams. Researchers need to explore the differences between tested and non-tested PLC teams, male and female teams, and the teacher's education level. Additionally, future research could explore studies to compare PLC teams within the district, state, and at the national levels. Policymakers may benefit from examining and incorporating the results from such research.

Furthermore, this research study did not capture and compare student achievement data with the TDM or LCC. Research is needed to provide evidence that student achievement data is related to PLC team development. The composition of PLCs is often separated into subject areas, grade levels, the entire faculty, or by district units. Providing collaborative opportunities among various groups builds a foundation of respect among teachers, as well as understanding of the value that each person brings to the school (Dowling-Hetherington, 2016). For example, to create a united mathematics department, the administrator could arrange workshops where educators can share ideas, worksheets, activities, and plans of study. It is important that each grade level be involved because mathematics builds upon itself. Continuity of terms, presentations, and methodology will help increase student success. It will also help solidify the group as they work (Dowling-Hetherington, 2016).

Although various types of assessment instruments were used throughout PLC literature, little consideration has been given to ensure that the psychological measurements of the constructs were validated. In the current study, the combination of the TDM and LCC assessments were selected to assess and describe the qualities associated with the levels of team development within PLCs. The utilization of Rasch modeling provided an avenue to produce psychometrically efficient assessments for measuring components of team development, which

displayed evidence of reliability and validity in the context of the population being studied. These findings of the reliability and validity of the collected data support their potential use in the education field by educators and administrators, and researchers should consider these findings.

The merger of the TDM and LCC instruments into the TDLCC assessment was designed with the objective of measuring PLC team development during the implementation process in the educational field. The preliminary findings of the psychometric testing of the instrument revealed that both subscales demonstrated a significant degree of reliability and validity among the sample of PLC team members. Both instruments showed potential for aiding in PLC team development and implementation of high school PLC teams. In contrast to the literature and previous assessments on team development and PLCs, the TDLCC targeted high school PLC teams to determine the level of teamness present. Since the TDLCC is a self-reported instrument, a future direction that would be meaningful is to evaluate PLC teams by using observations of PLC meetings. This type of investigation may help triangulate the information to help contain social desirability bias within the PLC team. Thus, this instrument has provided justification for use in the field of education by teachers, administrators, and researchers.

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APPENDICES

Appendix A

The Team Development and Learning Community Concepts Assessment

This questionnaire is to provide a measure of team development that can be used to assess and guide team functionality in professional learning communities. Today you are being asked to participate in a research study conducted by M. Paul Kirkland, a PhD candidate in Evaluation, Statistics, and Measurement at the University of Tennessee.

The survey has four sections: Demographic Information, the Team Development Measure, Learning Community Concepts, and open-ended questions. Please take the next few minutes to answer the following questions. In part two of the study, please indicate how much you strongly disagree – disagree – agree – strongly agree to each statement as it applies to your team at the present time. There are no right or wrong answers, just your perceptions. This survey is totally anonymous, and your responses will remain completely confidential.

Section 1: Demographic Information

Directions: Please select the best single answer that best describes you.

1. What is your sex?
   - ☐ Male
   - ☐ Female
   - ☐ Prefer not to answer

2. What is the highest level of education you have completed?
   - ☐ Associate's degree
   - ☐ Bachelor's degree
   - ☐ Master's degree
   - ☐ Educational Specialist (Ed.S)
   - ☐ Doctor of Philosophy (Ph.D) or Doctor of Education (Ed.D)

3. How many years of service have you been in the educational field? _____

4. What is the name of your content area focused PLC?

- ☐ English I
- ☐ English II
- ☐ English III
- ☐ English IV
- ☐ Algebra I
- ☐ Geometry
- ☐ Algebra II
- ☐ Biology
- ☐ Chemistry
- ☐ U.S. History
- ☐ Physical Education
- ☐ Career Technical Education

5. How many team members (administration and teachers) are in your content area focused PLC? _____

Section 2: Team Development Measure

	Strongly Disagree	Disagree	Agree	Strongly Agree
1. Team members say what they really mean.				
2. Team members say what they really think.....				
3. Team members talk about other team members behind their back.				
4. All team members participate in making decisions about the work of the team.				
5. All team members feel free to share their ideas with the team.....				
6. All team members feel free to express their feelings with the team.				

Section 2: Team Development Measure Continued.

	Strongly Disagree	Disagree	Agree	Strongly Agree
7. The team practices tolerance flexibility and appreciation of the unique differences between team members.				
8. The team handles conflicts in a calm caring and healing manner.				
9. Regardless of the topic communication between the people on this team is direct, truthful, respectful and positive.				
10. The team openly discusses decisions that affect the work of the team before they are made.				
11. In this team, members support, nurture and care for each other.				
12. The team has agreed upon clear criteria for evaluating the outcomes of the team's effort.				
13. As a team we come up with creative solutions to problems.				
14. In the team there is more of a WE feeling than a ME feeling.				
15. There is confusion about what the work is that the team should be doing.				
16. There is confusion about how to accomplish the work of the team.				
17. Roles and responsibilities of individual team members are clearly understood by all members of the team.				
18. All team members place the accomplishments of the team ahead of their own individual accomplishments.				
19. The goals of the team are clearly understood by all team members.				
20. All team members define the goals of the team as more important than their own personal goals.				
21. I am happy with the outcomes of the team's work so far.				
22. I enjoy being in the company of the other members of the team.				
23. This team is a personally meaningful experience for me.				
24. I have a clear understanding of what other team members expect of me as a team member.				

Section 2: Team Development Measure Continued.

	Strongly Disagree	Disagree	Agree	Strongly Agree
25. The work I do on this team is valued by the other team members.				
26. I am allowed to use my unique personal skills and abilities for the benefit of the team.				
27. Some members of this team resist being led.				
28. Information that is important for the team to have is openly shared by and with all team members.				
29. All individuals on this team feel free to suggest ways to improve how the team functions.				
30. When team problems arise the team openly explores options to solve them.				
31. On this team the person who takes the lead differs depending on who is best suited for the task.				

Section 3: Learning Community Concepts

	Almost Always	Sometimes	Seldom	Almost never
1. The extent to which you meet with the teachers who teach the same course.				
2. The extent to which you discuss what and when you want to teach various concepts in the curriculum.				
3. The extent to which you determine the most essential outcomes for this course.				
4. The extent to which you develop common assessments for this course.				
5. The extent to which you examine and compare student-learning results.				
6. The extent to which you develop a plan of assistance for the students who are not effectively learning the material.				
7. The extent to which you discuss instructional methods you use to teach your students.				

Section 3: Learning Community Concepts Continued.

	Almost Always	Sometimes	Seldom	Almost never
8. The extent to which you learn something useful from other members of your department in these meetings.				
9. The extent to which you are changing the way you teach, based on your work with other teachers.				
10. The extent to which you work together to achieve a common goal for student learning.				
11. The extent to which you are seeking new teaching methods, testing those methods, and reflecting on the results.				
12. The extent to which you have a shared vision about where you are headed with regard to student learning.				
13. The extent to which you and the other teachers are in agreement with administration about what should be happening with a learning community.				
14. The extent you and the other teachers are in agreement with administrators about the use of common assessments.				
15. The extent to which you and the other teachers are in agreement with administrators about the need to collaborate.				
16. The extent to which you and the other teachers are in agreement with administrators about what should be done with students who are not learning.				

Section 4: Open-Ended Questions

17. What is working well with the efforts in developing a learning community in your school?

18. What are the challenges in developing a learning community?

19. Please describe what is currently happening with the learning community in your school (i.e., what is happening with the various departments, etc.).

20. Are the teachers collaborating, and if so, please talk about what is happening.

21. General comments regarding your school's efforts to become a learning community.
22. If your version of a learning community were occurring, describe what would be happening.
23. Other comments you would like to share.

Appendix B

Initial Frequency Analysis of the TDM

Questions	Total Number of Respondents	Agree Strongly (%)	Agree (%)	Disagree (%)	Disagree Strongly (%)
TDM 1	52	27%	62%	10%	2%
TDM 2	52	27%	62%	10%	2%
TDM 3	51	8%	25%	47%	20%
TDM 4	52	15%	67%	15%	2%
TDM 5	52	21%	65%	13%	0%
TDM 6	52	21%	56%	21%	2%
TDM 7	52	17%	71%	12%	0%
TDM 8	52	15%	75%	10%	0%
TDM 9	52	12%	81%	6%	2%
TDM 10	52	8%	79%	13%	0%
TDM 11	51	16%	71%	14%	0%
TDM 12	52	15%	69%	13%	2%
TDM 13	52	13%	75%	12%	0%
TDM 14	52	13%	65%	19%	2%
TDM 15	52	0%	17%	62%	21%
TDM 16	51	2%	18%	63%	18%
TDM 17	52	15%	75%	10%	0%
TDM 18	52	12%	60%	23%	6%
TDM 19	52	21%	69%	10%	0%
TDM 20	52	4%	63%	27%	6%
TDM 21	52	19%	67%	13%	0%
TDM 22	52	17%	73%	6%	4%
TDM 23	52	6%	71%	19%	4%
TDM 24	51	16%	73%	12%	0%
TDM 25	52	10%	73%	13%	4%
TDM 26	52	19%	71%	10%	0%
TDM 27	52	10%	35%	48%	8%
TDM 28	51	14%	76%	10%	0%
TDM 29	52	15%	67%	17%	0%
TDM 30	52	13%	79%	6%	2%
TDM 31	52	10%	62%	25%	4%

Appendix C

Initial Frequency Analysis of the LCC

Questions	Total Number of Respondents	Agree Strongly (%)	Agree (%)	Disagree (%)	Disagree Strongly (%)
LCC 1	52	8%	10%	23%	60%
LCC 2	52	4%	8%	37%	52%
LCC 3	52	4%	12%	38%	46%
LCC 4	52	12%	19%	46%	23%
LCC 5	52	6%	15%	60%	19%
LCC 6	52	4%	29%	42%	25%
LCC 7	52	4%	15%	58%	23%
LCC 8	52	0%	8%	58%	35%
LCC 9	51	6%	10%	65%	20%
LCC 10	52	8%	8%	19%	65%
LCC 11	52	4%	12%	46%	38%
LCC 12	52	2%	10%	42%	46%
LCC 13	52	4%	10%	48%	38%
LCC 14	52	2%	8%	52%	38%
LCC 15	52	0%	12%	50%	38%
LCC 16	52	4%	15%	52%	29%

Appendix D

Participant's Overall Average and Z-scores for TDM and LCC Scores

Overall TDM Average	TDM Z-Scores	Overall LCC Averages	LCC Z-Scores
2.74	-0.55	3.63	1.05
4.00	2.55	4.00	1.90
2.81	-0.39	3.06	-0.23
2.43	-1.31	2.81	-0.80
2.48	-1.19	2.75	-0.94
2.48	-1.19	2.75	-0.94
2.90	-0.15	3.19	0.06
2.97	0.01	3.69	1.19
2.61	-0.87	3.25	0.20
2.77	-0.47	2.75	-0.94
3.06	0.25	2.31	-1.93
2.65	-0.79	2.81	-0.80
2.62	-0.85	3.06	-0.23
3.06	0.25	3.19	0.06
2.68	-0.71	3.00	-0.37
2.84	-0.31	3.63	1.05
3.26	0.72	2.88	-0.65
3.63	1.65	2.94	-0.51
3.00	0.09	3.31	0.34
2.68	-0.71	3.06	-0.23
3.00	0.09	3.69	1.19
3.48	1.28	3.63	1.05
3.00	0.09	4.00	1.90
3.48	1.28	3.25	0.20
2.16	-1.98	2.25	-2.07
3.90	2.32	3.38	0.48
1.90	-2.62	2.63	-1.22
3.06	0.25	3.25	0.20
2.94	-0.07	2.63	-1.22
3.29	0.80	3.44	0.62
3.32	0.88	3.19	0.06
2.87	-0.23	3.44	0.62
3.45	1.20	3.19	0.06
2.74	-0.55	2.56	-1.36
2.81	-0.39	3.19	0.06
2.61	-0.87	3.25	0.20
3.00	0.09	3.94	1.76

Appendix D Continued

Participant's Overall Average and Z-scores for TDM and LCC Scores

Overall TDM Average	TDM Z-Scores	Overall LCC Averages	LCC Z-Scores
3.84	2.16	3.19	0.06
2.77	-0.49	3.13	-0.09
3.00	0.09	3.56	0.91
3.16	0.49	3.31	0.34
3.03	0.17	3.40	0.54
2.94	-0.07	3.81	1.48
3.00	0.09	2.88	-0.65
3.06	0.25	2.94	-0.51
2.84	-0.31	3.44	0.62
2.58	-0.95	3.06	-0.23
3.00	0.09	2.63	-1.22
3.35	0.96	4.00	1.90
3.32	0.88	2.94	-0.51
2.55	-1.03	2.13	-2.36
3.00	0.09	3.13	-0.09

Appendix E

Descriptive Statistics of the Average TDM measures

Questions	Total Number of Respondents	Mean	Standard Deviation	Agree Strongly (%)	Agree (%)	Disagree (%)	Disagree Strongly (%)
TDM 1	52	3.13	0.66	27%	62%	10%	2%
TDM 2	52	3.13	0.66	27%	62%	10%	2%
TDM 3	51	2.78	0.86	8%	25%	47%	20%
TDM 4	52	2.96	0.63	15%	67%	15%	2%
TDM 5	52	3.08	0.59	21%	65%	13%	0%
TDM 6	52	2.96	0.71	21%	56%	21%	2%
TDM 7	52	3.06	0.54	17%	71%	12%	0%
TDM 8	52	3.06	0.50	15%	75%	10%	0%
TDM 9	52	3.02	0.50	12%	81%	6%	2%
TDM 10	52	2.94	0.46	8%	79%	13%	0%
TDM 11	51	3.02	0.55	16%	71%	14%	0%
TDM 12	52	2.98	0.61	15%	69%	13%	2%
TDM 13	52	3.02	0.50	13%	75%	12%	0%
TDM 14	52	2.90	0.63	13%	65%	19%	2%
TDM 15	52	3.04	0.63	0%	17%	62%	21%
TDM 16	51	2.96	0.66	2%	18%	63%	18%
TDM 17	52	3.06	0.50	15%	75%	10%	0%
TDM 18	52	2.77	0.73	12%	60%	23%	6%
TDM 19	52	3.12	0.55	21%	69%	10%	0%
TDM 20	52	2.65	0.65	4%	63%	27%	6%
TDM 21	52	3.06	0.57	19%	67%	13%	0%
TDM 22	52	3.04	0.63	17%	73%	6%	4%
TDM 23	52	2.79	0.61	6%	71%	19%	4%
TDM 24	51	3.04	0.53	16%	73%	12%	0%
TDM 25	52	2.88	0.62	10%	73%	13%	4%
TDM 26	52	3.10	0.53	19%	71%	10%	0%
TDM 27	52	2.54	0.78	10%	35%	48%	8%
TDM 28	51	3.04	0.49	14%	76%	10%	0%
TDM 29	52	2.98	0.58	15%	67%	17%	0%
TDM 30	52	3.04	0.52	13%	79%	6%	2%
TDM 31	52	2.77	0.67	10%	62%	25%	4%

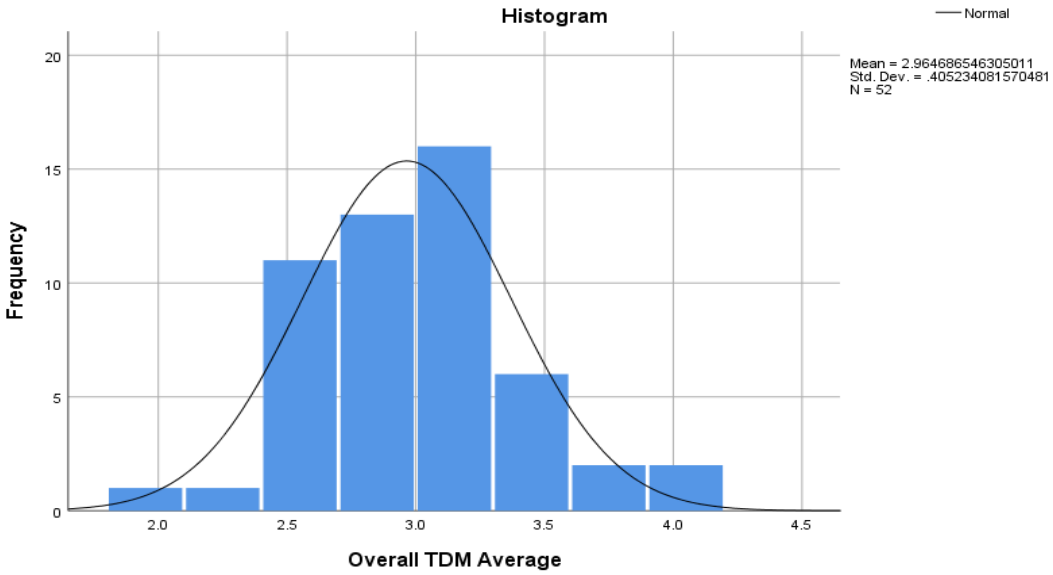
Appendix F

Descriptive Statistics of Average LCC measures

Questions	Total Number of Respondents	Mean	Standard Deviation	Agree Strongly (%)	Agree (%)	Disagree (%)	Disagree Strongly (%)
LCC 1	52	3.35	0.95	8%	10%	23%	60%
LCC 2	52	3.37	0.95	4%	8%	37%	52%
LCC 3	52	3.27	0.82	4%	12%	38%	46%
LCC 4	52	2.81	0.93	12%	19%	46%	23%
LCC 5	52	2.92	0.76	6%	15%	60%	19%
LCC 6	52	2.88	0.83	4%	29%	42%	25%
LCC 7	52	3	0.74	4%	15%	58%	23%
LCC 8	52	3.27	0.6	0%	8%	58%	35%
LCC 9	51	2.98	0.73	6%	10%	65%	20%
LCC 10	52	3.42	0.94	8%	8%	19%	65%
LCC 11	52	3.19	0.79	4%	12%	46%	38%
LCC 12	52	3.33	0.74	2%	10%	42%	46%
LCC 13	52	3.21	0.78	4%	10%	48%	38%
LCC 14	52	3.27	0.69	2%	8%	52%	38%
LCC 15	52	3.27	0.66	0%	12%	50%	38%
LCC 16	52	3.06	0.78	4%	15%	52%	29%

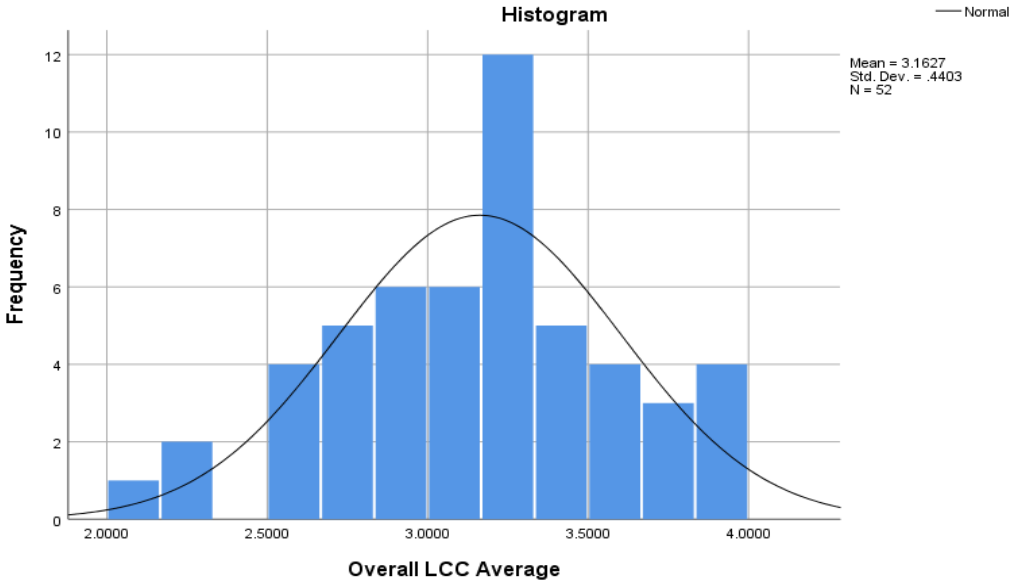
Appendix G

Histogram of Overall TDM Average Scores



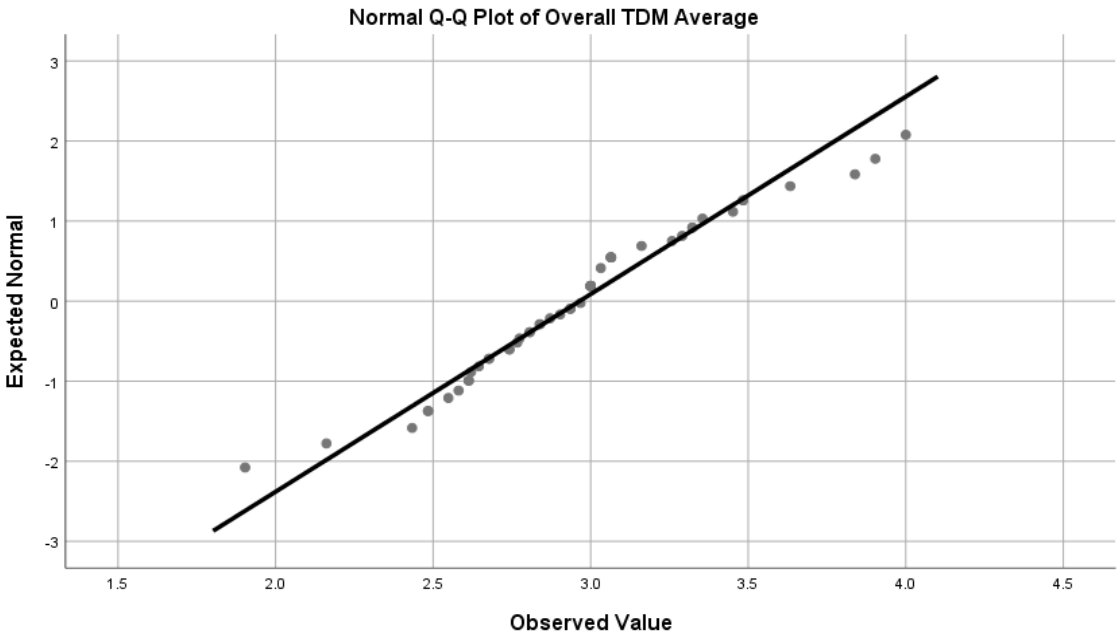
Appendix H

Histogram of Overall LCC Average Scores



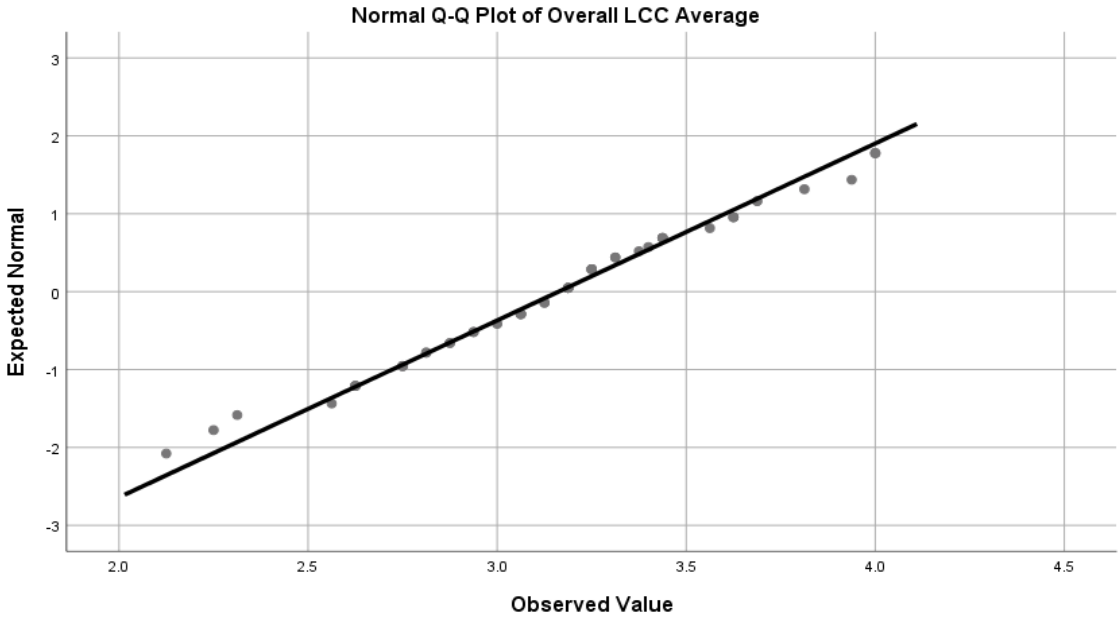
Appendix I

Normal Q-Q Plot of Overall TDM Average Scores



Appendix J

Normal Q-Q Plot of Overall LCC Average Scores



Appendix K

TDM Rasch Reliability Statistics Tables

Winsteps TDM Person Summary Statistics Output Table

					INFIT		OUTFIT	
	Total Score	Count	Measure	Model S.E.	MNSQ	ZSTD	MNSQ	ZSTD
Mean	85.6	28.9	1.86	0.56	0.82	-0.3	0.80	-0.3
P. SD	11.2	0.3	2.89	0.19	0.45	1.2	0.48	1.3
S.SD	11.3	0.3	2.93	0.19	0.46	1.2	0.49	1.3
Max.	113.0	29.0	8.51	0.86	1.60	2.2	1.61	2.1
Min.	55.0	28.0	-3.39	0.32	0.03	-2.3	0.02	-2.3
REAL RMSE	0.61	TRUE SD	2.83	SEPARATION 4.63		PERSON RELIABILITY 0.96		
MODEL	0.59	TRUE SD	2.83	SEPARATION 4.79		PERSON RELIABILITY 0.96		
S.E. of PERSON MEAN = 0.45								

Winsteps TDM Item Summary Statistics Output Table

					INFIT		OUTFIT	
	Total Score	Count	Measure	Model S.E.	MNSQ	ZSTD	MNSQ	ZSTD
Mean	130.9	43.9	0.00	0.40	0.98	-0.1	0.80	-0.4
P. SD	4.9	0.3	0.69	0.03	0.29	1.1	0.28	0.8
S.SD	5.0	0.3	0.71	0.03	0.30	1.1	0.29	0.8
Max.	137.0	44.0	1.99	0.44	1.55	1.8	1.26	0.7
Min.	116.0	43.0	-0.93	0.34	0.57	-2.0	0.37	-1.7
REAL RMSE	0.42	TRUE SD	0.55	SEPARATION 1.32		ITEM RELIABILITY 0.63		
MODEL	0.40	TRUE SD	0.57	SEPARATION 1.44		ITEM RELIABILITY 0.67		
S.E. of ITEM MEAN = 0.12								

Appendix L

LCC Rasch Reliability Statistics Tables

Winsteps LCC Person Summary Statistics Table

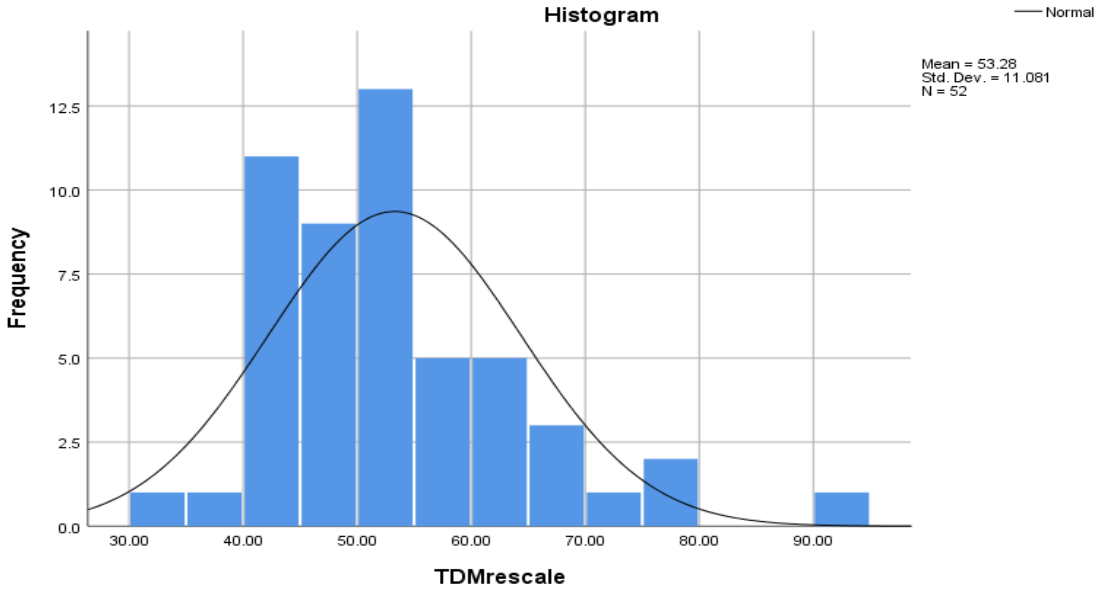
					INFIT		OUTFIT	
	Total Score	Count	Measure	Model S.E.	MNSQ	ZSTD	MNSQ	ZSTD
Mean	46.8	15.0	1.46	0.46	1.01	-0.1	1.01	-0.1
P. SD	5.8	0.1	1.21	0.10	0.50	1.4	0.53	1.4
S.SD	5.8	0.2	1.22	0.11	0.50	1.4	0.54	1.5
Max.	59.0	15.0	5.15	1.04	2.28	2.5	2.32	2.6
Min.	30.0	14.0	-1.21	0.36	0.14	-3.4	0.14	-3.5
REAL RMSE	0.51	TRUE SD	1.10	SEPARATION 2.14		PERSON RELIABILITY 0.82		
MODEL	0.47	TRUE SD	1.11	SEPARATION 2.35		PERSON RELIABILITY 0.85		
S.E. of PERSON MEAN = 0.45								

Winsteps LCC Item Summary Statistics Table

					INFIT		OUTFIT	
	Total Score	Count	Measure	Model S.E.	MNSQ	ZSTD	MNSQ	ZSTD
Mean	149.4	46.9	0.00	0.26	1.03	0.1	1.01	0.0
P. SD	9.6	0.2	0.63	0.02	0.31	1.4	0.28	1.2
S.SD	10.0	0.3	0.65	0.02	0.32	1.4	0.29	1.2
Max.	165.0	47.0	0.99	0.29	1.70	2.8	1.46	1.7
Min.	134.0	46.0	-1.12	0.23	0.46	-2.9	0.48	-2.6
REAL RMSE	0.28	TRUE SD	0.57	SEPARATION 2.01		ITEM RELIABILITY 0.80		
MODEL	0.26	TRUE SD	0.57	SEPARATION 2.20		ITEM RELIABILITY 0.83		
S.E. of ITEM MEAN = 0.12								

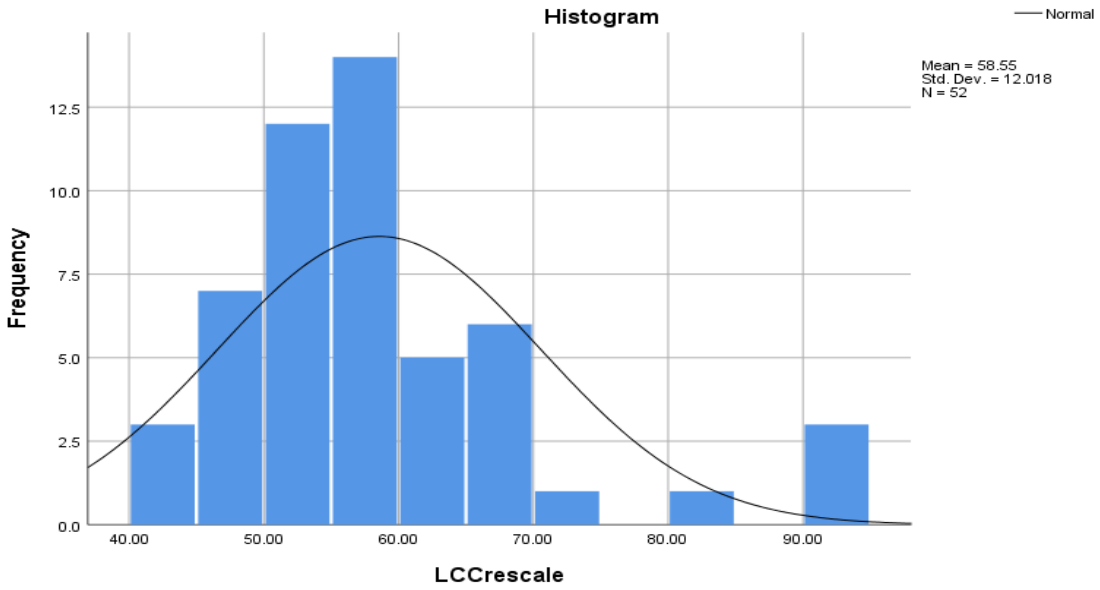
Appendix M

Histogram of TDM Rescale Scores



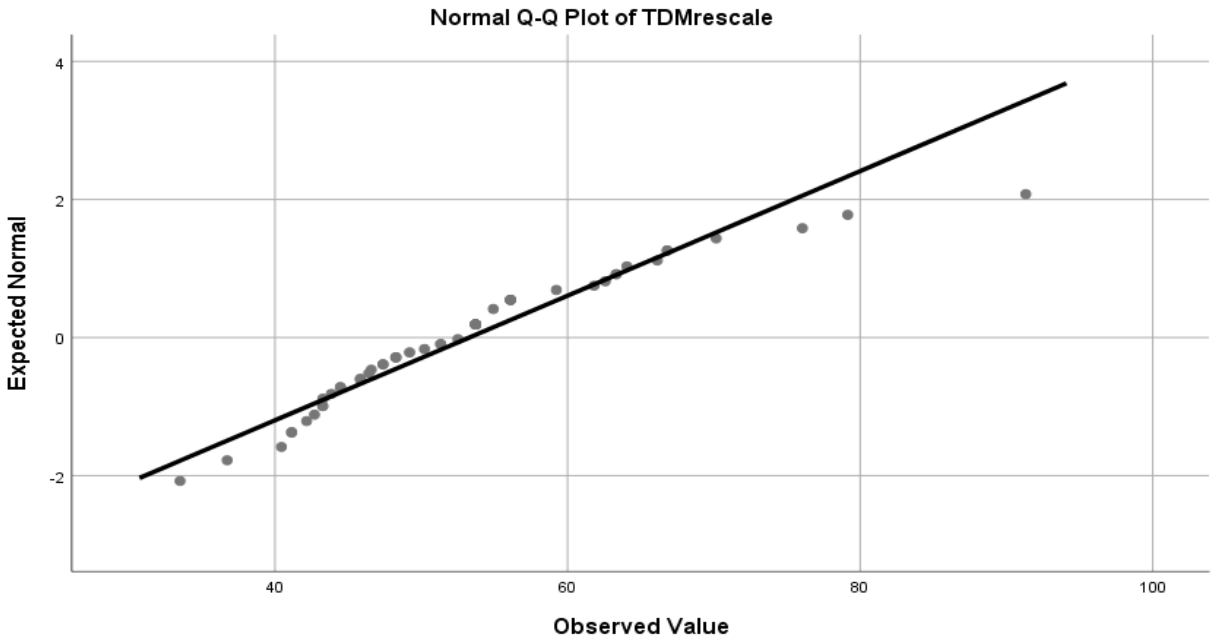
Appendix N

Histogram of LCC Rescale Scores



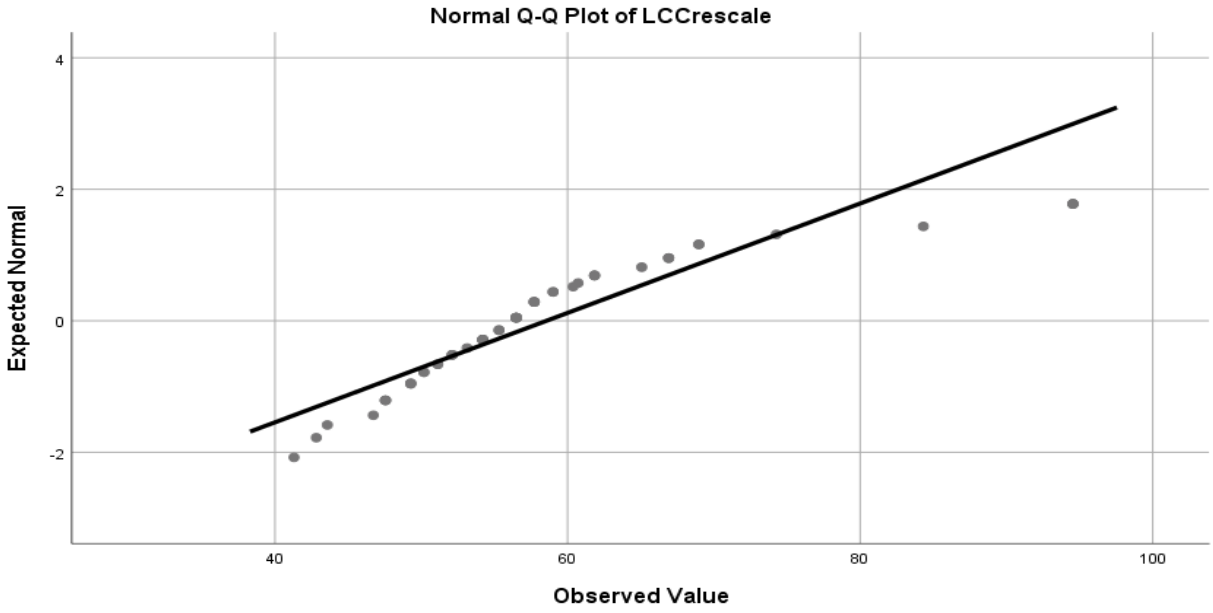
Appendix O

Normal Q-Q Plot of TDM Rescale Scores



Appendix P

Normal Q-Q Plot of LCC Rescale Scores



Appendix Q

Common Themes Found in LCC Open-Ended Questions

LCC Question 17: *What is working well with the efforts in developing a learning community in your school?*

PLC Dimension	Selected Quotes
Shared Personal Practice	Open communication and common plan times with other subject areas. We communicate with one another and build relationships through simply talking to one another each day. Social Studies has brought in the art teach and her voice brings something to the table.
Supportive Conditions	Working with members of my department and grade area to share ideas and plan lessons Subject-level PLC's have proven much more applicable to daily planning and incorporation in the classroom… The administration is tirelessly working on improving our environment by attaining new grants and certifications.

***Note**: Themes are presented alphabetically.

LCC Question 18: *What are the challenges in developing a learning community?*

Abbreviated Responses	Selected Quotes
Buy-In	Creating a plan where everyone is on the same page and wants to go in the same direction, because some members want to keep the status quo and not change. If there is a problem, team members tend to withdraw from the group and try to solve those problems alone. Some team members prefer no new techniques, no outside influence, no common assessment, no pacing guide, and no standards review by peers.
Communication	With a large staff communication is always a challenge. It is important for all of us to be clear on how to attain learning environment. Communication with administration is extremely limited.
Collaboration	Roles, responsibilities, and accountability. Some team members resist being led by others, especially if they perceive a superiority over that leading member. Getting teachers of the same subject on a similar track. The challenges are being able to get everyone on the same path. Ensuring that each teacher is on board with using common methods, order, and materials (i.e., common assessments). Long-time members' ideas trump new members ideas; long-timers already have a plan, everyone capitulates to that. Some departments have teachers that are self-centered and not willing to work with others in a meaningful way. Getting everyone together often enough to actually make a change
Expectations	Not all teachers are held to the same expectations. Making sure the individual teachers are responsible for their own parts of their content PLCs.

LCC Question 18 Continued.

Abbreviated Responses	Selected Quotes
Supportive Condition	Time! We are all so busy that it is difficult to spend the needed time to actually perform PLC's correctly. Getting a set meeting time that works for all members. Finding a time that works for all involved parties to be actively engaged.

***Note**: Themes are presented alphabetically.

LCC Question 19: *Please describe what is currently happening with the learning community in your school (i.e., what is happening with the various departments, etc.).*

Abbreviated Responses	Selected Quotes
Collaboration	To my knowledge, each grade meets with the people in their subject area to collaborate, and develop lesson plans and share data. We are working together to implement and develop new ways of learning for the school and our subject areas. Most learning communities work to maintain a common curriculum, discuss methods to raise standardized test scores and scores on the ACT. PLCs are meeting and collaboration is occurring in order to achieve the building, count, and state expectations concerning ACT scores, graduation rates, and actually preparing students for post-secondary education or the work force.
Content Specific	Algebra 1 meets every Friday to discuss the next week's lesson plans. Due to the pre-established process, it usually takes about 30 minutes to cover. Each teacher covers any tips or best practices for the following week's material so that the newer teachers can learn be successful. CTE courses meet to plan for state changes in standards and program of studies. In social studies fine arts meetings we are discussing ways to integrate history and reading comprehension across the curriculum. The special education department meets on an as-needed basis. Special education teachers who teach in a specific subject area meet with that subject area as well. Science and math department teacher collaborate and team certain lessons CTE - We are planning next year's classes and teacher schedules.

LCC Question 19 Continued.

Dysfunctional	Our team meets unwillingly once a month. It is a gripe session. Some faculty members are more difficult to work with and we find it hard to collaborate. Drama Different meeting times for each group; however due to lack of time and busy schedule around the end of the semester - meetings tend to taper off as everyone is too busy doing other required things in order to teach effectively.
Unaware	I have no idea what happens in other departments unless I actively pursue that information. When I do so, the answer is usually something prescribed by the state or central office (district administration) and not group-initiated. Most learning communities here are horizontally organized and never integrate departments or grade levels. It is a big school. I don't really know. Not a clue. There are no vertical meetings.

***Note**: Themes are presented alphabetically.

LCC Question 20: *Are the teachers collaborating, and if so, please talk about what is happening?*

Abbreviated Responses	Selected Quotes
Dysfunctional	They are collaborating to an extent, but the leadership is mainly the decision making body, and the team is cliquish lacks a whole unity. Never hear a word unless I approach them about what they are doing.
Research Strategies	We are collaborating by talking about research-based strategies and how they can be used in other classes.
Sharing Ideas	Our group collaborates. We team teach and share materials. Yes, most teachers meet once a week within their subject and grade level to discuss lesson plans and new ideas. Each teacher covers tips and best practices, if any, regarding the teaching of the material. There are also informal meetings for collaboration during the day. If something is not working as well as anticipated, we ask in between classes how the other teachers' classes are going and what could help us teach it better. Yes, a lot of emphasis on project-based learning and teachers from different subjects combining their material. Yes. I know multiple teachers that are collaborating and sharing information and methods on specific lessons.

***Note**: Themes are presented alphabetically.

LCC Question 21: *General comments regarding your school's efforts to become a learning community.*

PLC Dimension	Selected Quotes
Accountability	All teachers need to be held accountable for attending (at least monthly) and participating. Find a way to involve all teachers. It is doing fairly well. Could be clearer in instructions about how and when to meet as well as who has to meet.
Community Involvement	There needs to be both vertical and horizontal meetings. We need to find more ways to reach out into the community and bring individuals in that come from ALL walks of life. One "score" or path doesn't "fit" all students.
Sharing Ideas	It is a work in progress. Sharing ideas is taboo for some people, they feel threatened and want to keep their ideas to theirs selves. Communication between departments to find ways to evaluate and improve our student learning outcomes. I believe our school has taken a giant step in the correct direction by having each subject meet weekly to discuss common lesson plans and assessments. It ensures that no one is being left behind regarding missing any standards.
Supportive and Shared Leadership	There is no trust between collaborative groups and administration, nor is there clear communication about goals for each group. There are no repercussions or accountability concerning group members' roles and responsibilities. Workload is unevenly distributed. Creativity and initiative is DISCOURAGED. The administration requires a minimum number of meetings with our learning communities but not with others. We need instructional leadership, none of the administrators offer this.

***Note**: Themes are presented alphabetically.

LCC Question 22: *If your version of a learning community were occurring, describe what would be happening.*

PLC Dimension	Selected Quotes
Collective Creativity	People would collaborate and work together instead of against each other. A Utopian leaning community would have all teachers and all content areas meeting on a regimented basis sharing their best methods and practice. Likewise, these meetings would be addressing any individual teacher as well as content-specific issues or anomalies in terms of student gaps or deficiencies in the individual and whole-group leaning process. Furthermore, each meeting would conclude with potential solutions to each teacher's issues and the subsequent meeting would open with a discussion of the success or failure of these intervention efforts before new educational business would resume. Regular non-work get-togethers to foster true comradery amongst peers, where an equal respect of one another was established amongst every member of the group without exclusion. Those who do not try to educate would be kindly reprimanded and given ways to positively change their classroom atmosphere to encourage student growth and preparation for the next stage of their lives. More appreciation of teaching strengths and uniqueness rather than a focus on common assessments and tedious details of the minutes report. Reporters, facilitators, presenters, etc., would change every meeting. Equal representation of true ideas and feelings of every individual without fear of being ousted from a clique or judged for opinions.
Shared Personal Practice	Sharing ideas, best practices, failures, funny moments, each member is actively involved, the work load is divided EVENLY! Communication and everyone pulling their weight.
Shared Values and Vision	People would be happier with the outcome of the educational process, because we would all be invested in the same ideas.

LCC Question 22 Continued.

PLC Dimension	Selected Quotes
Supportive and Shared Leadership	Listen to all members & fresh voices; collaborate and build new units in which all stakeholders bring something to the table.
Supportive Conditions	Teachers of non-core areas or areas that do not require a traditional PLC, could attend PLCs of core areas -- at least monthly. Knowledge of what other teachers are doing in their classroom could benefit their classrooms too. For example, if Algebra students are learning metric system, that can be reinforced in shop classes. All teachers can use ACT prep daily. Looking at data and making research-based decisions on strategies. Collaboration among teachers sharing ideas, offering assistance and support. Agenda layout share ideas related to the standard(s)being planned to teacher, each teacher sharing a instruction technique and /or resource on the standard, discuss students in crisis.

***Note**: Themes are presented alphabetically.

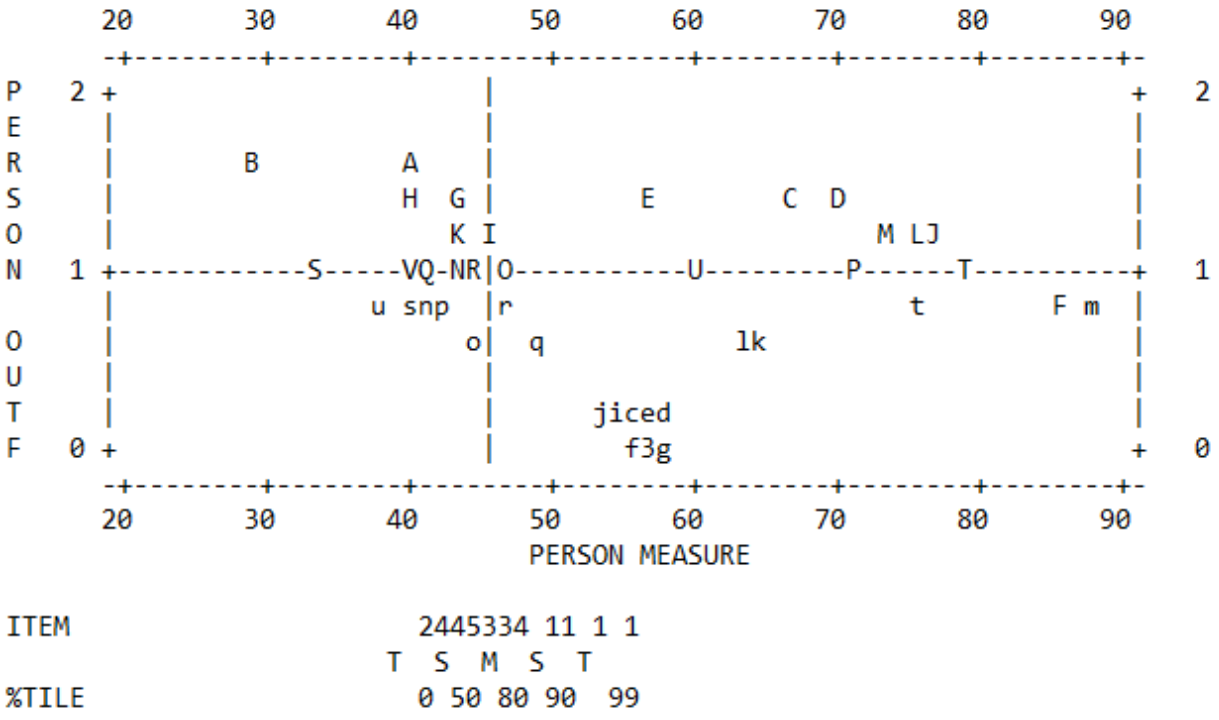
LCC Question 23: *Other comments you would like to share.*

PLC Dimension	Selected Quotes
Culture	CULTURE IS EVERYTHING. If our school does not have a collaborative, trusting, and hardworking culture, then no amount of talk or planning will change anything. We need to be DOERS. Culture, charisma, collaboration, creativity, communication. Lots of Cs, but I believe in every one of them.
Supportive Condition	Algebra 1 maintains successful scores on its EOCs partially due to the fact that no one teacher believes that their way is the only and best way. We try to be open to suggestions from all teachers and help the newer teachers avoid obstacles before he or she would encounter them in the classroom.

***Note**: Themes are presented alphabetically.

Appendix R

TDM – Person: Outfit Plot

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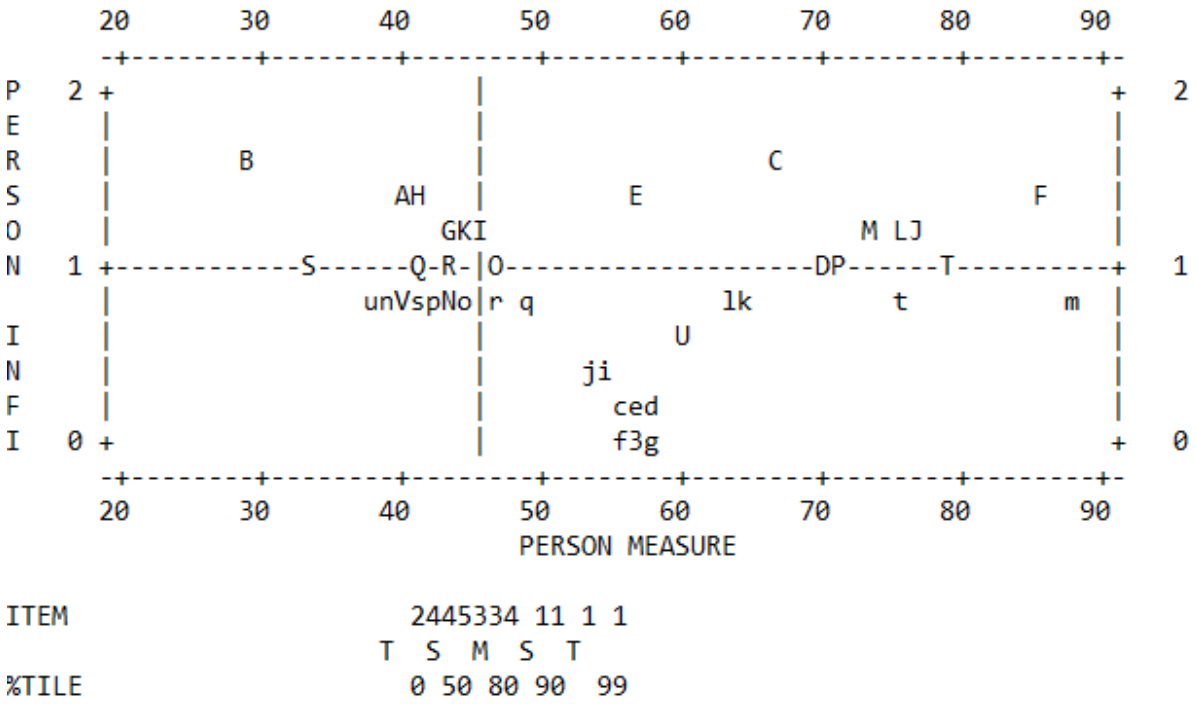
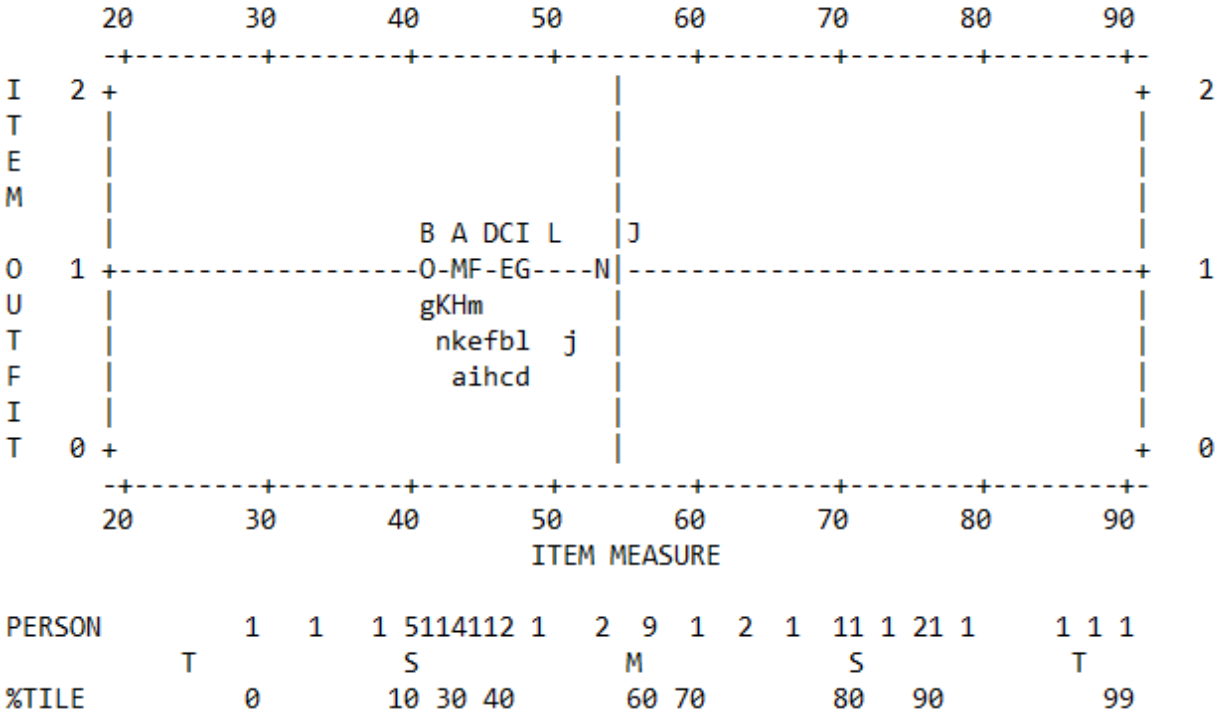
Appendix S

TDM – Person: Infit Plot



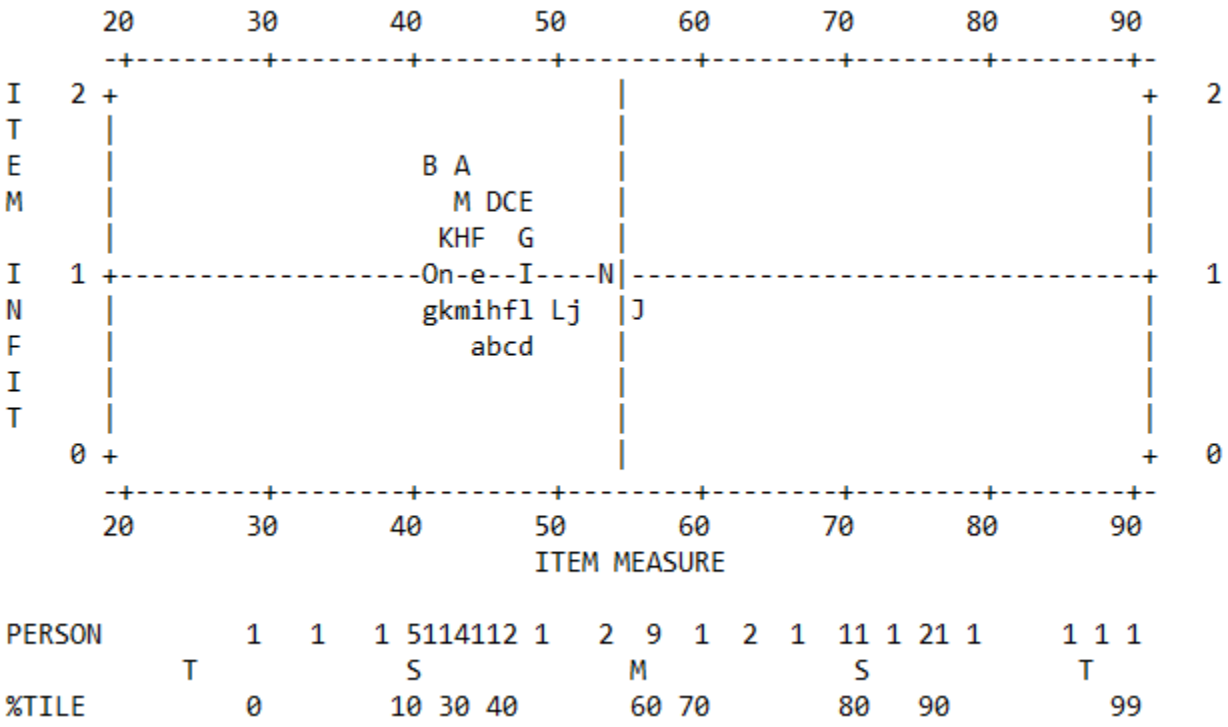
Appendix T

TDM – Item: Outfit Plot



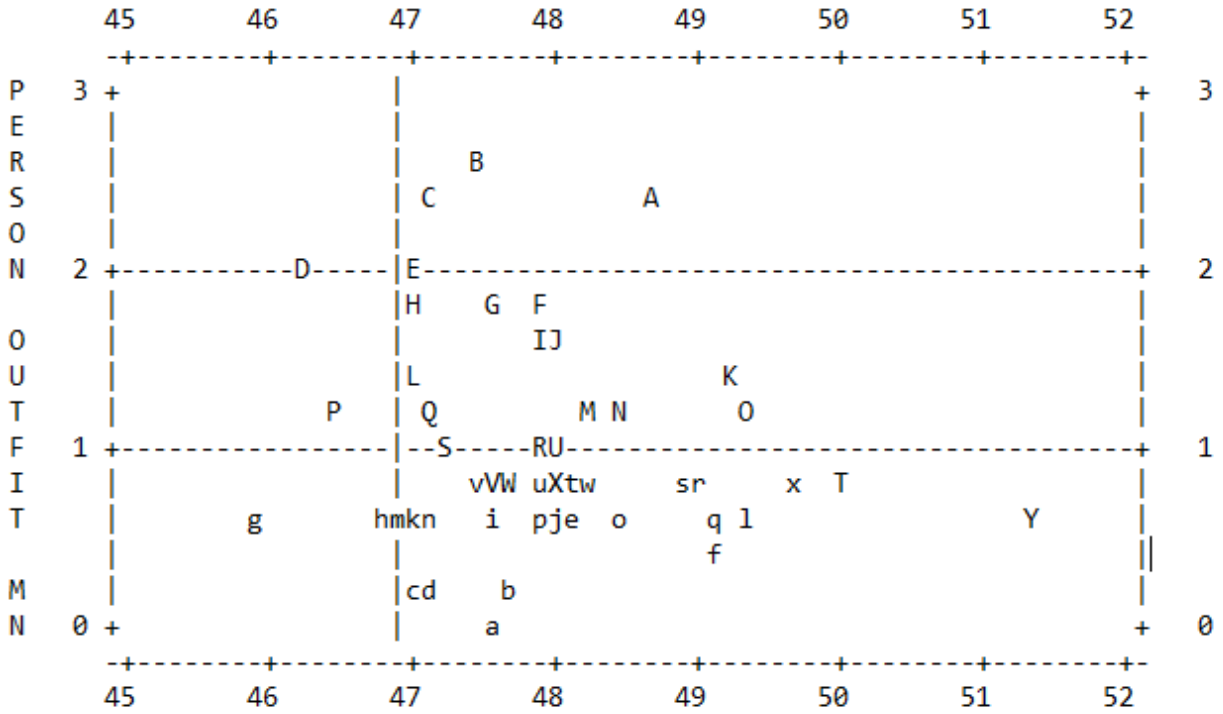
Appendix U

TDM – Item: Infit Plot



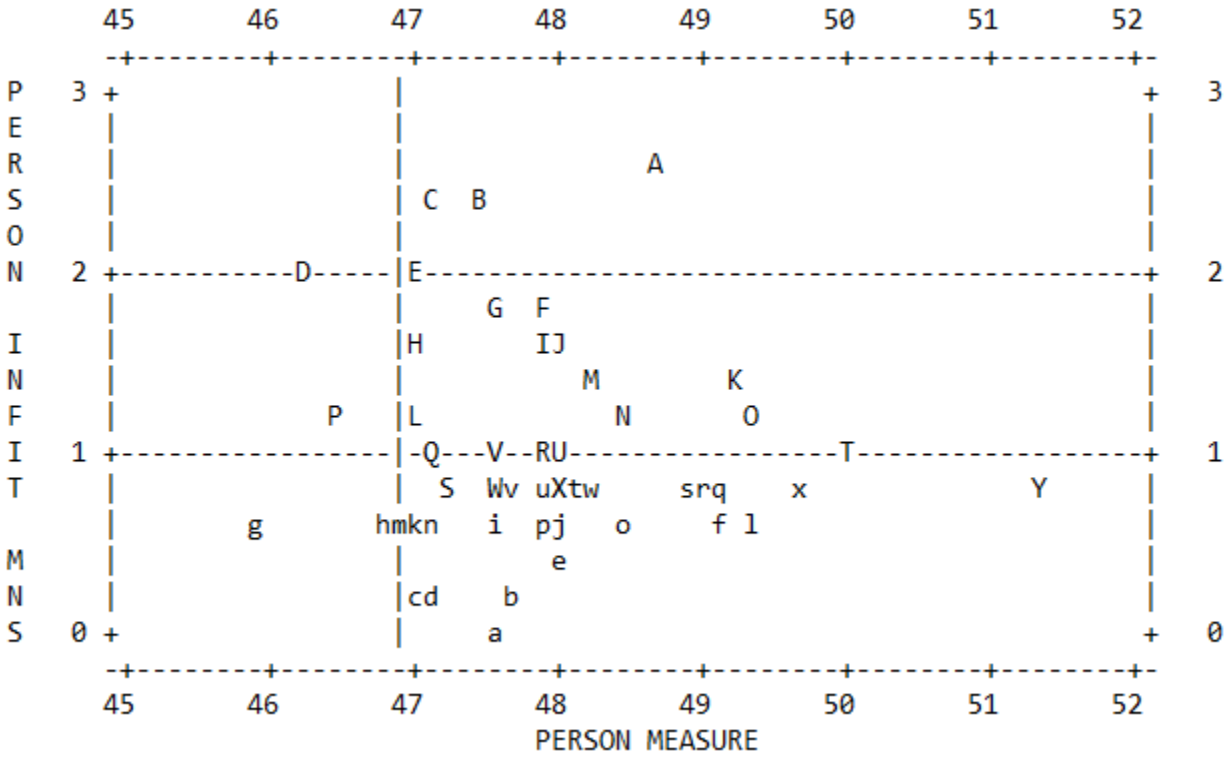
Appendix V

LCC – Person: Outfit Plot



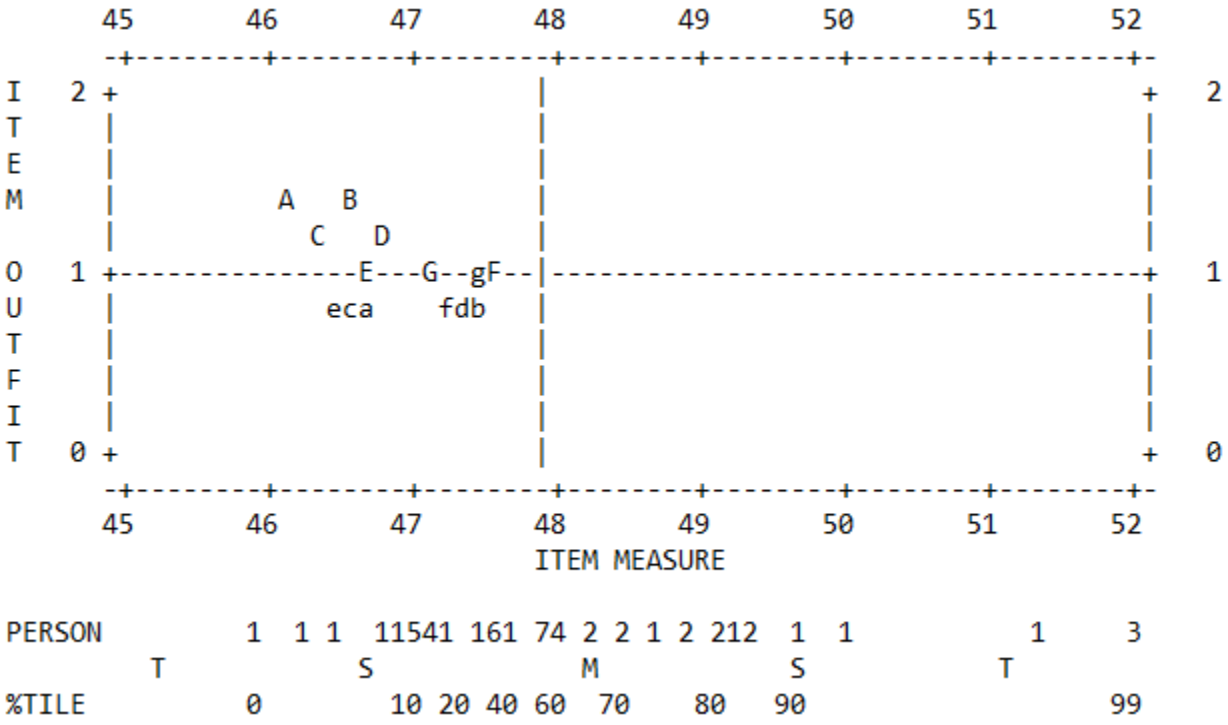
Appendix W

LCC – Person: Infit Plot



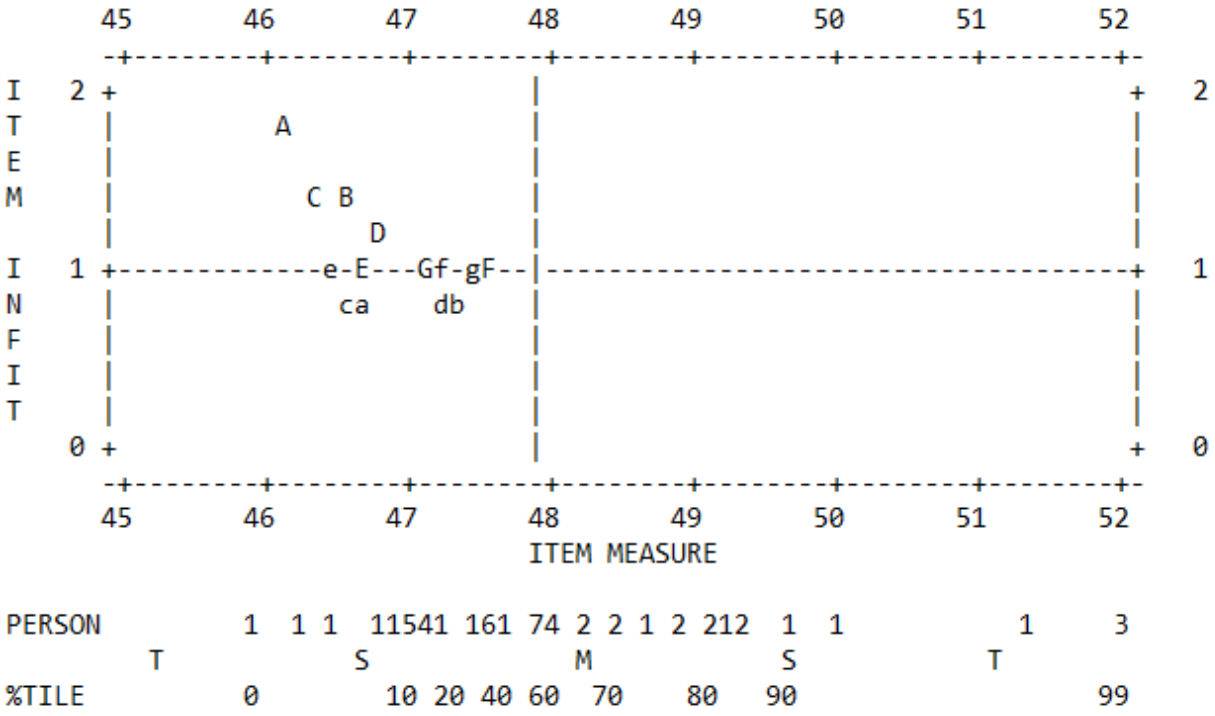
Appendix X

LCC – Item: Outfit Plot



Appendix Y

LCC – Item: Infit Plot



VITA

Michael Paul Kirkland was born in Sweetwater, Tennessee, to Ronald and Annis Kirkland. He is the youngest of three children, having two brothers, Brian and Tony. He grew up in Tellico Plains, Tennessee and graduated from Tellico Plains High School in 1997. Michael now lives in Madisonville, Tennessee with his wife, Teresa, and his three children, Jacob, Karli, and Emma.

Paul began his career in education as a high school mathematics teach, after receiving an A.S. from Hiwassee College and a B.S. from Tennessee Wesleyan College. He later earned his M.M. in Mathematics, Ph.D. in Educational Psychology and Research with a concentration in Evaluation, Statistics, and Measurement, and the PreK-12 Leadership Licensure Certificate from the University of Tennessee.

Currently, Paul is a veteran Mathematics teacher of 14 years at Sequoyah High School. He has been as a member of the school's data team, mentor teacher, liaison between the high school and community college, Possibilities in Postsecondary Education and Science (PiPES) Advisory Board member, and a Football, Track & Field, and Bowling Coach. Additionally, he has served as an Adjunct Professor of Mathematics and Statistics for Cleveland State Community College, Hiwassee College, and Pellissippi State Community College.