

Do Professional Learning Communities Influence Student Achievement? A Social Capital
Perspective

By

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CHAPTER 1: INTRODUCTION

Research on the professional learning communities (PLCs) is persistently focused on internal member relations with little recognition of the relevance of external ties of members to other actors in the PLCs' environment. In a network perspective, internal and external ties together represent the performance of a formal group. While internal ties represent member relations within a PLC, external ties denote member interactions with outside actors. Whereas internal ties affect harmony and shared trust, external ties enable the group to access to outside information, knowledge, innovation, and resources. Previous studies have primarily been concentrated on internal characteristics such as trust, collective learning, shared practices, and shared values and vision to examine PLC effectiveness and its effects on student achievement (Grossman, Wineburg, & Woolworth, 2001; Saunders, Goldenberg, & Gallimore, 2009; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006; Vescio, Ross & Adams, 2008). However, external interactions of teachers may play a significant role in their professional development and subsequent student achievement (Duncan-Howell, 2010; Hou, 2015; Matzat, 2013; Supovitz & Christman, 2005). In addition, the literature lacks a coherent theoretical framework that unifies internal and external ties of PLC members. This study utilizes Burt's (2005) social capital theory to examine PLC effects on student achievement. Burt's framework is unique because internal and external features of formal groups are considered simultaneously.

Background

The decline of student achievement has been, and continues to be, a concern of school faculty since it was indicated in *A Nation at Risk* (Denning, 1983) that American public schools were failing. Local, state and federal administrators have initiated several reform efforts to improve student achievement in the United States, such as the standards movement (Lewis,

1995), the No Child Left Behind Act (2002), and the Common Core State Standards Initiative (2010). These reform movements have focused much attention on the significance of professional development of teachers (Bausmith & Barry, 2011; Bishop, Berryman, Wearmouth, Peter, & Clapham, 2012; Butler, Lauscher, Jarvis-Selinger, & Beckingham, 2004). Since the 1980s, PLCs that offer professional progress for teachers have been promoted by practitioners and researchers (Hord, 1997; Mitchell & Sackney, 2000; Stoll et al., 2006; Toole & Louis, 2002).

There is no common definition of PLC in the literature. A dominant theme indicates that *a PLC is a group of professionals getting together for a shared purpose and working collaboratively to achieve professional progress for teachers and better outcomes for the students*. Similarly, PLC characteristics vary in the literature (e.g. Hord, 2004; Morrissey, 2000; Stoll et al, 2006; Stoll & Louis, 2007), yet there are some common features, including (a) supportive and shared leadership, (b) shared values and vision, (c) collaborative learning, (d) supportive conditions, (e) shared practice, and (f) mutual trust.

The research about, and practices of, PLCs suggest that professional communities may support not only student learning (Saunders et al., 2009; Vescio et al., 2008) but also instructional improvement (Hord, 1997; Kruse, Seashore Louis, & Bryk, 1994) as well as professional development (Armour & Yelling, 2007; Hadar & Brody, 2010). Although the notion of PLC has received significant attention, there is still a considerable lack of rigorous empirical and longitudinal work (Little, 2002; Stoll et al., 2006; Vescio et al., 2008). The key weakness is the exclusively internal focus, with little recognition of the relevance of external ties to PLC success. Researchers often examine trust, collective learning, shared practices, and shared values and vision. However, there may be a downside to examining individuals or

groups independent from their environments and networks (Hite et al., 2006). Therefore, the persistently internal focus on PLC member relations and omission of the external dimension may lead to inconclusive results in the study of PLCs.

Existing literature on PLCs can be addressed in terms of three orientations. Studies that take on a prescriptive orientation stress the power of PLCs for teacher development and student achievement by highlighting the benefits of productive member interactions (DuFour & Eaker, 2005; DuFour & Marzano, 2011; Hord, 1997; Mitchell & Sackney, 2000). Descriptive studies, on the other hand, emphasize how internal group processes in PLCs can improve teacher practices and student learning (Admiraal, Lockhorst & Van Der Pol, 2012; Andrews & Lewis, 2002; Bambino, 2002; Dunne, Nave, & Lewis, 2000; Wood, 2007). Finally, evaluative studies focus on empirical examination of teacher development and student achievement (Berry, Johnson, & Montgomery, 2005; Hipp, Huffman, Pankake, & Olivier, 2008; Hollins, McIntyre, DeBose, Hollins, & Towner, 2004; Rigelman & Ruben, 2012; Scott, Clarkson, & McDonough, 2011; Strahan, 2003).

None of the three perspectives in PLC research takes into account the relevance of external ties of PLC members. This is reflected in the choice of theories used for examining PLCs as well. For example, situated cognition theory (Riveros, Newton, & Burgess, 2012) addresses how PLC members influence one another's views within the group. Organizational learning theory (Bryk, Camburn, & Louis, 1999; Huggins, Scheurich, & Morgan, 2011) emphasizes how members learn from one another as they improve their practices and support the school's success. Constructivist learning theory (Armour & Yelling, 2007; Hoekstra, Brekelmans, Beijaard, & Korthagen, 2009; Hord, 2009) addresses the importance of collaborative or collective learning. Thus, PLC research lacks a sound and valid theory that

addresses internal *and* external member relations to understand PLC dynamics and performance better (Slegers, den Brok, Verbiest, Moolenaar, & Daly, 2013). Exclusive focus on internal member relations may also be associated with inconclusive results in PLC research.

Mainstream organization research suggests that group effectiveness is a function of internal and external features (Liao & Welsch, 2003; Oh, Chung & Labianca, 2004; Saxenian, 1994). While strong internal ties connect members to one another within the PLC, weak external ties are a gateway to innovation, novel information and useful resources (Ancona & Caldwell, 1992; Balkundi & Harrison, 2006; Brass, Galaskiewicz, Greve, & Tsai, 2004; Granovetter, 1973; Hansen, 1999; Tsai, 2001). In this context, a PLC—as a formal task group—can be described in terms of both its internal and external ties, and its effectiveness cannot be understood well without considering both types of ties.

Theoretical Background

The sociological concept of social capital presents a useful theoretical framework for addressing internal and external ties of members within a group. Social capital theorists suggest that individuals are surrounded with social relationships that facilitate access to valuable resources embedded in these social networks (Bourdieu, 2006; Lin, 1999; Portes, 1998). The notion of social capital suggests that social networks matter for social cohesion because they allow people to collaborate with one another (internal ties) and with actors they do not recognize directly (external ties) for reciprocal benefit (Field, 2008). Sociologists present a dis-similarity between two essential forms of social capital. Putnam (2001) separated the concept as bridging (or inclusive) and bonding (or exclusive). While bonding social capital represents internal ties and tends to emphasize exclusive characteristics and support uniformity, bridging social capital denotes external ties and tends to reinforce inclusive identities and reciprocity. According to

Woolcock (2001), the bonding ties refer to relations between people in similar situations, such as family members, close friends, and neighbors, while the bridging ties refer to more distant friends, associates, and colleagues. In other words, while bonding ties transpire within the PLC, bridging ties indicate member relations with other actors outside the PLC. Burt (2005) refers to bonding and bridging social capital as closure and brokerage, respectively.

In this study, social capital is defined as a function of internal ties as well as external ties (Burt, 2005). Burt (2005) stated,

facilitating the trust and collaborative alignment needed to deliver the value of external ties, internal interactions are a complement to external relations such that the two together define social capital in a general way in terms of internal interactions within a group and external ties beyond the group. (p.7)

According to Burt (2005), while external ties coordinate people who would be valuable to trust in an uncertain environment, internal ties cultivate cohesion and trust within the group.

Burt (2005), therefore, unified seemingly separate understandings of internal and external ties. His typology addressed outcomes of both external and internal relationships. The task performance of a group is highest when both internal and external interactions are high.

Statement of the Problem and Purpose of the Study

Since the notion of PLC came into prominence, it has received significant attention, and many studies have been published that have examined its impact on teacher development and student achievement (Stoll et al., 2006; Vescio et al., 2008). However, there is still a need for rigorous empirical and longitudinal work (Little, 2002; Stoll et al., 2006; Vescio et al., 2008). This study argues that PLC researchers focus their attention on internal aspects of teacher interactions, while consideration of external ties is omitted in the PLC literature. A PLC—as an

organization or group—can be defined by both its internal and external ties. Focusing on only one dimension may result in mixed findings.

The purpose of this quantitative study was to examine the internal and external relationship among PLC members and the effects of these relationships on student achievement. In this study, the social capital theory was relied upon to conceptualize PLC effectiveness. While the social capital theory has been applied to many aspects of education (Dika & Singh, 2002), it has not been applied as extensively to the issues of teachers' work. The social capital theory not only captures various internal aspects of PLC dynamics (e.g., harmonious and supportive interdependence) but also addresses other aspects related to innovation and creativity (e.g., exposure to novel ideas from outside the PLC). In addition, it sets the stage for operationalization of PLCs' functional attributes for a robust test of outcomes such as student achievement.

CHAPTER 2: LITERATURE REVIEW

Professional Learning Community as a Contemporary Concept

Many observers view American public schools as failing institutions. One solution to this problem is PLCs. Since "A Nation at Risk"(Gardner, 1983) indicated that American public schools were failing, local, state and federal administrators have initiated several reform efforts to improve student achievement in the United States. such as the standards movement (Lewis, 1995), the No Child Left Behind Act (2002), and the Common Core State Standards (Common Core State Standards Initiative, 2010). PLCs are considered as a promising solution to this problem. Since the 1980s, practitioners and researchers have promoted PLCs for providing professional progress (Hord, 1997; Marzano, 1998; Mitchell & Sackney, 2000; Stoll et al., 2006; Toole & Louis, 2002).

After "A Nation at Risk" report identified the problems related to teaching staff, researchers began to focus on teachers' working conditions, collaborations and collegiality (Kelchtermans, 2006). Little (1982) concluded that teachers in successful schools pursued professional interactions with colleagues more than those in unsuccessful ones. Similarly, Rosenholtz (1989) found that teachers who received support from their colleagues in their work settings were more dedicated and effective than others. Peter Senge (1990) defined a learning organization as one "where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together" (p. 3). After transferring the concept into the field of education, "learning organization" became the basis for understanding PLCs (Hord, 2004; Thompson, Gregg, & Niska, 2004).

The precise definition of PLC varies in the literature. Table A1 in the Appendix reviews existing definitions. In essence, a PLC consists of a group of professionals working collaboratively for improving student achievement and fostering educational change by means of common ideals, vision, and practices. Ideally, they teach and learn from one another in an environment of mutual trust. PLCs ideally work collaboratively through insightful and constructive discussion to improve student learning and to reach their professional goals.

Certain characteristics of successful PLCs are emphasized in the existing literature (Hord, 2004; Morrissey, 2000; Stoll et al, 2006; Stoll & Louis, 2007). For example, Hord (2004) focused on five features: (a) supportive and shared leadership, (b) shared values and vision, (c) collective learning and application of learning, (d) supportive conditions, and (e) shared practice (p. 9). In more recent studies, some other characteristics have been added, which expanded these five features to eight or more (Clausen, Aquino & Wideman, 2009; Sigurðardóttir, 2010; Stoll et al., 2006). Table A2 in the Appendix shows the characteristics of PLCs used by several scholars in the literature.

Weaknesses in the Existing Research on PLCs

Although the notion of PLCs has received significant attention, particularly with respect to the relationship between PLCs and student achievement (Avalos, 2011; Stoll et al., 2006; Vescio et al., 2008), there is still a significant lack of rigorous empirical work (Little, 2002; Stoll et al., 2006; Vescio et al., 2008). Stoll and her colleagues (2006) stated that “little is yet known about the potential for establishing enduringly effective PLCs” (p. 247). The concept is new and requires much work to examine its true potential. A key weakness is the persistently internal focus on PLC member relations with little recognition of the relevance of external ties of members to other actors in a PLC environment. Researchers tend to find PLC effectiveness and

its effects on student achievement through using inherent characteristics such as trust, collective learning, shared practices and shared values and vision.

Scholars propose the PLC notion as a knowledge acquisition process through interaction with one another "in an ongoing, reflective, collaborative, inclusive, learning-oriented, growth-promoting way (Stoll & Louis, 2007, p. 2). All members share a common vision and exchange information in a trusted environment (Bolam et al., 2005; Sigurðardóttir, 2010). Bryk et al. (1999) noted "by far the strongest facilitator of professional community is social trust among faculty members. When teachers trust and respect each other, a powerful social resource is available for supporting collaboration, reflective dialogue, and de-privatization characteristics of professional community." (p. 767). This powerful social resource is based on relatively dense and strong internal ties among faculty members (Coleman, 1988). Focusing on internal aspects creates a "strong in-group loyalty" (Putnam, 2001) that inhibits accessing novel information and useful knowledge outside the group (Burt, 2005).

Individuals and groups cannot be segregated from their external environments. External environments and networks of the schools present useful and additional organizational resources to improve school performance (Hite et al., 2006). Similarly, teachers' external ties help them access novel information and knowledge to develop their teaching practices and to increase student learning (Burt, 2005). Consequently, the persistent internal focus on PLC member relations and the exclusion of the external dimension may lead to a bias in the findings of PLC effectiveness. The next section will divide PLC studies into three categories: (a) prescriptive, (b) descriptive, and (c) evaluative, and clarify how scholars emphasize the internal features of PLCs.

Persistent Focus on Internal Member Relations

Scholars persistently focus on internal PLC member relations while ignoring external ties of members to other actors in a PLC environment. Internal and external features stem from a network perspective. From a network standpoint, internal features represent the characteristics of a PLC arising from the interactions among its members, such as trust, information channels, norms, and sanctions (Coleman, 1988). Internal features mostly cohere with the PLC characteristics indicated in Table A2 in the Appendix. It can easily be realized that the external dimension, which denotes the external ties of the members outside of the PLC, is ignored in the existing PLC studies.

A considerable proportion of *prescriptive* studies in the existing literature on PLC suggested that the use of PLCs can increase student learning (DuFour & Eaker, 2005; DuFour & Marzano, 2011; Hord, 1997; Mitchell & Sackney, 2000;). The researchers typically focus on the need for shared vision and values, collective responsibility, mutual trust, shared goals, collaboration and de-privatization of practice that develop the internal ties of PLC members. For example, Hord (1997) proposed that successful PLCs should include collegial and facilitative participation, shared vision among teachers, and collective learning among staff. These features highlight the close relationships in PLCs. Similarly, focusing on internal dimensions of PLCs, DuFour and Eaker (2005) offered specific and practical recommendations for educators to transform their schools as learning communities.

In this vein, there are also *descriptive* studies that are limited to accounts of how PLCs can improve internal teacher practices and relationships, assuming that such dynamics would result in increased academic performance (Admiraal et al., 2012; Andrews & Lewis, 2002; Bambino, 2002; Dunne et al., 2000; Wood, 2007). For example, Admiraal, Lockhorst and Van

Der Pol (2012) offered a descriptive model for PLCs. They determine three main features of a learning community: "group identity, shared domain and goals and shared interactional repertoire" (p. 348). All these features emphasized the characteristics inherent in group member collaboration.

Wood (2007) described two learning communities in different schools and contrasted their internal practices. While the first learning community adhered to techniques that operate PLC sessions, the other learning community used mutual interactions about real issues of practice. Neither school investigated the external ties of members. Instead, their focus was on shared knowledge among members. Therefore, the members' knowledge, based on their own experiences, lacked novel information and innovation (Burt, 2005). Soon after, the same practices circulated among the same members of a PLC.

Dunne et al. (2000) examined the Critical Friends Groups (CFG) project which aimed at training the coaches who would create a collegial culture in their schools. They constituted an evaluation team to determine the effectiveness of the project in meeting short-term and long-term objectives. In this study, the authors compared the practices of nonparticipants to the practices of teachers who participated in critical friends groups. The researchers argued that CFG participation plays an important role in teachers' attitudes and relationship. To measure CFG effectiveness, they implemented a Professional Climate Survey that addressed professional engagement and teacher collaboration in school. These questions also measured the internal factors of group relationships.

While there are a number of studies that include an *evaluative* component, few, if any, offered findings strong enough to support normative assumptions about PLC effects on academic performance. Some of these studies were qualitative and, thus, highly contextualized (Blasé &

Blasé, 1999; Carroll, 2005; Chou, 2011; Craig, 2013; Curwood, 2011; Dix & Cawkwell, 2011; Huggins et al., 2011; Hunuk, Ince & Tannehill, 2012). Qualitative studies also tend to examine internal features of PLCs. For example, Curwood (2011) examined the PLC effects on 12 participants and their students' health-related fitness content knowledge. Using mixed method research with experimental pre–post design, he observed the change in participants' teaching practices and teaching culture. Thus, he excluded the effects of teachers' external interactions from the study. Generally, qualitative studies focused on participants' interactions during the meetings, attitudes towards PLC strategies, and how these relate to classroom performance (Chou, 2011; Curwood, 2011; Dix & Cawkwell, 2011). Inherently, if researchers do not examine external interactions of PLC members, the impact of external ties of PLCs on teacher practices and student achievement are ignored.

The qualitative studies examining teachers' relations necessarily have their full attention focused on identifying the effects of mutual interactions in a PLC. The full network of social relations that help build the community are ignored. An internal perspective is prone to emphasize that teachers learn from one another in formal meetings rather than from outside discussions that occur in school corridors, lunchrooms, or other places (Penuel, Riel, Krause, & Frank, 2009). Researchers tend to focus on PLC characteristics as the only way to improve teacher and student learning, rather than on interactions that occur within the school or outside the school. PLC researchers tend to acknowledge that the quantity and the quality of PLC meetings build up the knowledge, but they tend not to focus on the role of informal ties of the members in facilitating access to novel information, valuable resources, and expertise.

Similar to qualitative studies, quantitative studies also focus on internal interactions; they also tend to lack important covariates and rely on “percent proficient” as a key outcome, which

can be prone to considerable bias and measurement error due to changes in cut scores, tests, and reporting conventions (Berry et al., 2005; Hollins et al., 2004; Phillips, 2003; Strahan, 2003). A notable exception is Louis and Mark's (1998) study, which relies on individual test scores and accounts for a host of student background characteristics. However, as the authors noted, this study utilized a nonrepresentative sample of schools, and much of the PLC effects on achievement disappeared when predictive models accounted for pedagogical quality in instruction in the classrooms.

In a manner similar to other studies, quantitative studies are prone to examine internal characteristics of PLCs. Goddard, Goddard and Tschannen-Moran (2007) conducted a study including a sample of 47 elementary schools with 452 teachers and 2,536 fourth-grade students. For measuring PLC effect, they used a teacher collaboration scale with no item asking about external ties of PLC members. This scale measured the degree of teacher collaboration influence on types of decisions. Some questions were "Selecting instructional methods and activities" and "Evaluating curriculum and programs" (p. 893). In this study, it is not clear that the source of the knowledge that changes the decision about which instructional method is better than the other source. This knowledge may be flourished within PLC meetings or develop among informal interactions with outside actors. Without examining the impact of external ties, the real effect of PLCs may not be well understood.

Similarly, Wiley (2001) used mean math teachers' opinion of the school's professional community (TPROFC) to measure the characteristics of PLCs. Some variables used to construct composite measure are "teachers change approach if students are not doing well" and "teachers believe different methods can affect achievement"(p. 16). These variables did not measure teachers' external ties, which are a unique way to access novel information and innovation.

Wiley found that "the composite measure of professional community has no effect on student achievement" (p. 27). This result could be different if external ties were taken into account because external actors may provide fruitful insights to PLC members.

Researchers typically tended to examine PLC characteristics together as a whole (Goddard et al., 2007; Lee & Smith, 1996; Louis & Marks, 1998). Combining PLC features in one score may be logical; however, the distinct and unique impact of each feature would provide useful insights into PLCs. Therefore, the effects of internal and external ties of PLC members should be taken into account separately when examining PLC impact on teacher development and student achievement. Internal effects cannot explain the knowledge gain without external ties that help access novel information and innovation (Burt, 2005).

Lack of a Rigorous Theoretical Framework

A deeper problem in PLC research is the absence of a coherent theoretical framework with a strong disciplinary grounding. Slegers et al. (2013) argued, "While many studies assume that the dimensions that underlie PLCs are interrelated, this assumption is, from our perspective, neither theoretically grounded nor systematically validated" (p. 120). Several studies addressed above relied on broad and varying definitions of teacher collaboration as the essential construct to help explain PLC effects (Berry et al., 2005; Carroll, 2005; Craig, 2013; Hollins et al., 2004). However, limiting the conceptualization only to the interpersonal dimension of teachers' work can result in theoretical underspecification that leads to mixed findings.

Scholars utilized various theories to test PLC effects. Riveros, Newton and Burgess (2012) suggested situated cognition theory to understand PLCs better. In this theory it was argued that learning is not isolated from its situation and context. The thinking and doing process is embedded in a particular situation, and the environment, other learners, and activities

that lead to novel knowledge should be taken into account (Pella, 2011). Using situated cognition as the theoretical framework, Pella (2011) examined four teachers from suburban and urban middle schools. Her analysis was based on participants' engagements in their own PLCs. She observed their behavior in each of their PLC meetings because the theory drove her to collect the notes in the context in which learning took place. Therefore, situated learning theory, by nature, dictates the internal characteristics to the researchers.

Another theory used in the PLC literature is organizational learning theory (Huggins et al., 2011). This theory is based on the idea that all learning processes are directed in line with the organizational requirements. Similarly, Bryk, Camburn, and Louis (1999) used the combination of organizational learning and teacher professionalism as a theoretical framework. They asked several questions to measure organizational learning and professional community. All items referred to the collaboration among teachers within the school.

Another learning theory utilized by scholars was constructivist learning theory (Armour & Yelling, 2007; Hoekstra et al., 2009; Hord, 2009). This theory argued that learning occurs in a social context in which learners work collaboratively and share new knowledge mutually. According to this framework, teachers learn from one another when they engage in learning activities in their workplace.

Caroll (2005) introduced a new theoretical framework to analyze the PLC meetings' conversations. His framework used the "interactive talk" of the participants to reveal "participant frameworks" over common ideas. Then, a speaker "re-voices" the ideas to negotiate and represent the meaning of joint experience. After all this, the members reach a "collaborative conversation floor" when they develop a common idea.

There are also a number of studies that treat the PLC as a theoretical construct in its own right, without contextualizing PLCs in reference to broader theories of teamwork and organizational design (Bolam et al., 2005; Hipp et al., 2008; Huffman, 2003; Sargent & Hannum, 2009). For instance, Hipp and her colleagues (2008) did research to find the relationship between PLCs and school culture. The theoretical framework of this study was based on the construct of the professional learning community. The authors applied the framework of Hord's (1997) study, including five internal characteristics of a PLC to change and school culture literature. Similarly, Huffman (2003) used Hord's (1997) construct as a theoretical framework to explain vision development in schools. In another relevant study, Mullen and Schunk (2010) viewed professional learning communities as "both theory and application of principles and practices in schools" (p. 186). Finally, Bolam et al. (2005) assessed professional learning communities as a concept, but they did not address broader theories of teamwork or organizational design.

The theories used in the literature typically emphasized the internal characteristics of member relationships in PLCs. PLC research lacks a sound and valid theory focusing on internal and external ties to understand better the interrelatedness of group dynamics (Slegers et al., 2013). Exclusive focus on internal member relations may lead to inconclusive results in PLC studies.

The Consequence of an Exclusively Internal Focus

Between 1986 and 2016, several quantitative and qualitative studies of PLCs have been conducted to determine their effects on student success (Louis & Marks, 1998; Saunders et al., 2009; Vescio et al., 2008). However, the findings are inconclusive. One plausible explanation for the inconclusive results is the exclusive focus on internal member relations. External ties are

omitted. Group/organization research reveals that if group members get along "well" but do not interact with parties outside, then they may suffer from a lack of innovation, valuable resources, knowledge, and information (Vissa & Chacar, 2009). Also, there is a significant relationship between external relations and performance (Ancona & Caldwell, 1992; Balkundi & Harrison, 2006). Based on the data collected from the managers of 38 new-product teams, Ancona and Caldwell (1992) found that the pattern of external interactions was a predictor of better team performance. Similarly, Balkundi and Harrison (2006) found that teams with more intergroup relationships in networks tended to perform better than the others.

In that vein, some researchers argued that group effectiveness is a function of internal and external features (Liao & Welsch, 2003; Oh et al., 2004; Saxenian, 1994). For example, Saxenian (1994) found that the success of firms in Silicon Valley was a function of organizational efficacy within firms and effective synchronization between firms. Similarly, Oh, Chung and Labianca (2004) studied over 77 teams from 11 organizations in Korea and found that the optimal level of group effectiveness was provided by a moderate level of internal ties within a group and a high level of external ties between groups. Liao and Welsch (2003) studied over 400 emerging entrepreneurs using the Panel Study of Entrepreneurial Dynamics (PSED). They concluded that technology-based entrepreneurs take advantage of external ties, while nontechnology-based counterparts benefit from internal ties.

As teachers struggle to increase student learning, innovation and creativity receive significant attention. Not only creative contributions to teaching practices, but unique ideas and solutions can play an important role in student learning. Mainstream organization research suggested that innovation comes to groups with external ties (Ancona & Caldwell, 1992; Balkundi & Harrison, 2006; Brass et al., 2004; Perry-Smith & Shalley, 2003; Rodan & Galunic,

2004). For example, Rodan and Galunic (2004) studied 106 middle managers in a European telecommunications company. They found that external ties, as a source of diverse knowledge and innovation, were closely related to performance. In addition, Perry-Smith and Shalley (2003) stated that access to novel information may facilitate creativity. They also noted that the exposure to new knowledge may help generate different options and flexible thinking. They suggested that weak ties were important when creativity is needed. According to the review of network studies by Brass et al. (2004), consequences of external ties are imitation, innovation and performance.

Unlike the strong ties that bind the members within a PLC and transmit group information, external ties are resources of new information and knowledge because they bridge outside groups (Podolny & Baron, 1997). Thus, knowledge and useful information flow through external ties (Brass et al., 2004; Granovetter, 1973). For instance, groups having weak external ties and communicate with outside actors frequently have better access to genuine information and potential assets outside (Hansen, 1999; Tsai, 2001). Likewise, Podolny and Page (1998) argued that external ties that transfer information and knowledge from one group to another facilitate learning. In addition, they contended that innovative knowledge may be created in networks rather than within the group.

Using data from 101 engineers in a petrochemical company and 125 consultants in a strategy consulting firm, Cross and Cummings (2004) found that external ties outside the organization contribute to an individual's overall performance. Similarly, using data from research scientists, Perry Smith (2006) concluded that weak ties support creativity, and having a large number of outside ties reduces the network centrality effects on creativity. In other words, when scientists have low centrality at work, which means that these scientists are probably less

aware of ongoing activities in the network, but have numerous ties outside, their creativity performance is equally high as those who have high centrality at work.

Together, these findings from mainstream organization literature illustrate the importance of external ties. In this sense, a PLC—as a formal task group—can be described in terms of its internal and external ties, and its effectiveness cannot be well understood without considering both types of ties. When the external dimension of PLC dynamics is ignored, results can be inconclusive. Since group effectiveness is a function of internal and external features (Liao & Welsch, 2003; Oh et al., 2004; Saxenian, 1994).

PLC results can be inconclusive because of several reasons. First, PLC studies tend to emphasize that the learning mechanism occurs through formal meeting interactions rather than through outside discussions happening in school corridors, lunchrooms, or other places (Penuel et al., 2009). Penuel and colleagues (2009) suggested some benefits of examining the internal and external ties among the teachers in a school: (a) a consideration of the network structure may better explain the internal structure of a school, (b) analyses of internal and external ties can produce measures to explain changes in teachers' practices, and (c) network analyses can produce useful data to help determine the success of PLCs and evaluate and improve the system.

Second, researchers tend to focus on internal features as the only way to improve teacher and student learning. This rationale may be wrong because teachers have informal ties, not only within but also outside the school. For example, teachers have increasingly used online communities for professional support, assistance, innovation, and motivation (Duncan-Howell, 2010; Hou, 2015; Matzat, 2013). Teachers may access professional development not only through the PLCs within a school but also through an online community (Duncan-Howell, 2010). In her study, Duncan-Howell (2010) stated that teachers prefer online communities because the

schedule is flexible, solutions are created rapidly, responses are fast, and the information can be authentic. In addition, Matzat (2013) argued that blended communities, a combination of online and real-life interaction, "provide more practical benefits to teachers, both in terms of perceived improvements to their teaching capabilities as well as for their substantial understanding of their core topic"(p .40). Teachers' external interactions will need to be taken into account to understand better the effects of PLCs on teacher development and student achievement.

Third, in the research about PLCs, the quantity and quality of PLC meetings is viewed as key for group functioning, but outside influences on internal information, resources, and expertise are ignored. For example, based on their study in Cincinnati and Philadelphia, Supovitz and Christman (2005) found that creating teacher communities is insufficient to improve student learning significantly without district support. They stated, "districts and school leaders must provide the communities with the necessary structures, strategies, and support to help teachers hone their instructional craft knowledge" (p. 649). Thus, looking at the problem from only one side (i.e., internal group relations of teachers) dilutes the PLC effects. This may lead to misunderstandings about PLC effects because external ties are closely related to innovation (Ancona & Caldwell, 1992; Balkundi & Harrison, 2006; Brass et al., 2004; Rodan & Galunic, 2004), creativity (Perry-Smith, 2006; Perry-Smith & Shalley, 2003), access to new information and knowledge (Brass et al., 2004; Granavotter, 1973; Hansen,1999; Podolny & Page, 1998; Tsai, 2001) and performance (Cross & Cummings, 2004; Perry-Smith, 2006).

Last, but not least, the role of the external ties is unclear in PLC research. For example, Hadar and Brody (2012) offered four professional development stages: "anticipation and curiosity, withdrawal, awareness, and change" (p. 147). In withdrawal stage, while they were explaining the reason for the withdrawal, they did not consider the informal ties of teachers.

External connections are important because, in recent years, teachers tend to attend online communities to access novel information and innovation (Duncan-Howell, 2010; Hou, 2015; Matzat, 2013). Without considering external interactions, PLC effects cannot be well understood.

In their study focusing on student achievement, Crippen and his colleagues compared the scores of students in two different assessment tests: the Nevada High School Proficiency Exam; and the Iowa Test for Educational Development. Teachers of these students were divided into three groups: (a) treatment group in which teachers fully participated in the professional development program, (b) partial treatment group in which teachers showed limited participation, and (c) the comparison group in which teachers did not join in other groups (Crippen, Biesinger & Ebert, 2010). Using the Iowa Test for Educational Development as a covariate, univariate analysis showed no significant difference between the three adjusted marginal group means. In addition, the comparison group demonstrated no significant difference from the partial treatment group. If external interactions of teachers were taken into account, the results would be different than the current outcomes. The comparison group teachers may have more external ties than the others, so they may access novel information required for student achievement. Without external features, the difference between groups cannot be understood well.

On the other hand, in her study focusing on three online communities for teachers (n=98), Duncan-Howell (2010) concluded that online communities provide valuable knowledge to their members. Based on the survey results, the majority of participants reported that online communities are useful sources for professional development. In addition, some respondents agreed that participation in online communities changed their practices while others did not have

the same opinion. The participants who did not share the same opinion may have changed their practices in their school PLCs before participating in online communities. This issue was not clear in Duncan-Howell's study, which examined only the external interactions of teachers. She did not present any background information about participants' internal ties in their schools. The real effect of learning communities on professional development and student achievement may be clarified by examining internal and external dimensions together.

Consequently, if organizations are isolated from their external environment, interpretations would be irrelevant, and a new conception of human beings would be needed (Riveros et al., 2012). Internal focus on PLC features constrains teachers from novel information, usable knowledge, innovation, and creativity. The lack of the impacts of external ties in PLC studies and a theoretical foundation that unifies internal and external features of PLCs may lead to highly questionable findings. In this context, this study will use the social capital theory, when addressing internal and external ties at the same time. The next section will review the social capital theory as a potential solution to key weaknesses in PLC research.

Social Capital Perspective as a Solution to the Key Weakness in PLC Research

As an important step in resolving both conceptual and empirical issues in the existing literature on PLCs, this study drew on the notion of social capital from organizational sociology. Social capital theory is unique because it emphasizes both internal and external ties as central dimensions of effectiveness for *any* formal task group. PLC social capital can be rooted in social interactions between PLC members within a PLC and/or it can be derived from social relations between PLC members and outside actors. Existing research on social capital contended that internal and external forms of social capital play an important role in group performance (Cross & Cummings, 2004; Oh et al., 2004; Perry Smith, 2006). Internal ties improve group

performance through interpersonal relations and communication (bonding view) and external ties increase group performance through innovation and knowledge transfer (bridging view) (Coleman, 1988; Putnam,2001).

Thus, the social capital theory not only captures various aspects of PLC functioning addressed in previous studies (e.g., harmonious and supportive interdependence) but also addresses other aspects related to innovation and creativity (e.g., exposure to novel ideas from outside the PLC). In addition, it sets the stage for operationalization of PLCs' functional attributes for robust tests of correlations with intended outcomes, such as student achievement. This view works because it introduces coherence to disparate insights from PLC literature. Also, social capital theory extends our understanding by highlighting the importance of external ties. Finally, it presents a robust theoretical grounding for PLC research because it has been used in organizational sociology for a long time. The next section will outline social capital theory.

Social Capital Theory

Social capital differs from other forms of capital. While economic capital refers to wealth, and human capital refers to the stock of knowledge, social capital is embedded in the nature of the social relationships of people. To acquire social capital, one must be connected to others (Portes, 1998). Therefore, social capital arises from the interactions among people. The different kinds of social interactions may be classified as the sources of interactions (Adler & Kwon, 2002). Social capital is a multidimensional concept that emphasizes both strong internal ties (closure) and weak external ties (brokerage). Closure highlights strong relationship ties among group members. From this point of view, trust, social norms, sanctions, and cohesion among members create social capital (Coleman 1988). Similarly, Putnam (2001) argued that internal ties strengthen reciprocity, solidarity, and trust. Conversely, network research in the

social capital literature underscored the importance of weak external ties that enable individuals to access possible outside information and resources for people and organizations. Likewise, Gronevetter (1973) argued that weak ties are more important to reach possible mobility opportunity than are strong ties. In cultivation of social capital, both the structure of the network and the quality of bonds play an important role (Bourdieu, 2006; Burt, 1997)

Pierre Bourdieu provided the first systematic modern analysis of social capital (Portes, 1998). Bourdieu (2006) defined social capital as “the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition” (p. 110). Social capital is a collection of resources based on people's personal and social acquaintance. In addition, the French sociologist managed to draw attention to two points. First, individuals have access to various possibilities through the relationships they have and, second, the quantity and quality of these relationships, namely the density of the network, affect resources available to them (Portes, 1998).

Also, volume and strength of the bonds are important to Bourdieu (2006). He argued that “the profits which accrue from membership in a group are the basis of the solidarity which makes them possible” (p. 110). Individuals do not inherently possess social networks. They seek to construct them by developing group relations that are useful for their future benefits.

An individual's social capital is a function of the size of the communication networks. The status of individuals in the community is directly proportional to the potential sources of social relationships that they have. Bourdieu (2006) emphasized concepts such as titles, names, friends, organizations, membership, and citizenship. People deliberately establish social relations to attain future benefits and to increase their capital. Bourdieu (2006) argued that the

investments in social capital can be perceived as a waste in the short term, but in the long run should be seen as a form of a solid investment that will result in monetary gains.

While there can be different perspectives to explain social capital theory (Woolcock & Narayan, 2000) in the literature, Adler and Kwon (2002) divide them into two basic traditions. In the first tradition, research on social capital focuses on the content of the ties that make up the social network, such as trust, social norms, and beliefs. In the second tradition, research emphasized the source of social capital in the formal structure of the ties. Woolcock and Narayan (2000) termed the second one as "network view of social capital" and underscored "the importance of vertical as well as horizontal associations between people and of relations within and among such organizational entities as community groups and firms" (p. 230).

The first perspective focuses on the content of social capital, such as social norms and trust. Coleman (1988) conceptualized social capital over the creation of social capital. According to Coleman, social capital exists in the relations between people, (i.e., in their social networks). Coleman believed that people tend to make relationships with others because these ties contain resources. Coleman (1988) defined social capital as (a) trustworthiness of the environment, (b) information channels, and (c) norms and sanctions. The nonmaterial positive values in society, such as justice, friendship, and confidence play a significant role in an individual's life. Social capital exists naturally in relations between and among people.

A contemporary figure in research on social capital is Robert Putnam, whose views gained currency particularly after publishing his "Bowling Alone (2001)." Contrary to Bourdieu (2006) and Coleman (1988), Putnam discussed the social capital in the societal level. In his theory, the important subject is collective action as opposed to individual action and purposes. Putnam (2001) defined social capital as: "social capital refers to connections among

individuals—social networks and the norms of reciprocity and trustworthiness that arise from them” (p. 19). According to Putnam (2001), social networks are valuable and have an influence on the efficiency of individuals and groups. The density of networks among people has shown the degree of social capital. Putnam (2001) argued that if a society shows moral excellence, but its individuals are isolated, social capital in this society will be weak. Networks are related not only to contacts but also to sturdy norms of mutuality.

Putnam (2001) defined some important functions of social capital. First, social capital easily reduces collective problems. Putnam saw networks and social norms as the mechanisms that solve the coordination challenges in communities. Second, social capital is a lubricant in a society that allows people to advance easily, because when people are trustworthy and trust each other “social transactions are less costly” (Putnam, 2001, p. 312). Third, social capital allows people to realize that individuals in society are connected to each other, and everyone should achieve a common consciousness. Next, social ties serve as means to reach useful information for our goals. Lastly, social capital improves people's life psychologically.

The second tradition is the network view of social capital that underlines the internal and external ties. While internal ties denote close relationships among people within the group, external ties represent connections outside the group. Putnam (2001) called the outcome of the strong internal ties that provide trust as bonding social capital, and the product of weak external ties that connect different groups as bridging social capital. Likewise, Burt (2005) suggested that two different network structures, closure and brokerage, are compatible with bonding and bridging social capital.

Closure (Internal Ties)

This perspective is based on Coleman's (1988) network closure view. Coleman defined closure as a “property of social relations on which effective norms depend” (p. S105). He stated that, if closure lacks in social structure, norms will not exist. Closure means that a social structure is in a closed loop that has relatively dense, strong ties among the members of the cluster and relatively few weak ties to those who are independent of this social structure. Similarly, Putnam (2001) argued that closure supports reciprocity and solidarity, develops trust within the group, and provides psychological support. He called closure as bonding social capital that creates "strong in-group loyalty" and this leads to "strong out-group antagonism" (Putnam, 2005).

Coleman (1988) defined three forms of social capital: “obligations and expectations, which depend on trustworthiness of the social environment, information-flow capability of the social structure, and norms accompanied by sanctions” (p. S119). Trust in society facilitates the creation of this kind of social capital. The information is transmitted efficiently within strongly bonded, dense networks. In the network closure, people sacrifice self-interest and act in the interests of the community. The central argument for closure refers to synchronization, coordination, cooperation, and trust in a closed social structure.

According to Burt (2000), closure has two effects in closed networks. First, closure facilitates accessing information. More direct connections improve communications between members. Burt (2005) explained the second effect with trust and reputation. When the network relations are very close, inappropriate behaviors in the network are easily detected and punished. People collaborate with other people in the group because they are unwilling to lose their reputation constituted in a long-standing relationship. Unwilling to lose reputation decreases the

risk and increases the likelihood of trust. Therefore, Burt (2005) concluded that the high rate of a hard worker, the low rate of turnover, and high-quality products are expected in closed networks.

Network closure has redundant ties that canalize group members to same sources of information (Burt, 2005). Therefore, network closure is ineffective in reaching novel information and useful knowledge. Redundancy has two indicators: cohesive contacts and structurally equivalent contacts. Cohesive contacts are linked to each other with strong ties that possibly have access to the same information. On the other hand, structurally equivalent contacts are connected to the same third parties, which offer the same sources of information. In network closure, actors continually access the same information, so innovation and creativity take a long time. Similarly, Putnam (2001) argued that strong group loyalties created in the network closure may isolate the members from valuable information outside the group.

Brokerage (External Ties)

The brokerage perspective focuses on external networks. While closure generates uniform groups and improves harmony and shared trust, brokerage enables groups to access possible outside information and resources. According to Putnam (2001), bridging social capital is inclusive. Bridging social capital reveals itself with variation in identities, better connection to external resources, and information exchange. However, the cost of developing external ties and pursuing these connections may appear to be nonsense to the members.

The concept of brokerage emphasizes the bridging mechanism that ties the gaps—structural holes—between disconnected people and groups (Burt, 1992, 1997, 2005). Structural holes present “a competitive advantage for an individual whose relationships span the holes” (Burt, 2000, p. 353). Disconnectedness between two different groups that concentrate on their

activities in hand and lack interest in others' activities creates a structural hole. The broker, bridging actor, who covers a structural hole gains a competitive advantage over others with controlling information channels and benefits. The broker accesses the information earlier than the others who are embedded within a dense network and do not have contacts with other structures. This presents the bridging actor the power to control flow of the information and to negotiate deals between otherwise disconnected networks (Thieme, 2007).

Burt's Work as a Uniquely Effective Approach

Burt (2005) defined brokerage with its three advantages: "access to a wider diversity of information, early access to that information, and control over information diffusion" (p. 16). These three advantages give those who have a connection with other networks an opportunity for "information arbitrage: the strategic deployment of information to create value" (p. 17). These people are familiar with new ideas and thinking because they access information before others. Burt (2005) calls this "vision advantage" (p. 59). Burt (2005) defined four levels of brokerage. In the first level, brokerage makes people realize interests and difficulties of other groups. The second level is to transfer best practice. In the third level, people compare each of the groups to find a way to implement the new idea. Lastly, people familiar with both groups synthesize the situation and find the new beliefs and behaviors that correspond to both sides. Creativity is the result and learning is a by-product of this process. According to Burt (2000), creativity and learning are central to brokerage.

This study employed Ronald Burt's (2005) typology that best explains the interrelatedness of trust and social networking. His typology is unique because it uses internal and external ties simultaneously. Social relationships cannot be evaluated apart from their environment. In this regard, the effectiveness of a formal group, such as a PLC, is a function of

both internal and external relationships of its members (Burt, 2005). Burt underscored the inseparability of internal ties (closure) and external ties (brokerage). PLC effectiveness is considered to be a combination of the degree of within-group dynamics and the degree of social networking outside the group. The next section reviews Burt's social capital typology.

Applying Burt's Social Capital Typology to the Study of PLCs

Burt's (2005) social capital theory provided a theoretical framework that explained the complex relationships embedded in formal teams or groups. He proposed a typology and theory in his work as well as the concepts of closure and brokerage and the interaction between the two. Burt (2005) defined social capital as "the advantage created by a person's location in a structure of relationships" (p. 4). Also, he suggested that social capital is "mixtures of brokerage and closure (p. 97)". He stated:

Brokerage is about coordinating people between whom it would be valuable, but risky, to trust. Closure is about making it safe to trust. The key to creating value is to put the two together, building closure around valuable bridge relations. Closure is valuable when it spans a structural hole. (p. 97)

Burt (2005) argued that there are four facts around his social capital concept. The first fact is that brokers whose networks bridge the holes have an advantage over others. The second fact is that improved vision is the process that leads to returns to brokerage. Brokers in a homogeneous group most probably access information earlier than others and implement creative ideas before the others do. The third fact is that closure strengthens the status quo not to let different beliefs and behaviors other than adopted ones in a closed network. The last one is that closure prevents decay in weak ties between new friends and intensifies the strong ties against the extreme distrust.

Burt (2005) unified seemingly separate views on internal and external ties into a coherent framework. His typology, shown in Figure 1, addresses combinations of brokerage and closure, as well as a specific outcome pattern across these combinations. The social capital of a group increases from the lower-left to the upper-right. The synergy of brokerage and closure represents the degree of social capital and performance of a network such as a PLC.

While benefits of this composition should be higher where brokerage and closure work together to improve cooperation across structural holes, performance should be lower where closure blocks the brokerage to collaborate across structural holes (Burt, 2005, p.139).

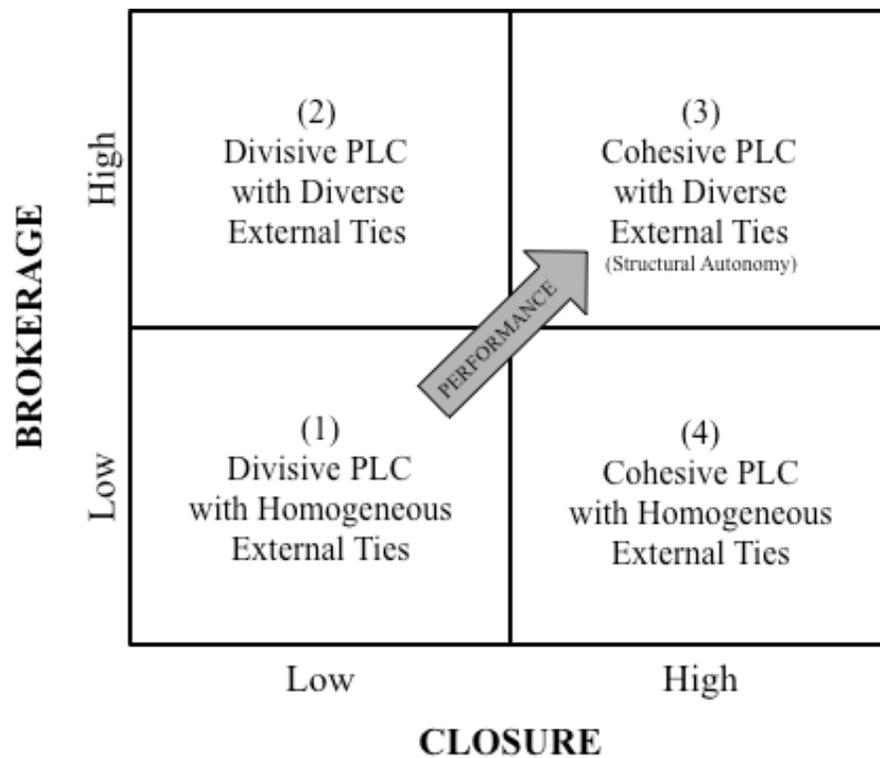


Figure 1

When both closure and brokerage are high, performance is greatest. Burt (2005) described this configuration as structural autonomy, “consisting of people strongly connected to one another, with extensive relations beyond the group” (p. 141). Therefore, an effective PLC should have “a strong reputation mechanism aligning people inside the group, and a strong vision advantage from brokerage outside the group” (Burt, 2005, p. 141). Members work together to realize creative projects for the benefit of students. Colleagues who accumulate a reputation in the long term cooperate with other members in the network so as not to lose their status. By applying Burt’s model to PLCs, this study hypothesized that PLCs with higher closure and brokerage values positively affect students and lead to higher student achievement outcomes.

When both closure and brokerage are low, performance is lowest. Group members spend

their time on unnecessary quarrels. The group lacks coordination; hence, the information remains hidden in the network. Contacts outside the group are redundant and offer few brokerage opportunities. Group members' perspectives, skill, and resources are similar, so there is only limited gain from their knowledge. Vision advantage and the reputation mechanism are restricted so this quadrant has a minimum structural autonomy. Distrust, indifference, and coordination problems are epidemic in this group.

When closure is high and brokerage is low, performance is high but not sufficient. While the reputation mechanism is operational and trust is high among members, vision advantage is not satisfactory. Information flows smoothly among the members, but access to new ideas and thinking is limited, and innovation is not sufficient to gain an advantage. Even if external ties are the source of advantage, they do not need to be the initial cause. For example, when two old friends from separate schools decide to collaborate, they begin introducing trusted colleagues in their schools to teachers in the other school. Although these teachers are trying to bridge the structural hole, initial developing closure is the main cause of advantage. For this situation, "closure can be the more accurate definition of social capital so it would be inaccurate to reject closure in favor of brokerage" (Burt, 2005, p.164).

When closure is low and brokerage is high, performance is high but not sufficient. While vision advantage is operational, trust among members is low and they tend to keep their own counsel. There are two situations for innovative concepts in the group. First, people with new ideas are unwilling to share them due to the distrustful environment. Second, group members lack coordination; hence, the information remains hidden in the network. Nevertheless, brokerage is the main cause of advantage.

To reach a better performance, internal factors may affect the external benefits in two

ways: "strategic consensus and cohesion" (Vissa & Chacar, 2009, p. 1182). The power of an external tie will depend on the strategic consensus if the PLC members agree on the strategy and the goals of the PLC for improving student achievement. Strategic consensus can help PLC members clarify the group's needs and necessary resources. Also, strategic consensus concentrates the efforts to collect relevant information available through external networks. Cohesion, on the other hand, increases communication and trust within a PLC. Improved communication facilitates fast and more accurate information exchange. Trust among members ensures that information gathered from an outside network is reliable and authentic.

In this context, next two sections will emphasize the benefits of both closure and brokerage to PLCs.

Benefits of Closure and Brokerage to PLCs

Closure in PLCs

Closure can be characterized by trust, communication, and shared values and norms (Coleman, 1988). Trust is a significant factor for constructing collaboration in a school among staff, teachers, or families (Tschannen-Moran, 2001). Also, relationships characterized by trust play an important role in both a collaborative school culture and students' academic achievement (Goddard, Tschannen-Moran & Hoy, 2001; Hoy & Sabo, 1998; Tschannen-Moran, 2004). Creating a school setting in which teachers trust each other makes a contribution to student learning by providing social support (Goddard et al., 2001; Hoy, 2002). Furthermore, when teachers trust leaders and colleagues to support them, they are motivated and willing to try new teaching practices. Tschannen-Moran (2014) defined trust as "willingness to be vulnerable to another based on the confidence that the other is benevolent, honest, open, reliable and competent" (p. 19). When a teacher trusts his or her leader and colleagues, he/she feels free to

ask for help and to act collaboratively. Therefore, trust among faculty members supports teacher professionalism (Tschannen-Moran, 2015; Tschannen-Moran & Hoy, 1998).

Tschannen-Moran and Hoy (1998) described trust “as “a remarkably efficient lubricant” that reduces the complexities of organizational life and facilitates transactions far more quickly and economically than other means of managing” (p.334). In task groups, such as PLC, people work together, build relationships, and develop norms and behaviors. Lencioni (2006) argued that trust is a key characteristic of such teams. Without trust, teams waste extreme time and energy to regulate the interactions within the group, abstain from team meetings, and their members tend to be uncooperative with others (Lencioni, 2006). Also, closure supports reciprocity and solidarity, develops trust within the group, and provides psychological support. For example, Fox and Wilson's (2015) study on beginning teachers revealed that beginning teachers develop a sense of belonging to a teaching career when they gain support from other teachers in the school.

Information is a key factor to provide a basis for teaching practice but is costly to gather (Coleman, 1988). However, open communication channels established in PLCs are often ready for other purposes, and reduce the amount of time and energy required to gather information. PLCs focus on openness, collective learning, de-privatized practices, open communication channels, and reflective dialogue to share their knowledge (Clausen et al., 2009; Hord, 2004; Lomos, Hofman, & Bosker, 2011; Stoll et al., 2006). Communication channels need to be open on a number of levels for a productive and successful PLC in a school (Clausen et al., 2009). Adler and Kwon (2002) noted: "strong ties facilitate the cost-effective transfer of complex information and tacit knowledge" (p. 32). Consequently, one of direct benefits of social capital (Adler & Kwon, 2002) is information exchange among the group members.

Shared values and norms that make social capital strong are key factors of effective PLCs (Kruse et al., 1994; Stoll et al., 2006). PLC members share the collective ideals and norms to improve student learning, and to develop better teaching practices (Bezzina, 2006; Clausen et al., 2009; Servage, 2008). Leana and Pil (2006) argued "the shared vision and goals, and the collectively held values that underlie them, help promote integration and create a sense of shared responsibility and collective action" (p. 354). Shared values and norms must be developed with regard to student learning, reflective dialogue and de-privatizing practices (Vescio et al., 2008).

Brokerage in PLCs

Research on external ties among teachers is not sufficient in PLC literature. However, organization literature holds ample studies about brokerage. Organization research suggested that external ties are closely related to innovation (Ancona & Caldwell, 1992; Balkundi & Harrison, 2006; Brass et al., 2004; Rodan & Galunic, 2004), creativity (Perry-Smith, 2006; Perry-Smith & Shalley, 2003), access to new information and knowledge (Brass et al., 2004; Granavotter, 1973; Hansen, 1999; Podolny & Page, 1998; Tsai, 2001) and performance (Cross & Cummings, 2004; Perry Smith, 2006).

Contrary to the closure perspective that refers to an advantage of strong internal ties within a network structure, the brokerage perspective advocates the benefits of weak external ties enabling members to reach new ideas and resources (Burt, 2005). In this context, teachers' external ties help them access novel information and knowledge to develop their teaching practices and to increase student learning. For example, Critical Friends Group was an external program to train coaches who would train other teachers in schools. Dunne et al. (2000) stated, Teachers who participated in CFGs agreed more than did other teachers that they had many opportunities to learn new things in their job, that they felt supported by colleagues

to try out new ideas, that they were encouraged to experiment with their teaching, and that teachers in their schools were continually learning and seeking new ideas. (p.4)

Partnership with the actors outside the school, such as corporate businesses, supports innovation in schools through economic strategies, cooperative initiatives and political supports (Antelo & Henderson, 1992; Scales et al., 2005). For example, Scales and his colleagues (2005) found that the degree to which the students were exposed to school-business partnerships indicated the school success, such as better grades, less absence, and more academic motivation. Similarly, after examining 62 schools in Uganda, Hite et al. (2006) suggested that external ties of head teachers may help access outside resources and may have fruitful results for school performance. Thus, technical support from external organizations can be very effective for schools (Newman, King & Youngs, 2000). Also, Supovitz and Christman (2005) argued that, without district support, building teacher communities is not sufficient to improve student learning significantly.

In PLCs, teachers who have connections outside the school are likely to be exposed to diverse teaching practices and resources. For this reason, educators tend to use online communities for professional support, assistance, innovation, and motivation (Duncan-Howell, 2010; Hou, 2015; Jones & Dexter, 2014; Matzat, 2013). Duncan-Howell (2010) argued that teachers prefer online communities because of their flexible schedule and rapid solutions and feedbacks. Likewise, Jones and Dexter (2014) reported that teachers participating in online learning activities, such as using Google and Teacher, easily reached great resources. One teacher stated, "I think the biggest support is Google because you can Google everything and anything"(p. 378). Another teacher reported that he/she used some Internet sites like Science Teachers Association and Promethean Planet to get information. In addition, Matzat (2013)

noted that teachers using online communities along with everyday interactions attained more practical benefits. To put this idea in context, brokerage happens when teachers engage in social interaction with other PLCs in the same school and in other schools, district level trainers, school administrators, professional institutes, resource and instructional specialists, and external educational contacts.

Summary

In conclusion, the review of the literature revealed that PLC studies tend to focus exclusively on internal features of PLCs, such as trust, shared vision, and group norms. However, organization literature emphasizes the benefits of external ties to formal teams like PLCs. Without external ties, formal groups lack novel information, innovation, and useful resources. In this sense, social capital theory presents a sound theoretical framework for PLC research. This study employed Ronald Burt's typology that best explains the interrelatedness of trust and social networking. His typology is unique because it uses internal and external ties simultaneously. Chapter 3 outlines the research methodology of this study.

CHAPTER 3: METHODOLOGY

Introduction

The existing PLC research is focused persistently on internal features of PLC member relations with little recognition of the relevance of external ties of members to the other actors in a PLC environment. Researchers tend to examine PLC effectiveness and its effects on student achievement through using inherent characteristics such as trust, collective learning, shared practices and shared values, and vision (Grossman et al., 2001; Saunders et al., 2009; Stoll et al., 2006; Vescio et al., 2008). Instead, some researchers advocate that the external interactions of teachers play a significant role in their professional development and student achievement (Duncan-Howell, 2010; Hou, 2015; Matzat, 2013; Supovitz & Christman, 2005). Moreover, theoretical frameworks used in the literature do not unify internal and external features of PLCs. In this sense, Burt's (2005) social capital theory is unique because it considers internal and external features of formal groups simultaneously. For the theoretical framework, this study drew on Burt's theory. In other words, this dissertation utilized the social capital theory, especially closure and brokerage within PLCs, to find the impact of PLCs on student reading achievement as measured by DIBELS Next reading inventory. For this purpose, the overarching question for this study is: *What is the relationship between PLC social capital and student achievement?*

The following hypothesis was tested: *Student achievement increases as PLC brokerage and closure increase.*

Data

The data for this study were drawn from students and teachers in a Kansas suburban school district, serving about 30,000 students, for the 2011-12 school year. The sample, data

collection procedures, student-level variables, and the teacher social capital (closure and brokerage) measure are described below.

The population for this study relied on a sample of students from kindergarten to sixth grade in the 2011-2012 school year from a suburban Kansas school district. This district has a higher rate of teacher compensation than other school districts in the state of Kansas. For this reason, although student demographics are statistically identical with the results for the state of Kansas, teacher demographics may be somewhat incompatible with the state averages. As of 2013, the district's students were 66% Caucasian, 16% Hispanic, and about 9% African American. Nearly 30% of the students were eligible for free or reduced-price lunch. The school district had a 91% graduation rate. In addition, about 90% of its students were proficient or above in reading and mathematics on state assessments. The district has been implementing PLCs for nearly a decade.

Data were collected in the spring of 2012 via a social capital questionnaire sent out to kindergarten through sixth grade teachers in 26 of the 35 elementary schools in the study district. The profiles of the nine nonparticipating schools—in terms of average student achievement, teacher credentials, and other basic building features—suggested no dramatic differences compared to the 26 schools that agreed to participate. This sample included 17 schools, 184 respondents (2,52 teachers per PLC on average), and 73 different PLCs. It contained 2,477 students nested within the PLCs. School sizes ranged from 10 to 326 students in grades K-6. This sample is reasonably representative of the district (including varying degrees of SES status, school size, racial diversity, and teacher experience).

Teacher and student characteristics and individual student records were provided by the school district. Individual student characteristics included basic background information (lunch

codes, race/ethnicity, gender, ELL, SPED, gifted) and scores for December 2011 assessment and June 2012 assessment on the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) test for reading.

Measurement

Dependent Variable

The dependent variable was the *DIBELS Next Gain Score*. This study utilized DIBELS Next to measure student reading achievement growth. All measures and variables used in the research were collected in December 2011 and June 2012. The gain scores used in the study were calculated by subtracting the December 2011 assessment scores from the June 2012 assessment scores.

DIBELS Next is an assessment comprised of a set of standardized procedures and measures. The DIBELS Next assessments contain: (a) Letter Naming Fluency, (b) First Sound Fluency, (c) Phoneme Segmentation Fluency, (d) Nonsense Word Fluency, (e) Oral Reading Fluency (ORF), and (f) Retell and DAZE (the **DIBELS maze** comprehension task). DIBELS Next data are gathered three times each year, usually at routine benchmarking days in the fall, winter, and spring. The DIBELS score theoretically ranges from 0 to 812.

This test measures the acquisition of early literacy skills from kindergarten through sixth grade. Good and his colleagues (2004) found that the DIBELS are reliable and valid. They stated,

The DIBELS offers educators brief, valid, reliable and repeated measures to assess student's early literacy skills. Knowing how a child performs on the DIBELS measures in kindergarten and first grade strongly predicts their end of first and second grade reading outcomes. (p. 38)

This study used the DIBELS Next composite score for students' reading ability. Below is the formula for the composite score.

$$\text{Composite score} = (\text{DORF words correct}) + (\text{Retell Score} \times 2) + (\text{DAZE adjusted score} \times 4) + (\text{DORF Accuracy Value}).$$

Student gain scores were calculated with the formula below:

$$\text{Student gain score} = \text{Spring}_{2012} \text{ DIBELS Comp. score} - \text{Winter}_{2011} \text{ DIBELS Comp. score}$$

Independent Variables

PLC Closure. Closure was measured by a 5-point scale (1 = strongly disagree ... 5 = strongly agree), based on Leana and Pil's (2006) work on trust (5 items; e.g., "Teachers on my grade level team can rely on each other in difficult situations"), information exchange (5 items; e.g., "Teachers on my grade level discuss and review student achievement data at each meeting"), and shared vision (5 items; e.g., "Teachers on my grade level team share a common view of the school's purpose in educating students). These measures demonstrate structural (information sharing), relational (trust), and cognitive (shared vision) aspects of internal ties.

Leana and Pil's (2006) study suggested that social capital has three dimensions: the structural, relational, and cognitive aspects of social capital. They argued that closure plays an important role in the development of high levels of relational and cognitive social capital, and structural dimension influences them indirectly. The structural dimension indicates the general template of connections that provide channels for information exchange, which encourages openness and learning. The relational dimension highlights personal ties people have established with each other in the same social environment through a history of interactions. This kind of dimension includes behavioral aspects, such as trust, norms, obligations and expectations. The

cognitive aspect of social capital refers to shared understandings among members, such as shared values and vision.

The individual information exchange score was the mean of five questionnaire items (Table 2) reviewing openness, honesty, frequency, and willingness in information sharing. The individual trust score was the mean of five questionnaire items (Table 3) evaluating respect, integrity, team spirit, and confidence among PLC members. The Individual vision score was the mean of five questionnaire items, including similarity of views concerning the PLCs purpose and the degree of equal participation in goal-setting (Table 1). The individual closure score was the mean of individual's information exchange, trust and vision scores. Closure was the mean of individual closure scores aggregated to PLC level.

Table 1

Vision

Questions	Respond
Teachers on my grade level team share the same ambitions and visions for student learning.	1. Strongly Disagree
Teachers on my grade level team share a common view of the schools purpose in educating students.	2. Disagree
Teachers on my grade level team have clear established norms (how we behave when we meet to talk about data reviews, student interventions, etc.).	3. Neutral
Teachers on my grade level team are committed to reach the student achievement goals of your team.	4. Agree
Teachers on my grade level team view themselves as a partner in accomplishing the student achievement goals.	5. Strongly Agree

Table 2

Information Exchange

Questions	Respond
Teachers on my grade level team engage in open and honest communication with one another.	1. Strongly Disagree
Teachers on my grade level team DO NOT have "hidden agendas" or issues.	2. Disagree
Teachers on my grade level team discuss and review student achievement data at each meeting.	3. Neutral
Teachers on my grade level team share and accept constructive criticism without making it personal.	4. Agree
Teachers on my grade level team are comfortable to discuss personal issues if they affect their job responsibilities.	5. Strongly Agree

Table 3

Trust

Questions	Respond
Teachers on my grade level team can rely on each other in difficult situations.	1. Strongly Disagree
Teachers on my grade level team believe in the spirit of collaboration where the flow of ideas is encouraged.	2. Disagree
Teachers on my grade level team have confidence in one another that they will do their part to help student succeed.	3. Neutral
Teachers on my grade level team show a great deal of integrity.	4. Agree
Teachers on my grade level team have a professional relationship built on trust and respect.	5. Strongly Agree

PLC Brokerage. The measure for brokerage was based on a 7-point scale from the works of O’Toole (1997) and Meier and O’Toole (2003). Respondents rated the frequency of their interaction with three tiers of external factors. Meier and O’Toole’s work was used in this study because it is reliable and frequently utilized in the context of public administration (Andrews, Boyne & Walker, 2006; Meier, O’Toole, Boyne & Walker, 2007; Nicholson-Crotty & O’Toole, 2004). Conceptualizing Tier 1 collaboration includes the components of external ties of the PLC within the school (Table 4). Tier 2 collaboration shows the components of external ties of the PLC with not in the school, but within district resources (Table 5). Tier 3 illustrates the components of external ties of the PLC with not in district (Table 6). Participants’ responses rated their frequency of collaboration as never, rarely, a few times per year, monthly, weekly, or daily. The scores of every tier will be the mean of these scores. Individual brokerage score will be the mean of individual's Tier 1, Tier 2 and Tier 3 scores. Brokerage will be the mean of individual brokerage scores aggregated to PLC level.

Table 4

Collaboration within the school

Questions	Respond
Teachers at my grade level	1. Never
Teachers at my school, BUT NOT at my grade level	2. Rarely
Principal/Asst. Principal/Teacher on Assignment (TOA)	3. A few times per year
Special Education teacher (Speech or Learning Center)	4. Monthly
Reading/Math Specialist	5. Weekly
School counselor / social worker	6. Daily
Professional development offered at your school	7. Does not apply
School Psychologists	

Table 5

Collaboration not in the school, but within district resources

Questions	Respond
District curriculum and instruction subject area specialist (Indian Creek reading, math, science, etc. staff)	1. Never
Teacher mentor	2. Rarely
District trainers (technology)	3. A few times per year
District Office of Research and Assessment	4. Monthly
District specialists (PBS, MTSS, Behavior / Autism specialists)	5. Weekly
Curriculum council or district committees or instructional cadre	6. Daily
Collaboration with other teachers in book study	7. Does not apply
District-wide professional development (summer academy, pre-service, etc.)	
Collaboration with teachers from other buildings	

Table 6

Collaboration not in school or district

Questions	Respond
Educators from other school districts	1. Never
Graduates level Academic classes at accredited college/university	2. Rarely 3. A few times per year
Member of professional organizations (ASCD, NSDC, etc.)	4. Monthly 5. Weekly
Participation in action research	6. Daily
Partnership with state agency	7. Does not apply

PLC Controls. Individual teacher information was aggregated to a PLC level variable (Table 7). The PLCs with more experienced teachers may be more likely to be successful than others because they may probably contribute a lot to their teacher counterparts. This study included the number of years of experience in the same grade level, PLC, school, and district because individuals with more experience in these institutions may have the same expectations and standards for student achievement than newer teachers. Also, PLCs with a longer history of common practices, knowledge, and experiences may have more information to support student learning.

Table 7

PLC level controls

Questions	Respond
How many years have you taught? (include all schools)	1. 0-2 years
How many years have you taught in your current district?	2. 3-5 years
How many years have you taught at your current school?	3. 6-10 years
How many years have you taught at your current grade level?	4. 11-15 years
How many years has the current grade level teachers taught together?	5. 16-20 years 6. 20 years or more

The number of total years taught of PLC members was a variable that indicated the mean years of the members of a PLC in the teaching position.

The number of years taught in the same district of PLC members was a variable that indicated the mean years of the members within a PLC teaching in the same district.

The number of years taught in the same school of PLC members was a variable that

indicated the mean years of the members within a PLC teaching in the same school.

The number of years taught in the same grade of PLC members was a variable that indicated the mean years of the members within a PLC teaching in the current grade level.

The number of years taught in the same PLC of the members was a variable that indicated the mean years of the members teaching in the same PLC.

Student Controls. The student level control variables are shown in Table 8.

Ethnicity: White was the base race. Other races were "Black," "Hispanic," and "Other" (Asian or American Indian). While the White-Black reading gap narrowed 21 points and the White-Hispanic reading gap narrowed 13 points since 1971, there is still a gap between races in terms of reading achievement (National Center for Education Statistics, 2013).

Gender: Male was a dummy variable coded 1 if a student is male. Gender will be a control variable because some research has repeatedly showed that girls outperform boys in reading in America (Bae et al., 2000; Freeman, 2004) and in every other country (Chiu & McBride-Chang, 2006).

Free Lunch category: No support was the baseline. "Free" and "Reduced Lunch" were other categories. This variable is important because research has demonstrated that the socioeconomic structure of schools is a strong predictor of teacher's collective efficacy (Bandura, 1997; Parker, 1994). In schools with a high proportion of SES students, teacher's sense of collective efficacy is low.

English Language Learning (ELL): ELL was a dummy variable coded 1 if a student is in ELL status. This study included ELL because when analyzing national standardized testing scores, Fry (2007) found that about 51% of the eighth grade and 47% of the fourth grade ELL students are behind whites in reading.

Special Education: The regular education category was the baseline. Other categories were "Disabled" or "Gifted." Special education categories were added because teachers must treat each category differently and carefully (Collins & Aiex, 1995).

Table 8

Student level controls

Measures	Respond
Race	1. White 2. Black 3. Hispanic 4. Other
Gender	0. Female 1. Male
SES	0. No support 1. Reduced 2. Free
English Language Learner (ELL)	0. Not ELL 1. ELL
Special Education	1. Regular education 2. Gifted Education 3. Special Education

Analyses Strategy

In an educational setting, data are often organized at different levels, such as student, classroom, and school. Also, these levels are nested within each other; for example, students are nested within classrooms, classrooms are nested within schools and schools are nested within districts (Osborne, 2000; Raudenbush & Bryk, 2002). Because of the nested nature of schools, it is clear that variables at hierarchical levels can influence each other (Hofmann, 1997).

This research has two levels of data; the student level, which includes DIBELS Next reading scores, and the PLC level, which includes closure and brokerage. Also, this study examined how PLC social capital affects student proficiency gains on the DIBELS Next assessment. Therefore, hierarchical growth (gain score) modeling was used in this study for three reasons. First, student gain scores are used because growth in achievement is important to understand PLC effects. Second, gain scores provide a reference point and better information on student learning than a single score at one point in time. Third, growth models are useful when outcome measures have a numerical maximum because sensitivity of change in the outcome is affected by its initial level. In other words, the more an initial achievement score is near to top, the less room the next observation has for growth. This study used DIBELS Next reading scores measured in December and June. It is not possible to consider subsequent data because the survey was not repeated later. The study data does not include the next September data. Even if the next September data was possible, it would be subject to the summer loss problem.

The following models were used in the study:

$$CS_{ijt}-CS_{ij(t-1)} = \beta_{0j} + \beta_1 CS_{i(t-1)} + \sum_{k=1}^5 (\gamma_k S_{kit}) + \varepsilon_{jt}$$

$$\beta_{0j} = \lambda_{00} + \lambda_{01} \text{Closure}_{jt} + \lambda_{02} \text{Brokerage}_{jt} + \sum_{p=1}^5 (\delta_p \text{PLC}_{pjt}) + \nu_{0j}$$

where i =student, j =PLC and t =time. t denotes June 2012 assessment and $t-1$ represents December 2011 assessment. CS_{ijt} is the i^{th} student's DIBELS Next composite score in PLC j for June 2012 assessment and $CS_{ij(t-1)}$ is the i^{th} student's DIBELS Next composite score in PLC j for December 2011 assessment. $CS_{ijt}-CS_{ij(t-1)}$ is the gain score for the i^{th} student in PLC j . S_{kit} denotes the k^{th} characteristic for student i where k runs from one to five (see Table 8). PLC_{pjt} represents the p^{th} characteristic for PLC j where p runs from one to five (see Table 7). λ_{00} is the grand mean of student gain score. ε_{jt} symbolizes the level-1 error term, signifying a random error related

with student i at PLC j . v_{0j} is the level-2 error term, signifying the error related with the group means.

Summary

This chapter outlined the methodology of the study that examined the impact of PLC social capital on student achievement. It consisted of the introduction, hypotheses, population and sampling, sources of information, measurement, and data analysis procedures. The hierarchical growth model was used as the statistical method to analyze the data in this study.

CHAPTER 4: RESULTS

Introduction

The purpose of this chapter is to analyze the data collected and to present the results in connection with the study's purpose and research question. The data collected were inputted into STATA software. The data were analyzed using Hierarchical Growth (Gain Score) Modeling.

This study was focused on answering the following research question: *What is the relationship between PLC social capital and student achievement?* The following hypothesis was tested: *Student achievement increases as PLC brokerage and closure increase.*

Descriptive Analysis

Population and Sample

The participants in this research were public elementary school teachers in a suburban school district in Kansas. The survey and district student demographics reflect the state demographics as seen in Table 9. Teachers' data were collected from suburban Kansas elementary schools from the same school district during the 2011-12 school year. A questionnaire was sent out via email to kindergarten through sixth grade teachers in 26 of the 35 elementary schools in the district. Raw data of that survey included 502 respondents and 182 PLCs and contained more than 7,500 students nested within the PLCs. School sizes in these data ranged from 240 to 650 students in grades K-6. This study only used data from PLCs that had a 50% or better response rate and from students who had both June 2012 and December 2011 DIBELS composite scores. Data included 2,477 students and 184 teachers (2.52 teachers per PLC on average) nested in 73 PLCs in 17 different schools in the same district. There were a possible 502 teachers in the district, but given a response rate of about 24%, the analysis relied on responses from 184 teachers across the 17 schools.

Table 9

Evaluation of Student Demographics

	Study schools %	Study School District %	State of Kansas %
White students	64.0	67.0	67.9
Hispanic students	19.0	16.0	17.1
Black Students	7.8	8.6	7.3
English Language Learners	13.9	10.2	10.2
Students on lunch support	43	35.5	49
Students with Disabilities	19	9.6	13.7

Student Characteristics

Data consisted of 2,477 student achievement and demographic statistics nested in PLCs. This data sample contained 50.75% males and 49.25% females. The racial/ethnic composition constituted 58% white students and 24% Hispanic students, the largest minority group in the sample. This study showed a moderately equal range of students per grade, with a low of 10.04% (n=245) to a high of 15.61% (n=381) of students from K-6th grade. Almost half of the students (49.3%, n=1,221) received some kind of lunch support for their SES level. While 89.1% of students in the sample are regular education category, 2.1% (n=53) have been identified as gifted and have an Individualized Education Program (IEP) for giftedness. Additionally; 8.7% (n=432) of students have been identified and have an IEP. Table 10 illustrates the statistics of student controls collected.

Table 10

Descriptive Statistics of Student Characteristics

Gender	Male	50.75%
	Female	49.25%
Ethnicity	White	57.97%
	Black	10.21%
	Hispanic	23.70%
	Other	8.11%
Lunch Support Status	Regular	50.71%
	Reduced	9.33%
	Free	39.97%
Education Category	Regular Ed.	89.14%
	Gifted Ed.	2.14%
	Special Ed.	8.72%
English Language Learners	Regular	82.28%
	ELL	17.72%
Student Grade	Kindergarten	15.57%
	1st Grade	15.61%
	2nd Grade	15.36%
	3rd Grade	15.44%
	4th Grade	10.04%
	5th Grade	13.36%
	6th Grade	14.63%

Teacher Characteristics

Teachers in this study were mainly experienced teachers. The majority of survey participants had taught more than 10 years (67.7%) while 95.16% of the teachers had taught for 5 or more years. The respondents who participated primarily taught in the district for more than 10

years (50%), although 76.6% of respondents taught for more than 5 years. More than half of the teachers (59.36 %) taught together for less than five years. Table 11 shows the statistics of collected teacher controls.

Table 11

Experience of Teachers

Years	Years Taught %	Years in current district %	Years at current school %	Taught current Grade %	Years taught together %
0-2 years	1.61	11.04	17.53	16.88	28.39
3-5 years	3.23	12.34	14.94	22.08	30.97
5-10 years	27.42	26.62	31.82	26.62	16.77
11-15 years	11.29	17.53	11.04	16.23	16.13
16-20 years	22.58	9.09	9.09	5.84	4.52
>20 years	33.87	23.38	15.58	12.34	3.23

Analysis of Student Reading Achievement

The district in this study measured student reading achievement with DIBELS Next in the fall, winter and spring of each year. DIBELS Next scores measure the reading achievement of students with three classifications: (a) benchmark, (b) strategic, and (c) intensive. Benchmark is the least severe, and the intensive group is the most severe. Tables 12 and 13 review the analysis of DIBELS Next composite scores for each grade and achievement category for winter 2011 and spring 2012. In both assessment periods, fourth graders were the most severe group in the study.

Table 12

Analysis of DIBELS Next Composite Scores for Each Grades and Achievement Categories (Winter).

		Student Grades						
		K	1st	2nd	3rd	4th	5th	6th
Categories	Benchmark	76.30%	68.77%	72.00%	72.15%	60.41%	75.46%	84.87%
	Strategic	15.53%	8.67%	10.40%	13.79%	11.84%	17.18%	8.68%
	Intensive	8.16%	22.57%	17.60%	14.06%	27.76%	7.36%	6.44%

Table 13

The Analysis of DIBELS Next Composite Scores for Each Grades and Achievement Categories (Spring).

		Student Grades						
		K	1st	2nd	3rd	4th	5th	6th
Categories	Benchmark	81.32%	67.19%	68.53%	71.88%	60.41%	73.01%	83.47%
	Strategic	13.68%	13.12%	18.40%	12.99%	19.18%	18.10%	8.68%
	Intensive	5.00%	19.69%	13.07%	15.12%	20.41%	8.68%	7.84%

Confirmatory Factor Analysis of Closure Survey Instrument

This study utilized Leana and Pil's (2006) survey instrument to measure for closure, based on 5-point scale from strongly disagree to strongly agree about the structural, relational, and cognitive characteristics of internal ties, Participants evaluated the structural facet of their

PLCs' social capital as willingness to share information among teachers, While the trust among teachers constituted the relational aspect of PLC social capital, shared vision in PLC represented the cognitive facet of social capital, Tables 14-16 illustrate the descriptive statistics of the closure survey instrument, In this research, compared to the information exchange ($\mu= 4.1$) and trust ($\mu=4.308$), shared vision had the highest mean ($\mu= 4.316$) of the three variables,

Table 14

Summary of Shared Vision

Variable	Mean	SD	Strongly Disagree %	Disagree %	Neutral %	Agree %	Strongly Agree %
1. Teachers on my grade level team share the same ambitions and visions for student learning.	4.26	1.051	4.32	4.49	6.17	31	54.03
2. Teachers on my grade level team share a common view of the school's purpose in educating students	4.39	0.959	2.6	3.52	7.97	24.45	61.45
3. Teachers on my grade level team have clear established norms	4.22	0.986	3.48	4.11	6.71	38.13	47.57
4. Teachers on my grade level are committed to reach the student achievement goals of your team.	4.42	0.953	2.6	2.52	10.03	19.51	65.35
5. Teachers on my grade level team view themselves as a partner in accomplishing the student achievement goals.	4.29	1.063	4.27	4.48	7.06	26.16	58.03

Table 15

Summary of Information Sharing

Variable	Mean	SD	Strongly Disagree %	Disagree %	Neutral %	Agree %	Strongly Agree %
1. Teachers on my grade level team engage in open and honest communication with one another	4.29	1.049	4.11	4.49	6.59	28.19	56.63
2. Teachers on my grade level team do not have "hidden agendas" or issues.	4.22	0.989	2.31	5.41	10.15	31.92	50.21
3. Teachers on my grade level discuss and review student achievement data at each meeting.	3.87	1.14	4.91	9.73	12.92	39.18	32.51
4. Teachers on my grade level share and accept constructive criticism without making it personal	3.91	1.169	5.08	9.23	14.97	30.96	39.77
5. Teachers on my grade level team are comfortable to discuss personal issues if they affect their job responsibilities.	4.21	1.008	3.27	4.99	7.89	35.28	48.57

Table 16

Summary of Trust

Variable	Mean	SD	Strongly Disagree %	Disagree %	Neutral %	Agree %	Strongly Agree %
1. Teachers on my grade level team can rely on each other in difficult situations.	4.48	0.946	3.44	3.61	0.76	25.59	66.61
2. Teachers on my grade level team believe in the spirit of collaboration where the flow of ideas is encouraged.	4.21	1.145	4.32	9.06	4.19	26.26	56.17
3. Teachers on my grade level team have confidence in one another that they will do their part to help students succeed.	4.37	0.959	2.6	3.44	8.43	25.67	59.86
4. Teachers on my grade level team show a great deal of integrity.	4.25	1.024	2.62	5.46	10.75	26.12	55.04
5. Teachers on my grade level team have a professional relationship built on trust and respect.	4.23	1.091	4.32	5.29	8.81	26.13	55.45

This study used the Confirmatory Factor Analysis (CFA) to determine direct and indirect effects of observable variables on the hypothesized latent variable. Each factor of the model, vision, information exchange, and trust, was measured by a set of observed indicators via a questionnaire. Each latent variable had five observable items. CFA tested the validity of the theoretically defined or hypothesized latent variables of the measures in the survey instrument (Wang & Wang, 2012). Table 17 displays the goodness of fit indicators for the three factor structures.

This study used MPLUS to perform a CFA, based on data from 120 public elementary school teachers in a school district in Kansas. The maximum likelihood estimation was chosen because the data were normally distributed. The data came from 15 questions on a 5-point Likert-scale survey measuring closure (Leana & Pil, 2006). This research hypothesized a three-factor model to be confirmed in the model. This study assessed the assumptions of multivariate normality and linearity. Data did not consist of univariate or multivariate outliers. The sample

size was 203; there were 2 missing data. The comparative fit index (CFI) = .921, the Tucker-Lewis fit index (TLI) = .905, and the RMSEA = .127. Those values indicate an adequate fit between the model and the observed data.

Table 17

Goodness of Fit Indicators for 3-Factor Models

Measure of Fit	Model
1. Chi-square test of minimum sample discrepancy:	
Chi-square	370.882
p-value (df)	<.000 (df=87)
Chi-square/df	4.26
Missing values	5
2. Tucker-Lewis Index (TLI)	.905
3. Comparative Fit Index (CFI)	.921
4. Root Mean Squared Error of Approximation	.127
90% confidence interval:	.114–.140
Pclose	.000
5. SRMR	.046
Sample size	203
Missing observations	2

Review of Brokerage Survey Instrument

In order to measure brokerage, a 6-point scale based on the work of O’Toole (1997) and Meier and O’Toole (2003) was used in this study. This scale shows the frequency of respondents’ collaboration with three tiers of outer links. Tier I represents the collaboration within PLCs. While Tier II denotes the brokerage relationships within the school, Tier III signifies the interactions within district level or external educational institutions or professional affiliations outside of the school district. Participants evaluated their frequency of association from never, rarely, a few times per year, monthly, weekly, or daily collaboration.

In this study PLC members reported that they collaborated most frequently with their colleagues in the same grade level either daily (66.2%) or weekly (23.5%). This is not a surprise for PLC literature. In addition, Tier I brokerage with other PLC members was reported highly as either daily (19.3%) or weekly (43.2%). In their daily routine, teachers collaborate frequently with teachers at the same grade level, teachers at the other PLCs, and special education teachers, respectively. Table 18 summarizes Tier I brokerage that represents the interactions among the agents within each PLC's school building. The average Tier I brokerage falls on a monthly basis. Collaboration with the school psychologist is the least frequent interaction in Tier I brokerage.

Table 18

Tier I Brokerage – Frequency of Collaboration with Sources Inside the Same School.

Variable	Mean	SD	Never %	Rarely %	Few times /Year %	Monthly %	Weekly %	Daily %
1. Teachers at my grade level (PLC)	5.45	1.01	0.85	2.79	3.23	3.39	23.51	66.24
2. Teachers at my school, but not at my grade level	4.66	1.03	0.86	3.83	5.56	27.37	43.13	19.26
3. Principal/Asst. Principal	4.44	0.96	0.00	3.96	12.04	30.41	43.54	10.06
4. Special education teacher	4.45	1.27	1.67	8.92	11.86	17.28	40.99	19.27
5. Reading/Math specialist	4.42	1.14	4.36	2.95	8.32	24.47	50.48	9.41
6. School counselor/ social worker	4.16	1.21	5.41	4.60	14.50	25.24	44.55	5.69
7. Professional development offered at school	3.75	1.03	0.93	7.96	31.02	41.60	15.06	0.85
8. School Psychologist	2.93	1.02	6.00	26.40	43.45	19.67	2.69	0.86
Average Tier I Brokerage	4.28	0.62	2.51	7.68	16.25	23.68	32.99	16.46

The mean frequencies of Tier II and Tier III collaborations are less frequent than daily, weekly, and monthly bases. Tables 19 and 20 illustrates the descriptive statistics of Tier II and Tier III, respectively. Tier II interaction is described as being less frequent as “a few times per year.” Respondents of this survey reported that they collaborated frequently with “district

curriculum specialist” and “district PBIS/MTSS/Autism-behavior specialists,” and they attended mostly “district professional development courses” and “teacher summer academy.” Attendants reported the frequency of Tier III collaboration as “never” or “rarely.” The interactions within the district level, external educational institutions, or professional affiliations outside of the school district were never or rarely used by a majority of PLC members. Teachers collaborated most frequently with “educators from other school districts,” with 30% of attendants designating such relationship occurred daily to monthly.

Table 19

Tier II Brokerage – Frequency of collaboration with sources outside the same school, but within the school district.

Variable	Mean	SD	Never %	Rarely %	Few times /Year %	Monthly %	Weekly %	Daily %
1. District curriculum or instructional specialist.	3.54	1.01	1.75	11.62	34.50	38.25	10.20	3.67
2. Currently a mentor or have a mentor assigned to you	3.24	2.46	42.11	10.35	2.12	3.74	2.88	6.24
3. District technology trainer	2.86	1.1	11.46	24.10	39.36	20.07	3.30	0.94
4. District Assessment & Research office	2.27	0.96	19.60	45.51	24.83	9.34	0.00	0.00
5. District professional development courses	3.34	0.96	3.79	13.58	35.73	40.62	4.57	1.71
6. District specialist (MTSS, PBIS, Autism, Behavior)	3.59	1.3	4.36	16.71	26.80	28.35	17.00	5.03
7. Participate with Curriculum council or instructional cadre	3.12	1.3	13.25	17.13	33.03	19.74	15.21	0.77
8. Collaboration with other teachers in book study	2.38	1.19	23.76	36.12	26.77	8.40	3.17	0.00
9. District-wide PD (summer academy, pre-service)	3.36	0.96	5.06	12.64	27.79	51.83	1.81	0.00
10. Collaboration with teachers from other buildings	3.18	0.97	1.35	25.41	35.07	31.32	5.34	1.51
Average Tier II Brokerage	3.09	0.65	12.65	21.32	28.60	25.17	6.35	1.99

Table 20

Tier III Brokerage – Frequency of collaboration with sources outside of the school district.

Variable	Mean	SD	Never %	Rarely %	Few times /Year %	Monthly %	Weekly %	Daily %
1. Educators from other school districts.	3.07	1.37	9.30	28.93	29.51	18.77	7.24	3.87
2. Graduate level academic classes at accredited college/university	2.72	1.51	20.95	26.58	35.35	7.08	1.81	2.84
3. Member of professional/ educational organizations (ASCD, NSDC, etc.)	2.22	1.13	27.78	40.78	19.75	6.34	4.57	0.00
4. Participation in Action Research project	2.15	1.15	25.14	51.36	16.17	3.13	0.00	2.59
5. Partnership with a school agency	2.13	1.23	28.89	46.30	19.30	1.52	0.00	0.00
Average Tier III	2.46	0.73	22.41	38.79	24.02	7.37	2.72	1.86
Average Tier 1 – 3 Brokerage	3.27	0.5	12.52	22.59	22.95	18.74	14.02	6.77

HLM Analysis of Brokerage-Closure Models

In an educational setting, data are often organized at different levels, such as student, classroom, and school. Also, these levels are nested within each other; for example, students are nested within classrooms, classrooms are nested within schools, and schools are nested within districts (Raudenbush & Bryk, 2002; Osborne, 2000). Given the nested nature of schools, it is clear that variables at hierarchical levels can influence each other (Hofmann, 1997) and researchers cannot ignore this nature of school organizations. Researchers interested in level-1 outcomes need to analyze both lower- and higher-level attributes to examine the performance of groups as a whole.

There are three main options to analyze data consisting of variables at more than one level (e.g., student grade and both student and PLC predictors; Hofmann, 1997; MacKay & Rocchi, 2012; Osborne, 2000; Woltman, Feldstain). The first method is disaggregation of data. This technique ignores the existence of probable between-group variations. It considers that all connections between variables are independent from their own level and situated at the

individual level. That is, all subjects at lower level would receive a score representing their higher level. For example, in current data, all students in the same classroom would be assigned the same mean teacher-related scores (e.g., teaching experience, number of years taught at current grade level, and number of years at school), and all students in the same PLC would be assigned the same mean PLC-related scores (e.g., the level of collaboration PLC members receive from the district, principal, and colleague levels; Woltman et al., 2012). This approach violates the assumption of independence of observations. Students drawn from the same classroom and same school tend to share certain characteristics. Therefore, these individuals' observations are not fully independent (Osborne, 2000). In turn, this leads to “inflated Type-I error rate, and results in correlated residuals, which generally lead to lower standard errors, higher probabilities of rejecting null hypotheses and inflated R^2 s” (Tracz, Newman & Newman, 2014, p. 23).

The second technique is aggregation. Unlike disaggregation, this method aggregates the lower level data to the higher level. Whereas disaggregation ignores higher-level group variances, aggregation disregards lower level individual differences. Individual variations, which are very important for analysis, would be lost when lower level variables (e.g., student achievement scores) are aggregated to higher hierarchical levels (e.g., classroom, PLC, or school levels; Woltman et al., 2012). In this approach, potentially meaningful lower-level variance is ignored and entities are treated as homogenous individuals (Hofman, 1997; Woltman et al., 2012).

Hierarchical linear modeling (HLM) is the third approach overcoming the limitations found with the above two approaches. Raudenbush and Bryk (2002) stated that different disciplines refer to HLM with several names, sociology as multilevel linear models, biometrics

as mixed-effects models and random-effects models, econometrics as random-coefficient regression models, and the statistical literature as covariance components models. HLM simultaneously measures connections within a specific level and between or across hierarchical levels. Thus, HLM allows researchers to investigate two models simultaneously: the first one estimates the relationships within each of the lower level units, and the second one evaluates how these within-unit's relationships vary between-units (Hofmann, 1997, p.726). HLM not only keeps the correct level of analysis for the explanatory variable but also measures both lower- and higher-level variance in the response variable. This method allows researchers to use level-1 independent variables at the level-1 and level-2 independent variables at the level-2.

The data set for this study included two levels, as students nested within PLCs. Therefore, this research utilized HLM to examine the relationship between PLC social capital and student achievement. The student level included DIBELS Next reading scores; and the PLC level consisted of teacher perceptions of trust, vision, and information exchange as well as the frequency of the interactions of members with the actors in the district, school, and colleague levels.

This research reports the results of the HLM estimates of the effects of PLC social capital (closure and brokerage) on individual student gains in reading, measured with DIBELS between the winter and spring period in the 2011-2012 school year, controlling for student characteristics. The gains between periods were measured by the equation below:

$$\textit{Gain} = \textit{Spring}_{2012} \textit{DIBELS composite score} - \textit{Winter}_{2011} \textit{DIBELS composite score}$$

The intent of this model is to examine the question: "Does a PLC with more or less of the explanatory level 2 variables, closure and brokerage, affect the student gains in reading achievement more or less?"

This study fit the model below to estimate the effects of PLC social capital with student gains in DIBELS scores. Student observations (Level 1) are nested in PLCs (Level 2). Table 23 presents the findings of this research. The empty model (Model 1) is the baseline model with no predictors. Equations (1) and (2) represent the statistical form for the baseline model.

$$\text{Level 1: } Y_{ij} = \beta_{0j} + r_{ij} \text{ where } r_{ij} \sim N(0, \sigma^2) \quad (1)$$

$$\text{Level 2: } \beta_{0j} = \gamma_{00} + u_{0j} \text{ where } u_{0j} \sim N(0, \tau_{00}) \quad (2)$$

Y_{ij} : the value of the outcome measure for student i at PLC j .

β_{0j} : the value of the intercept for PLC j , or the mean outcome for the j th group.

γ_{00} : the grand mean.

r_{ij} : the level-1 error term, signifying a random error related with student i at PLC j .

u_{0j} : the level-2 error term, signifying the error related with the group means.

Both the level-1 and level-2 errors are assumed to be independent and normally distributed with means of 0 and variances σ^2 and τ_{00} , respectively. The alternative hypothesis for the model is that variance components are significantly different from zero. Variance components estimated from this model indicate that between-PLC differences account for about 28% of variance in students' DIBELS gains (intra-class correlation coefficient=0.284, $p \leq 0.010$). This result means that hierarchical models can be used for this data rather than the normal OLS models.

In Model 2, PLC closure and brokerage and PLC averages for teacher characteristics are entered into the model. Equations (3) and (4) represent the statistical form for the model 2.

$$\text{Level 1: } \text{Gain}_{ij} = \beta_{0j} + r_{ij} \quad (3)$$

$$\begin{aligned} \text{Level 2: } \beta_{0j} = & \gamma_{00} + \gamma_{01}(\text{Closure})_j + \gamma_{02}(\text{Brokerage})_j + \gamma_{03}(\text{Years in Teaching})_j + \gamma_{04}(\text{Years in} \\ & \text{the Same District})_j + \gamma_{05}(\text{Years in the Same School})_j + \gamma_{06}(\text{Years in the Same Grade} \\ & \text{Level})_j + \gamma_{07}(\text{Years in the same PLC})_j + u_{0j} \end{aligned} \quad (4)$$

After adding teacher characteristics to the model, the intra-class correlation coefficient reduced to 0.269, indicating that observed PLC characteristics account for about 5% of the variance in DIBELS gains picked up by between-PLC differences $((0.284-0.269)/0.284)$. Although teacher characteristics entered are not significant, total years in the teaching profession ($\beta=-5.162$), total years in the same district ($\beta=-0.094$), and years in the same grade level ($\beta=-5.791$) have negative impacts while total years in the same school ($\beta=6.316$) and in the same PLC ($\beta=0.443$) have a positive impact.

Model 3 consists of all student controls. Equations (5) and (6) represent the statistical form for the model 3.

$$\begin{aligned} \text{Level 1: } \text{Gain}_{ij} = & \beta_{0j} + \beta_{01}(\text{Winter}_{2011} \text{ DIBELS score}) + \beta_{02}(\text{Gender}) + \beta_{03}(\text{Ed.Cat.}) + \\ & \beta_{04}(\text{SES}) + \beta_{05}(\text{Ethnicity}) + \beta_{06}(\text{ELL}) + r_{ij} \end{aligned} \quad (5)$$

$$\begin{aligned} \text{Level 2: } \beta_{0j} = & \gamma_{00} + \gamma_{01}(\text{Closure})_j + \gamma_{02}(\text{Brokerage})_j + \gamma_{03}(\text{Years in Teaching})_j + \gamma_{04}(\text{Years in} \\ & \text{the Same District})_j + \gamma_{05}(\text{Years in the Same School})_j + \gamma_{06}(\text{Years in the Same Grade} \\ & \text{Level})_j + \gamma_{07}(\text{Years in the same PLC})_j + u_{0j} \end{aligned} \quad (6)$$

As expected, the higher the Winter_{2011} DIBELS score, the lower the gain by Spring_{2012} (-0.137 , $p \leq 0.010$). Another explanation is that one-unit increase in Winter_{2011} DIBELS score decreases student gain by 0.137 point. In terms of student controls, significant predictors are being Hispanic and in the special education category. Hispanic students gain, on average, 6.794 points less than white students ($p \leq 0.050$). Additionally, students in the special education category gain, on average, 7.969 points less than regular education peers ($p \leq 0.050$).

The results of this study show that the student characteristics are consonant with the prior research. Analyzing 43 countries for reading comprehension, Chiu and McBride-Chang (2006) found that girls are better than boys in reading in 90% of the countries. Similarly, this study indicated that male students' reading gains are less than the female students' gains. Also, in parallel with the findings of national statistics, Hispanic students' reading gains are less when compared to their White counterparts. Moreover, students in the special education category are less successful than regular education students in this study.

Table 21

HLM Estimates of Effects on Gain in DIBELS score from Winter 2011 to Spring 2012

	Model 1	Model 2	Model 3	Model 4
DIBELS _{Winter 2011}			-0.137 ^{***} (0.010)	-0.137 ^{***} (0.010)
Student Characteristics				
Male			-3.190 [*] (1.722)	-3.151 [*] (1.722)
White (baseline)				
Black			-4.313 (3.302)	-4.312 (3.301)
Hispanic			-6.794 ^{**} (3.059)	-6.771 ^{**} (3.058)
Other			-11.448 (21.085)	-11.131 (21.083)
FRLN (not) (baseline)				
Reduced			-4.540 (3.261)	-4.603 (3.261)
Free Lunch			-0.104 (2.320)	-0.129 (2.320)
Reg. Ed. (baseline)				
Gifted Ed.			9.252 (6.071)	9.354 (6.072)
Special Ed.			-7.969 ^{**} (3.305)	-8.027 ^{**} (3.305)
English Language Learner			-0.176 (3.273)	-0.114 (3.272)
PLC social capital				
Closure		2.037 (4.554)	3.581 (5.927)	
Vision				0.223 (12.348)
Information Exchange				-15.107 (13.580)
Trust				18.714 (14.094)
Brokerage		5.534 (7.830)	12.386 (10.202)	
Tier 1: Within school				21.042 ^{***} (7.516)
Tier 2: Outside the school within the district				1.808 (9.424)
Tier 3: Outside the district				-10.645 (8.200)

Table 22

HLM Estimates of Effects on Gain in DIBELS score from Winter 2012 to Spring 2012

	Model 1	Model 2	Model 3	Model 4
Teacher characteristics (PLC average)				
Total years in teaching profession (PLC average)		-5.162 (4.734)	-6.393 (6.147)	-4.083 (5.878)
Years in the district (PLC average)		-0.094 (5.137)	3.982 (6.718)	8.921 (6.552)
Years in school (PLC average)		6.316 (4.910)	5.807 (6.424)	-0.635 (6.346)
Years in grade level (PLC average)		-5.791 (3.745)	-11.173 ** (4.907)	-12.147 *** (4.737)
Years in the same PLC (PLC average)		0.443 (3.640)	1.397 (4.764)	2.669 (4.549)
Constant	25.056 *** (3.320)	17.216 (30.760)	42.660 (40.058)	4.593 (39.909)
Variance components				
Level 2: PLC	728.591 *** (132.956)	682.666 *** (127.633)	1216.608 *** (224.668)	1050.897 *** (195.050)
Level 1: Student	1838.114 *** (53.666)	1851.023 *** (54.696)	1676.754 *** (49.594)	1676.647 *** (49.588)
Intraclass Correlation Coefficient	0.284	0.269	0.420	0.385
Log Likelihood	-12616.434	-12313.704	-12218.874	-12213.999
Wald chi-square		5.190	212.580 ***	219.250 ***

Note: 2,477 students, 120 teachers and 73 PLCs from 17 schools. FRLN=Eligible for free or reduced price lunch. *** p \leq 0.010; ** p \leq 0.050; * p \leq 0.100;

As for PLC characteristics, those PLCs composed of teachers who have been at their grade level for longer appear to have students with smaller DIBELS gains (-11.173; p \leq 0.050). This means that a one-unit increase in years taught in the same grade level decreases student DIBELS gains by 11.173 points. The explanation for this may be that teachers in the same grade level longer than others may consider their teaching practices sufficient for student achievement (Porter, Garet, Desimone, Yoon, & Birman, 2000). Porter et al. (2000) found little change in overall teaching practices in their longitudinal data from 1996 to 1999. They concluded that "teachers' alignment of content with national standards, the goals that teachers have for their

students, and their basic pedagogical strategies appear to remain highly stable over time" (p. 13). For this reason, teachers in this study may not need professional support, novel information, or innovation for their teaching practices. Conversely, beginning or inexperienced teachers in the grade level may investigate novel information and methods that will increase their teaching skills. Another possible explanation may be that PLCs with teachers who are in the same grade level longer than the others tend to work with relatively less successful students.

In Model 3, after entering student characteristics, the intraclass correlation coefficient increases to 0.420 indicating that between-PLC differences pick up about 42 percent of variance in students' DIBELS gains. This likely means that observed student characteristics increase about 36% of the variance in DIBELS gains accounted for by between-PLC differences ($(0.269 - 0.420)/0.420$). The possible explanation for this result is that some PLCs contain less successful students than the others, or PLCs are not homogeneous in respect to unsuccessful students. Another possible explanation may simply be that student characteristics are more important predictors than teacher characteristics.

Most importantly, as seen in Model 3, both PLC closure and brokerage have, as expected, a positive effect, but they are nonsignificant. While they are nonsignificant, this result tends to support Burt's (2005) model. There may be two reasons for this result. First, contrary to PLC literature, internal features of PLCs are not good predictors of student achievement. Second, teachers are "altruistic" and congruent with the PLC values. Therefore, PLCs are more likely to show similar characteristics leading to a nonsignificant effect on student achievement. Similarly, brokerage may not have an effect on student achievement gain or PLCs may not utilize external interactions for teacher development as expected.

The current dataset enabled the researcher to break the social capital effects into their sub-components. Specifically, in Model 4 (in which covariate effects are essentially the same as in Model 3), PLC vision, information exchange, and trust are entered as separate constructs representing closure, and Tier 1 (outside the PLC but within the school), Tier 2 (outside the school but within the district), and Tier 3 (outside the district) external ties as separate aspects of members' links to the outside for brokerage. Equations (7) and (8) represent the statistical form for the Model 4.

$$\text{Level 1: Gain}_{ij} = \beta_{0j} + \beta_{01}(\text{Winter}_{2012} \text{ DIBELS score}) + \beta_{02}(\text{Gender}) + \beta_{03}(\text{Ed.Cat.}) + \beta_{04}(\text{SES}) + \beta_{05}(\text{Ethnicity}) + \beta_{06}(\text{ELL}) + r_{ij} \quad (7)$$

$$\text{Level 2: } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Vision})_j + \gamma_{02}(\text{Info. Exchange})_j + \gamma_{03}(\text{Trust})_j + \gamma_{04}(\text{Tier I})_j + \gamma_{05}(\text{Tier II})_j + \gamma_{06}(\text{Tier III})_j + \gamma_{07}(\text{Years in Teaching})_j + \gamma_{08}(\text{Years in the Same District})_j + \gamma_{09}(\text{Years in the Same School})_j + \gamma_{10}(\text{Years in the Same Grade Level})_j + \gamma_{11}(\text{Years in the same PLC})_j + u_{0j} \quad (8)$$

Student and PLC characteristics display the same effect as the previous model. Of the six social capital sub-components, only Tier 1 ties have a significant effect (Tier 1: ties to others outside the PLC but within the school, such as other teachers, administrators, and staff). Thus, a one-unit increase in Tier 1 (within the school) interactions increases students' reading gain about 21.042 points. One can be 95% confident that one unit change in Tier I ties increases student gain, on average, between 6.31 points and 35.77 points. Participants' responses rated their frequency of Tier I interactions as never, rarely, a few times per year, monthly, weekly, or daily. Thus, daily Tier I interactions increase student gain, on average, between 37.86 points and 214.62 points. Mean gain was 25.056 points, so daily Tier I interactions increase, at least, more than the mean. This result means that each PLC reaches out to others within the school for ideas

and advice on how to improve student performance. It appears that the same dynamic does not pertain to outsiders in the district and beyond (Tier 2 and Tier 3).

One unanticipated finding was that information exchange contradicts the PLC literature suggesting the more exchange information and knowledge, the more student achievement should increase. Contrary to social capital literature and PLC research, this data set pointed out that information exchange had a negative effect on student achievement. There are several possible explanations for this result. One suggestion is that the literature may not be true. However, the data is not longitudinal enough to make a robust investigation of this concept. Another possible explanation is that teachers exchange more information in PLCs with more struggling students. Why this variable has a negative effect cannot be answered easily with this data set. For this reason, this issue may be the focus of future research.

Summary

In summary, this chapter presented the findings of the data analysis, which were used to address the study's research question. This study was focused on the gains in student reading achievement that occurred as a result of the social capital of PLCs. This study utilized student reading assessment data and teachers nested in PLCs, and survey information from elementary schools in state of Kansas. The study data were analyzed to observe changes in reading achievement. The data showed significant gains in academic achievement of students whose teachers nested in PLCs that have interactions outside the PLC but within the school. Chapter 5 addresses a discussion of the findings, as well as their practical implications.

CHAPTER 5: DISCUSSION AND CONCLUSION

Overview

The aim in this study was to examine PLC effects on student achievement. To extend existing research on PLC, this study took into account external ties of PLC members. Existing research persistently focused on internal member relations to examine PLC effects. While previous studies ignored the importance of members' external ties, they primarily were focused on internal characteristics such as trust, collective learning, shared practices, values, and vision in order to examine PLC effects on student achievement (Grossman, Wineburg, & Woolworth, 2001; Saunders, Goldenberg, & Gallimore, 2009; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006; Vescio, Ross & Adams, 2008). However, external ties of PLC members may play a significant role in teachers' professional development and student learning (Duncan-Howell, 2010; Hou, 2015; Matzat, 2013; Supovitz & Christman, 2005). This study drew on the social capital theory, particularly Burt's (2005) social capital model, which emphasized closure (internal ties) and brokerage (external ties) as central dimensions of effectiveness for *any* formal task group. Burt's theory is unique because it considered internal and external features of formal groups simultaneously. For this purpose, the overarching question of this study was: *What is the relationship between PLC social capital and student achievement?* The following hypothesis was tested: *Student achievement increases as PLC brokerage and closure increase.*

The data for this study were drawn, for the 2011-12 school year, from students and teachers in a Kansas suburban school district, serving about 30,000 students. The sample for this study consisted of students from kindergarten to sixth grade and included 2,477 students from 17 schools, 184 teachers working in 73 different PLCs in the same schools. Teacher and student characteristics and individual student records were provided by the school district. Individual

student characteristics included basic background information (lunch codes, race/ethnicity, gender, ELL, SPED, gifted) and scores for the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) test for reading from the winter of 2011 and the spring of 2012.

PLC closure was measured based on Leana and Pil's (2005) work on trust, information exchange, and shared vision. PLC brokerage was measured with an instrument on a 7-point scale adapted from O'Toole (1997) and Meier and O'Toole (2003) in which respondents rated the frequency of their interaction with three tiers of external actors. The dependent variable was the students' achievement scores measured by the DIBELS test for reading. This study employed hierarchical growth models to examine the effects of PLCs' social capital on student achievement.

The key finding from this study was that student achievement gains increased as external interactions of teachers of PLCs within the same building increased. In contrast to the existing PLC research, this finding is new because previous studies have focused on internal member relations to examine PLC effects, ignoring the relevance PLC members' external ties. Another finding was that internal characteristics of PLCs did not have a significant effect, although it was positive, on student achievement.

There may be several explanations for these results. First, the most basic explanation for the nonsignificance of internal relations among PLC members may be that PLC closure does not have an effect on student achievement. However, PLC research suggested that professional communities may support not only student learning (Saunders et al, 2009; Vescio et al., 2008) but also instructional improvement (Hord, 1997; Kruse, Seashore Louis, & Bryk, 1994) and professional development (Armour & Yelling, 2007; Hadar & Brody, 2010). For this reason, this result may be explained by the fact that it could, for instance, very well be that *positive* PLC

effects on gain scores are lagged. If so, positive brokerage and closure effects may transpire in the subsequent semester.

Second, internal member ties in PLCs may not be beneficial for professional development and student achievement as expected. Teachers may tend not to change their teaching practices, or the solutions offered at the PLC meetings may not improve achievement. In addition, Schechter (2012) argued that, in the standards and accountability era, competitive climate is a factor which restrains learning. Due to a competitive environment, some teachers may be reluctant to share their success and prefer to work isolated within their own classrooms (Schechter, 2012). During the PLC meetings, members may be anxious about their colleagues' reactions; therefore, they may prefer not to disclose their instructional strategies to others. A superintendent in Schechter's study (2012) stated, "This criticism may be harmful. People will hide in their shells, be afraid to talk and share their successes. That's why every year we have to reinvent the wheel" (p. 70).

Third, teachers in PLCs may reflect their perceptions about internal features such as trust, information exchange, and vision as high, but, in their classroom, they may not employ the opinions revealed during the PLC meetings. Theoretically, when teachers interact with each other, they share their classroom experiences, practices, and knowledge that can improve student learning. However, in reality, some teachers may "sit in a meeting and say nothing and go back to the room and do nothing" (Wells & Feun, 2013, p. 247). Similarly, some teachers may be unwilling to adopt new information because it may result in additional workloads (Schechter, 2012).

A fourth possible explanation is that harmonious and easygoing PLCs based on close internal ties may "limit teachers' opportunities for professional development as friends reduce

access to alternative perspectives and do not address improper professional conduct" (Achinstein, 2002, p. 447). PLCs with high closure may reflect little innovation, impaired organizational decisions, and limited seeking of alternatives (Achinstein, 2002). In this regard, the current findings add substantially to our understanding of PLC effectiveness by stressing external relations of the members.

A fifth possible explanation is that there may be a collaborative climate existing in the building level already. Considering descriptive tables for internal features, it can be noted that there is moderate variation in these measures. School climate may lead internal measures to be nonsignificant. Teachers do not "get to lead in education without being well socialized to the norms, values, predispositions, and routines of the organization one is leading" (Elmore, 2000, p.2). Thus, well socialized teachers congruent with the school climate may reflect the same characteristics with the others.

When PLCs get along well, the members underplay dissent in favor of consensus, and such PLCs "limit inquiry and change and easily fall prey to myopia, losing an outside perspective." (Achinstein, 2002, p. 447). Similarly, limited interaction with other teachers within the school and the actors outside restricts information on best practices, know-how, creativity, and support for innovation. With external ties, teachers may acquire new knowledge and innovation. Such interactions may better be compared to the traditional teacher development activities. After a three-year longitudinal study on 287 teachers in five different states, Porter et al. (2000) found that professional development had a "little change in overall teaching practice" (p. 13).

In this study, it was found that social capital plays a significant role in increasing student achievement. Bridging social capital of PLC members increases accessibility to information

from their networks. The bonding capital, or closure, of a PLC did not have a significant impact on achievement gain for students in elementary school settings. Namely, whether or not there are extensive internal ties among PLC members does not affect student achievement. This finding does not confirm previous empirical research about PLC effects on student achievement. For example, Goddard, Goddard and Tschannen-Moran (2007) found evidence that "fourth-grade students have higher achievement in mathematics and reading when they attend schools characterized by higher levels of teacher collaboration" (p. 878). By contrast, Wiley's study (2001) does confirm the findings of the current study. Using teachers' opinion of school's professional community, Wiley (2001) found that the professional community has no effect on student achievement. However, these results could be different if bridging social capital were to be taken into account because external ties may be more consequential.

External ties may help by bridging teachers to others in the same school for novel information and innovation (Ancona & Caldwell, 1992; Balkundi & Harrison, 2006; Brass et al., 2004; Perry-Smith & Shalley, 2003; Rodan & Galunic, 2004). Bridging social capital links PLC members to colleagues in the same school. This tends to open access to broader networks to develop teaching practices and improve student achievement. The findings of this study indicate that bonding social capital has no significant effect on student achievement, but bridging social capital plays a role in improving student attainment.

This finding is also consistent with organizational literature. For example, examining over 400 emerging entrepreneurs using the Panel Study of Entrepreneurial Dynamics (PSED), Liao and Welsch (2003) concluded that technology-based entrepreneurs take advantage of external ties for new ventures. Similarly, when they examined over 77 teams from 11 organizations in Korea, Oh, Chung and Labianca (2004) concluded that the optimal level of

group effectiveness is provided by a moderate level of bonding ties within a group and a high level of bridging ties between groups. In organizational literature, group effectiveness is defined as a function of internal and external features (Liao & Welsch, 2003; Oh et al., 2004; Saxenian, 1994). Consequently, these findings and conclusions are consistent with the argument of Burt's (2005) typology which is the main theoretical framework for this study.

Using data from a large urban school district, Bryk, Camburn and Louis (1999) suggested that the PLC supports instructional change by creating a school setting that promotes teacher learning through innovation and experimentation. Innovation and novel information emerge largely through bridging social capital.

Teachers' external ties may have advantages over strong relationships (De Lima, 2001). External ties may provide innovation (Ancona & Caldwell, 1992; Balkundi & Harrison, 2006; Brass et al., 2004; Rodan & Galunic, 2004), creativity (Perry-Smith, 2006; Perry-Smith & Shalley, 2003), access to new information and knowledge (Brass et al., 2004; Granovetter, 1973; Hansen, 1999; Podolny & Page, 1998; Tsai, 2001), and performance (Cross & Cummings, 2004; Perry-Smith, 2006). Moreover, De Lima (2001) stated that these external ties allow teachers "to experiment with new and risky behaviors and identities without fear of being judged negatively by their closest ones" (p. 109). In this regard, the main insight of this study suggested that teachers' professional ties outside of their PLCs, but within the school, may have a significant effect on student achievement.

The main finding of this research shows that learning may not occur only in PLC meetings. Teachers collaborate with other teachers outside their own PLC in staff rooms, hallways, and classrooms. For example, Coburn and Russell's study (2008) on eight schools in two different districts displayed that "teachers' social networks almost always stretch beyond

grade-level groups to include others inside and outside the school" (p. 209). One possible explanation would be that collaborations outside the PLC but within the school may be better than the formal PLC meetings. In fact, the finding of a positive link between within-school interactions and student achievement may be important. For example, teachers in Jones and Dexter's study (2014) stated that face-to-face conversations are both helpful and effective. They reported the importance of short conversations in the corridors to reach information quickly and timely: "in between classes, at the end of the day, I use this, here you go... I mean there is some formal aspect to it but it's like [teacher 1] finding ideas from [teacher 2] over a 60 s conversation" (Jones & Dexter, 2014, p. 377). Based on the results of this study, it can be noted that if teachers' collaboration with other teachers outside the PLC in elementary school settings has the potential to increase student reading achievement, such efforts should be encouraged and supported.

PLCs appear to work better when the school promotes ongoing exchange across PLCs. When teachers work collaboratively to improve classroom practices, they more effectively promote professional development and student learning (Borko, 2004; Darling-Hammond, 2010; Stoll et al., 2006; Vescio, Ross, & Adams, 2008). Also, teacher learning happens through social interaction, communication, and reflective dialog (Rigelman & Ruben, 2012). Moreover, in contrast to previous research emphasizing that teachers learn from one another in formal PLC meetings, learning may occur through outside discussions in school corridors, lunchrooms, or other places (Penual, Riel, Krause, & Frank, 2009). For example, one teacher in Retallick and Butt's (2004) study stated;

The coffee table tended to draw specific people at specific times, so that you could almost say it formed the community of sorts. It was a place where you didn't have to prove

anything; you just belonged because you were an instructor. It was a social place, where you shared one another's sorrows and successes. It was also a place where you could project ideas and get some sort of feedback on them. And also, it was a place where you could get informal reflection on what was happening in your classes that others had heard about. (p. 89)

Hargreaves (1994) argued that contrived collegiality, which is "administratively regulated," "compulsory," "implementation-oriented," "fixed in time and space," and "predictable," may be unproductive. In contrast, a school structure that supports having coffee and professional discussions around a coffee table or in a workroom, rather than attend a formal PLC meeting may facilitate and improve teacher learning. Similarly, Fox and McCormick (2009) stated, "while photocopiers are often the hub of a school, and water coolers an important focus for knowledge exchange in many workplaces, around the coffee bar, the lobby and side areas at events might be scenes of meaningful interpersonal interactions" (p. 5). In addition, McGregor (2004) found that while about 11% of all teacher interactions occurred in the department meetings, 9% of all teacher interactions were with individuals in other departments. Moreover, McGregor (2003) stated that a huge amount of information was "informally discussed, overheard, questioned and answered" (p. 360) in the department offices.

Within-school interaction should be encouraged for collaboration and social cohesion within the school. Collaboration among faculty plays an important role in resolving teacher individualism and isolation (Hadar & Brody, 2010). Teachers in schools that lack trust tend not to take risks in asking for help (Lencioni, 2006). In this study, trust in PLCs has a positive effect on student achievement but it is nonsignificant. This does not mean that trust is not important. Trust may be a feature transpired in the school level.

Implications for Practice

The study of internal and external interactions of teachers to consider the efficacy of professional learning is an important step to reveal the impacts of PLCs on student achievement. After analyzing the literature and the data, the researcher suggests the following recommendations for policy makers. The first practical suggestion highlights the importance of school context. School leaders should encourage teachers to collaborate with other teachers in different PLCs within the school. Formal PLC meetings should not be the only instrument for professional development. These meetings occur on a preconcerted schedule during the school year. However, the expertise and resources may be exchanged through interactions among faculty in school corridors, rooms, library, or classrooms (Penuel et al., 2009). In this way, teachers may find quick solutions to their daily instructional problems and solve others' practical experiences because within-school informal interactions do not have a scheduling problem. Collaboration among the faculty in a building is more likely to promote teacher development than the sources located outside the school. Teachers within a school may help others to implement practical innovations and new ideas that can improve student learning.

The second recommendation of this study suggests that the faculty of a school may be more likely to provide ongoing support to their colleagues, to facilitate practical innovations, to bring novel information for instructional improvements and to find resources for school. In view of these benefits, school districts may examine their professional development models to support informal interactions within the buildings. In addition, district leaders should offer support for formal, informal, and individual learning activities. To that end, school districts may provide an opportunity of online platform, which builds community for schools and the district to connect not only teachers within the schools but also teachers within the district. The research on online

communities suggests that teachers have increasingly used online communities for professional support, assistance, innovation, and motivation (Duncan-Howell, 2010; Hou, 2015; Matzat, 2013). Teachers may access professional development not only through the PLCs within a school but also through an online community (Duncan-Howell, 2010). The schedule for the online community platform is flexible and responses are fast. Furthermore, Matzat (2013) argued that blended communities, a combination of online and real-life interaction, "provide more practical benefits to teachers, both in terms of perceived improvements to their teaching capabilities as well as for their substantial understanding of their core topic"(p. 40). Creating blended communities in schools and in the school district may be beneficial for teacher development.

This study suggested that school context matters. To increase informal interactions within the schools, leaders should provide time and opportunities for collaboration among faculty. In this sense, leadership is an important tool for building a collaborative culture in schools. To create effective PLCs and collaborative culture in schools, leaders must demonstrate and benefit from different leadership styles, such as distributional, instructional, transformational, and transactional, beyond traditional ones (Mullen & Schunk, 2010). Leaders may use one of them or a combination of them to create a collaborative and trusted environment and increase innovation and information exchange among faculty. This leads to greater motivation, increased job satisfaction, and better decision making (Mullen & Schunk, 2010). Open, reciprocal and critical discussions among teachers are more likely to support growth and development (blasé & Blase, 1999).

School districts take into account using formal professional learning activities more than supporting or building informal learning processes. By considering informal learning practices,

school districts could develop initiatives to provide the necessary continuing and just-in-time support for teachers. These efforts may include technology integration that supports school or district wide collaboration.

Limitations and Directions for Future Research

This study has four limitations. First, this study used data limited to the 2011-2012 academic school year. The findings of the study are subject to the limitations related to the short period of the study (less than one year). The effects of PLCs on student achievement may not appear because of the limited time period. If previous data was used in the study, test would be more robust. This indicates that longitudinal data are needed to examine the long-term effects of PLCs on student achievement. Future research should have longitudinal student achievement data that control and reduce inherent limitations. This would allow the further analysis of the lagged effects of PLCs' social capital on student achievement. Longitudinal data may provide robust findings of the proposed theoretical constructs.

Second, this data lacked students' parental controls, such as the number of parents in the household, parents' educational attainment levels, and parents' support of the educational goals. This could affect the variance in student achievement growth. Without parental controls, this study may have underestimated the PLC's effects on student achievement, especially for those with special needs. Future studies should add parental controls to refine the effects of PLCs on student achievement.

Third, brokerage was measured by the frequency of the teachers' interactions with outside actors. The survey used in this study, which was designed by Meier and O'Toole (2003), does not measure the quality and effectiveness of the interactions. Additional information about the quality of the interactions may provide some understanding about the value of these interactions.

For example, some professional development opportunities may occur only a few times per year. The value of these high-quality interactions may not display the efficacy on teacher learning because the frequency of this event is less than those which are less effective, but more frequent, interactions.

Fourth, the data of this study does not contain the number of teachers in each PLCs. This sample consists of the number of teachers who responded to questionnaires. Teachers per PLC on average is 2,52. This means that three-teacher-PLCs reflect, to a large extent, the mean of the PLC effect but six-teacher-PLCs represent the mean of the PLC effect to some degree. Future research should exploit the weighted mean of PLCs' closure and brokerage scores.

Lastly, the student achievement was measured by the DIBELS Next test and the data in this study were collected from the elementary school levels in the state of Kansas. DIBELS Next is a test, which only evaluates the students' reading achievement; therefore, future research should examine the PLC's effects on students' math or science achievement. Similar studies should be employed on the middle- and high-school levels. Furthermore, it would be very beneficial if similar studies were conducted in different states and using different achievement tests.

In addition to the suggestions stated in the previous paragraph, future studies may collect qualitative data for a deeper understanding of PLCs' effects. For example, contrary to the previous findings in the PLC literature, this study shows that the impacts of internal interactions within PLCs are not significant for student reading achievement. Qualitative data for this study could provide insight into why closure was not significant and which external interactions affected student achievement. Moreover, future studies may advance a closure survey by adding different items to measure additional characteristics of the PLCs. In addition, any further

research measuring the quality and duration of external interactions would provide a more robust examination of PLC effectiveness.

Similar studies that employ mixed methods would be the next step in considering the effects of PLCs on student achievement. Future research should combine qualitative data coming from interviews, observations, field notes, and meeting transcriptions with quantitative data to examine the social capital (internal and external ties) impacts on student achievement for an in-depth analysis. These studies could contribute to the PLC research facing theoretical and empirical challenges.

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Appendix

Table A1

Definitions of PLC

Nu.	Authors	Definition
1	DuFour & DuFour	PLC "is an ongoing process in which educators work collaboratively in recurring cycles of collective and action research to achieve better results for the students they serve. Professional communities operate under the assumption that the key to improved learning for students is continuous job-embedded learning for educators" (2010, p. 11)
2	Stoll & Louis	There is no universal definition of a professional learning community, but there is a consensus that you will know that one exists when you can see a group of teachers sharing and critically interrogating their practice in an ongoing, reflective, collaborative, inclusive, learning-oriented, growth-promoting way. (2007, p. 2)
3	Bolam et al.	An effective professional learning community has the capacity to promote and sustain the learning of all professionals in the school community with the collective purpose of enhancing pupil learning. (2005, p.131)
4	Sigurðardóttir	A professional learning community consists of a group of professionals sharing common goals and purposes, constantly gaining new knowledge through interaction with one another, and aiming to improve practices. (2010, p. 397)
5	Harris & Jones	A professional learning community is a group of connected and engaged professionals who are responsible for driving change and improvement within, between and across schools that will directly benefit learners. The basic argument is that by cultivating professional learning communities it is possible for schools to improve student achievement through changing teaching and classroom practices. (2010, p. 173)
6	Intanam & Wongwanich	A professional learning community can be defined as a group of persons working together with an aim to exchange information, generate knowledge, develop expertise, and solve problems in work. (2014, p. 477)
7	Mullen & Schunk	The PLC is a model of school organization designed to foster collaboration and continuous learning among educators to harness school improvement through organizational and cultural change. (2010, p. 186)
8	DuFour, DuFour, Eaker, & Many	A PLC is composed of collaborative teams whose members work interdependently to achieve common goals linked to the purpose of learning for all. (2006)
9	Parsons	A professional learning community is a group of educators who are sharing and critically reflecting on their practice in order to enhance the learning of students and teachers, thereby supporting school development (2014, p. 120).
10	Servage	The professional learning community (PLC) is one model within a constellation of models and theories characterized by a number of core beliefs: (1) that staff professional is critical to development improved student learning; (2) that this professional is most effective when it is collaborative development and collegial; and (3) that this collaborative work should involve inquiry and problem solving in authentic contexts of daily teaching practices. (2008, p. 63)

Table A2

Characteristics of Professional Learning Communities

Nu.	Authors	Characteristics
1	Hord	(1) Supportive and shared leadership, (2) Shared values and vision, (3) Collective learning and application of learning, (4) Supportive conditions, and (5) Shared practice (2004)
2	Stoll, Bolam, McMahon, Wallace, & Thomas	(1) Shared values and vision, (2) collective responsibility, (3) reflective professional inquiry, (4) collaboration, (5) group, as well as individual, learning, (6) mutual trust, (7) inclusive membership, and (8) openness, networks and partnerships (2006)
3	Clausen, Aquino, & Wideman	(1) There exists within the community a constructed understanding of reality and learning. (2) The community is driven by a shared goal or purpose. (3) Informal power is shared amongst community stakeholders. (4) Flexibility is created within the organizational structure. (5) Through a balance of support and pressure, formal leaders show long-term commitment. (6) There is an open communication channel. (7) There is a group memory. (8) In-servicing becomes ongoing and internal. (9) Teachers begin to think in collegial terms. (10) A culture of trust and respect exists among stakeholders. (2009)
4	Sigurðardóttir	(1) Shared values and vision that focus on students' learning. (2) High expectation of pupils' academic achievement. (3) Shared leadership that values teachers' participation in making decisions. (4) A perception of mutual support among staff. (5) Collaborative learning among professional staff that addresses pupils' needs. (6) Organizational arrangement that supports teachers' collaboration. (7) Habits of work that encourage collaborative learning. (8) A social climate that supports collaborative learning. (9) Job satisfaction and commitment. (2010)
5	Harris & Jones	(1) Respect and trust among colleagues at the school and network level; (2) Possession of an appropriate cognitive and skill base that enables effective pedagogy and leads to effective learning; (3) Supportive leadership from those in key roles and shared leadership practices; (4) The norms of continuous critical inquiry and continuous improvement; (5) A widely shared vision or sense of purpose; (6) A norm of involvement in decision-making; (7) Collegial relationships among teachers; (8) A focus upon impact and outcomes for learners. (2010)
6	Lomos, Hofman & Bosker	(1) Reflective dialogue, (2) Collaborative activity, (3) The de-privatization of practices, (4) A shared sense of purpose or collective responsibility, and (5) Focus on student learning. (2011)
7	Wahlstrom & Louis	(1) Deprivatized practice, (2) Reflective dialogue, (3) Collective responsibility, and (4) Shared values and vision. (2008)
8	Intanam & Wongwanich	(1) Working collaboratively together with reflective dialogue or discussion among academic technicians of schools; (2) Collective focus on student learning and their professional goals; (3) Gathering and using the results of evaluation to make decisions regarding the learning progress of students. (2014)
9	Kruse, Louis & Bryk	(1) Reflective dialogue, (2) De-privatization of practice, (3) Focus on student learning, (4) Collaboration, (5) Shared values (1994)
10	Fulton & Britton	(1) Shared values & goals, (2) Collective responsibility, (3) Authentic assessment, (4) Self-directed reflection, (5) Stable settings, (6) Strong leadership support. (2011)