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TEACHER LEADERSHIP AND STUDENT ACHIEVEMENT IN THE UNITED STATES AND SOUTH KOREA: INVESTIGATING THE ROLE OF TEACHER LEADERSHIP IN HIGH-POVERTY SCHOOLS

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ABSTRACT

Teacher leadership (TL) research has often failed to investigate equity and social justice as well as to consider national contexts and cultural differences. This study examines the relationship between TL and student achievement while investigating the moderating role of TL on the association between school poverty and student achievement in two countries (i.e., the United States and South Korea). TL is defined by two primary practices or activities: (a) supporting professional learning of peers (i.e., *collaboration, cooperation*) and (b) influencing school decisions (i.e., *distributed leadership, decision-making responsibility)*. I address three research questions: (a) How are TL practices reported by teachers and their school principals in the US and Korea? (b) How are TL practices associated with differences in student achievement in the US and Korea? (c) Do the associations between school poverty and student achievement vary according to TL practices in the US and Korea?

Using 2015 PISA data, I utilized hierarchical linear modeling (HLM) to address the research questions and test specific hypotheses. The present study first found that the two TL practices (i.e., TL in peer learning and TL in school decisions) were weakly correlated to each other in both countries. Student achievement in the US was positively correlated with TL for school decisions *(distributed leadership* and *decision-making responsibility)*, whereas student achievement in Korea was correlated to TL in peer learning (i.e., *collaboration* and *cooperation*). In addition, HLM analysis partially indicated that among the four different TL practices, only (budgeting- and curriculum-related) *decision-making responsibility* was statistically related to higher student achievement in the US. In Korea, *collaboration* (i.e., observing and providing feedback; joint activities) was negatively related to student achievement, while *cooperation* (i.e., exchanging teaching materials; ensuring common standards together; and attending team conferences). Furthermore, the results showed two significant patterns of the relationships among

TL, student achievement, and school poverty. First, negative relationships between school poverty and student achievement were weaker in schools with a higher degree of TL (i.e., *distributed leadership* in the US, *curricular decision-making responsibility* in Korea). Second, the negative relationship between school poverty and student performance was great in schools with a higher degree of teacher *collaboration* in Korea.

These findings have implications for theory and policy. First, these two major TL practices (i.e., TL in peer learning and TL in school decisions) that may be independent rather than interconnected concepts. Second, the conceptualization of TL should include the effects of educational systems and cultural contexts. Third, policymakers need to understand the different associations between TL practices and student achievement by country before formulating policy. Finally, a more valid and reliable database with elaborated measurement would enable future researchers to rigorously assess the relationships among TL, student achievement, and school poverty.

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Chapter 1

Introduction

Teacher leadership (TL) in collegial learning and school decisions is a key driver for school improvement. Sustainable school improvement is more likely to be achieved by collective capacities rather than either the heroic leadership of one school principal or one excellent teacher (Darling-Hammond, Bullmaster, & Cobb, 1995; Hargreaves & Fullan, 2012; Heller & Firestone, 1995). Thus, educational policy reforms have advocated for the TL approach, which argues that teachers are professionals who can decide what they need to learn as well as agents who can accomplish successful school change (Council of Chief State School Officers [CCSSO], 2019; Margolis & Huggins, 2012; National Council on Teacher Quality [NCTQ], 2019). Specifically, teachers can contribute to school improvement by influencing the professional learning of their colleagues (L. D. Gonzales & Behar-Horenstein, 2004; Margolis, 2012; Vernon-Dotson & Floyd, 2012) and by utilizing their professional knowledge of the students and classroom practices in school decision-making processes (Englert, Tarrant, & Rozendal, 1993; Marks & Louis, 1997; Rosenholtz, 1989; Smylie, 1992; Smylie, Lazarus, & Brownlee-Conyers, 1996).

Accumulated literature illustrates the positive influence of TL on teacher leaders, their colleagues, and teaching and learning cultures in a school (see Wenner & Campbell, 2017; York-Barr & Duke, 2004 for the systematic reviews). In addition, recent empirical research suggests a possible link between TL and higher student learning outcomes, which are usually measured by academic achievement. Some researchers identified that student academic performance is indirectly related to TL via the quality of professional development program (Sebastian, Allensworth, & Huang, 2016), school learning climates (Sebastian, Huang, & Allensworth, 2017), or focused instruction of teachers (Louis, Dretzke, & Wahlstrom, 2010a). Other researchers also found a direct relationship between TL and student achievement (Hallinger &

Heck, 2010; Ingersoll, Dougherty, & Sirinides, 2017; Leithwood & Mascall, 2008; Luschei & Jeong, 2020).

Nevertheless, previous studies often failed to investigate how TL plays a role in increasing student achievement in high-poverty schools. The socioeconomic composition of schools is a crucial predictor of student achievement (Vanderhaar, Muñoz, & Rodosky, 2006). This is because the negative influence of concentrated poverty could be far more than the influence of the individuals' family backgrounds on students, teachers, and the school (Banks, 2001). Still, we do not know much about how the relationship between school poverty and student learning varies according to TL. The prior studies just controlled the school environmental factor, rather than examined the importance of TL for student learning in high-poverty schools. This study is thus distinct from previous literature in that it investigates the moderating roles of TL on the association between the school poverty level and student achievement.

Furthermore, we need to understand the TL and student achievement associations within a national context. Even though global education reforms have advocated for TL roles in peer learning and shared decision-making (OECD, 2016), considerable variations exist across nations regarding TL (Brezicha, Ikoma, Park, & LeTendre, 2019; Luschei & Jeong, 2020). Therefore, this study employs a comparative lens and selects two countries—the United States and South Korea (hereafter, Korea)—to examine the different relationships among TL, student achievement, and school poverty, according to the educational systems and cultural contexts. The two countries are particularly interesting cases for this study because both countries emphasize the TL roles in student learning, but they show highly different poverty levels from each other.

For instance, both countries emphasize the role that TL can play in teacher and student learning, but the US and Korea show an opposite policy direction regarding TL in the recent decade. In the US, TL is constrained by the standardization movement and federal accountability

policies such as the No Child Left Behind (NCLB) Act (D. W. Jeong & Luschei, 2018), even though policymakers and researchers still encouraged TL to address the higher turnover rates caused by feelings of isolation (Brownell, Yeager, Rennells, & Riley, 1997; Johnson, S. M., Kraft, M. A., & Papay, 2012). Also, the US has a highly decentralized education system, and its school environment (e.g., school poverty) varies by district, county, and state. On the other hand, in Korea, the importance of TL increases as the government promotes a bottom-up school reform in recent decades (K.-H. Chung, Kim, Kim, & Kim, 2008). Korean school systems were traditionally centralized and school environments were relatively homogenous across the country, but the government has actively promoted the decentralization of educational authority structures and diversified its school systems (Y.-H. Choi & Kim, 2017; Moon et al., 2018).

The distinct national contexts of the US and Korea suggest that the relationships among TL practices, student achievements, and school environments will differ by country. To deepen our understanding of the moderating role of TL on the association between school poverty and student achievement in two different countries, this study uses the 2015 Programme for International Student Assessment (PISA) and answers the following research questions.

1. How are TL practices (i.e., *collaboration, cooperation*, *distributed leadership*, and *decision-making responsibility*) reported by teachers and their school principals in the US and Korea?
2. How are TL practices associated with student achievement (i.e., reading, mathematics, and science) in the US and Korea?
3. Do the associations between school poverty and student achievement vary according to TL practices in the US and Korea?

Chapter 2

Literature Review

This chapter consists of three parts: 1) the conceptual frameworks of TL and equitable leadership, 2) contextual backgrounds of TL in the US and Korea, and 3) prior literature on the relationship between TL and student achievement.

Conceptual Framework

Teacher leadership

This section begins with the definition of TL and then introduces frameworks for two essential leadership practices of teachers: supporting the professional learning of colleagues and influencing school decision-making.

Definition

There are various nuanced concepts of what constitutes TL, but a recent systematic review defines that it is "focused on roles beyond the classroom, supporting the professional learning of peers, influencing policy/decision-making, and ultimately targeting student learning" (Wenner & Campbell, 2017: p.116). The first theme of the definition, focusing on roles beyond the classroom, means that a teacher leader leads not only his or her students but also peer teachers and other staff outside of his or her classroom. For instance, TL could positively affect teachers' self-esteem (Friedman, 2011) and collective efficacy in a school (Vernon-Dotson & Floyd, 2012). The first theme also indicates that a teacher leader plays roles in improving his or her school

organization and changing school cultures and climates, beyond classroom walls (Beachum & Dentith, 2004; Brooks, Scribner, & Eferakorho, 2004; Gaffney & Faragher, 2010; Margolis & Huggins, 2012; Muijs & Harris, 2006).

The second theme, supporting the professional learning of peers, suggests that teacher leaders provide more opportunities for other teachers to engage in professional learning communities and formal professional development activities (Carpenter & Sherretz, 2012; S. Gonzales & Lambert, 2001; Hickey & Harris, 2005; Westfall-Rudd, 2011). Teacher leaders can also increase the quality of professional learning and make teacher learning more meaningful (Vernon-Dotson, 2008; Vernon-Dotson & Floyd, 2012). Furthermore, they informally support their colleagues for professional growth (Margolis & Deuel, 2009; Muijs & Harris, 2006; Supovitz, 2018).

The third theme, influencing policy/decision-making, points to how teacher leaders participate in a decision-making process and exert their influence on the process. For instance, shared decision-making could contribute to taking better approaches to problem-solving (S. Gonzales & Lambert, 2001) and teaching and learning (Carpenter & Sherretz, 2012; Muijs & Harris, 2006), and promoting inclusive education (Vernon-Dotson, 2008). ,

Finally, the fourth theme, ultimately targeting student learning, means that all the roles of teacher leaders beyond their classroom are connected to student learning and success. In other words, teacher leaders' roles go beyond supporting the professional growth of peers and changing a school organization, and in turn, positively influencing student learning outcomes (Carpenter & Sherretz, 2012; Hunzicker, 2012; Vernon-Dotson & Floyd, 2012).

In sum, Wenner and Cambell's (2017) review framed TL as seeking to improve student learning and success by facilitating the professional learning of colleagues and participating in a decision-making process outside of their classroom at some levels of practices (e.g., department-, grade-, school-, or district level). Still, as Wenner and Campbell (2017) pointed out, more

empirical evidence is required to establish the conceptual links between TL and student learning, as well as to address TL for equity and social justice.

TL in supporting the professional learning of peers: Collaboration and cooperation

TL in encouraging the professional learning of teaching staff plays an important role in teacher and student learning. Teachers can learn instructional and classroom managerial skills from each other by observing classes and exchanging feedback (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009). Interactions among teachers could encourage them to access new ideas, teaching materials, or instructional strategies in their lessons (Darling-Hammond et al., 2009; Egodawatte & Mcdougall, 2011). Peer learning approaches also could make teachers more satisfied (Reeves, Pun, & Chung, 2017; Vangrieken, Dochy, Raes, & Kyndt, 2015) and confident (Moolenaar, Sleegers, & Daly, 2012; Zinke, 2013), which leads to teachers' increased focus on their professional learning and teaching practices (Darling-Hammond et al., 2009). Moreover, TL in collegial learning supports teachers' commitment to collective reflection on pedagogy and exchange of their teaching practices, and it fosters a professional culture of intellectual inquiry and learning climate in the workplace (Moolenaar et al., 2012; Westheimer, 2008), which benefits all students in the school (Y. L. Goddard, Goddard, & Tschannen-Moran, 2007; Hargreaves & Fullan, 2012; Reeves et al., 2017; Supovitz, Sirinides, & May, 2010).

In this study, I use *collaboration* and *cooperation* to understand TL practices that support the professional growth of teacher colleagues and student learning progress in a school. Some studies used teacher collaboration as an umbrella and interchangeable term with professional (learning) community (PLC), community of practice (CoP), team, and group (see Kelchtermans, 2006; Vangrieken et al., 2015, for the literature review). However, Hord (1986) distinguished *collaboration* from *cooperation* by synthesizing research on organizational collaboration.

Collaboration is a within-group system that operates by joint planning and joint implementation with shared aspirations for outcomes, whereas *cooperation* indicates working together autonomously and separately. In other words, a mutual agreement might exist around the cooperative task, but the work does not proceed beyond the agreement. Thus, *collaboration* requires more time and energy to sustain it by pooling resources and by dividing labor as compared to *cooperation*. In contrast, *cooperation* occurs in a daily teacher practice more organically, naturally, and informally (Fairman & Mackenzie, 2015; Spillane, Halverson, & Diamond, 2004; Sun, Penuel, Frank, Gallagher, & Youngs, 2013). Based on these clarifications, teacher *collaboration* refers to shared responsibility and decision-making for teachers' joint work, and teacher *cooperation* means voluntary exchange and coordination for teaching and administrative work.

Finally, the cultural differences in peer learning of teachers will be considered. Numerous teacher studies are heavily based on the western contexts, especially on the US contexts, but Shimahara and Sakai (1995) argue that teacher practices are culturally patterned. Many comparative studies illustrated the cultural differences between the US and Japan in terms of teacher education pedagogies (Howe & Arimoto, 2014), notice teacher induction and mentoring (Ahn, 2014), and professional learning of teaching staff (Kinney, 1997). These studies showed that Japanese teacher education institutions highlighted interrelationship and bonds among teaching staffs (Howe & Arimoto, 2014), induction programs provided sustained mentoring for beginning teachers in a social (Ahn, 2014), and collaborative space in a school, and there are rich collegial interactions and learning practices among teachers throughout their career (Howe & Arimoto, 2014). Given findings, peer learning of teachers in the US and Korea should be understood as a cultural process.

TL in influencing school decisions: Distributed leadership and decision-making responsibility

This study employs distributed leadership and decision-making responsibility to frame another TL practice that influences school decisions. First, TL in influencing decision-making needs to be understood in the context of the shared or distributed nature of leadership (Harris, 2003; Supovitz et al., 2010). Prior literature also endorses that effective educational leadership is attributed to school-wide staff rather than one person or the principal (Darling-Hammond et al., 1995; Hargreaves & Fullan, 2012; Heller & Firestone, 1995). While many studies address the formal role of teacher leaders (e.g., year or departmental heads), recent research argues that not only quasi-formal leadership of teacher leaders but also distributed leadership across general teachers can significantly contribute to their school improvement (S. Gonzales & Lambert, 2001; Muijs & Harris, 2001; Portin, Russell, Samuelson, & Knapp, 2013; Supovitz, 2018).

Importantly, the concept of distributed leadership needs to focus on "*practice* rather than leaders or their roles, functions, routines, and structures" (Spillane, 2005, p. 144). This means that distributed leadership is "not only on *what* people do but *how* and *why* they do it" (Spillane, 2005, p. 143). The *practice* also indicates "*interactions* of school leaders, followers, and their situation, rather than any particular action" (p. 145). Thus, this study considered three specific practices of distributed leadership that could impact school improvement and student learning: shared accountability for student learning, making collaborative school decisions, and school-wide participation in efforts to evaluate the school's academic development (Hallinger & Heck, 2010).

For instance, when leadership is distributed to school-wide teachers, they can have a clear voice to initiate school visions to support student learning and share accountability for student success (Beachum & Dentith, 2004; Buckner & McDowelle, 2000; Gigante & Firestone, 2008). Distributed TL can also contribute to collaborative school decision-making processes for school improvement by utilizing teachers' professional knowledge of teaching and learning practices in

their classes (Englert et al., 1993; Marks & Louis, 1997; Rosenholtz, 1989; Smylie, 1992; Smylie et al., 1996). Finally, when a school principal considers teachers as a professional, teachers can meaningfully engage in school-wide decisions related to curriculum, instruction, and managerial tasks, which benefits student academic performance (Bryk, Sebring, Allensworth, & Luppescu, 2010; Smylie et al., 1996).

Second, teacher decision-making responsibility is also a crucial aspect of TL in school decisions. The research literature on teacher autonomy, empowerment, and professionalism overlaps with the TL studies in terms of teacher decision-making responsibility (Conley, 1991; Rinehart, Short, Short, & Eckley, 1998; Sweetland & Hoy, 2000). Global policymakers provide more school and policy decision-making responsibilities for teachers to achieve a bottom-up school reform (OECD, 2016). The school-based management initiative is one of the examples of decentralization in education. The proponents of decentralized school governance claim that local information and knowledge could be more responsible (Oates, 1999), and they gain productive efficiency (Barankay & Lockwood, 2007). In the policy contexts, teachers should demonstrate their leadership in decision-making processes at different levels (e.g., school, district, state, or federal).

In addition, literature endorses that more decision-making responsibility is essential for teachers to exercise their genuine leadership in a school (Benson, 2010; Hanushek, Link, & Woessmann, 2013; Scribner, Sawyer, & Myers, 2007). Teachers with considerable responsibility could actively apply their professional knowledge and skills to school improvement and classroom practices (James & McCormick, 2009; Sales, Traver, & García, 2011). Further, teacher decision-making responsibility takes place in disparate areas such as staffing, budget allocations, curriculum and assessment, and student discipline (Ingersoll, Sirinides, & Dougherty, 2018; D. W. Jeong & Luschei, 2018; Luschei & Jeong, 2020). In particular, literature often addresses the

importance of teacher responsibility in curriculum and instruction to improve student learning outcomes (Luschei & Jeong, 2020; J. H. Park, Cooc, & Lee, 2020).

Building on the literature above, this study frames TL in influencing school decision-making with three specific distributed leadership practices and four different domains of teacher decision-making responsibilities.

Equitable leadership

This study conceptualizes the TL roles in high-poverty schools by using equitable leadership theory that prioritizes both equity and excellence in leadership practice (Theoharis, 2007, 2010). A systematic review (Riehl, 2000) suggests three major leadership practices for equity: developing new meanings of diversity based on values of equity and social justice, building inclusive instructional programs and school cultures, and establishing a trustful relationship between schools and community. In other words, equitable educational leaders challenge deficit views regarding implicit bias about race, gender, and socioeconomic status (SES) and create a new vision for social justice and equity (Galloway & Ishimaru, 2017; Valencia, 2010). Moreover, equitable leadership rebuilds school structures and cultures to address issues of equity and diversity by communicating with community members (Oakes, Wells, Jones, & Datnow, 1997; Rubin, 2008; Theoharis, 2010).

With the equitable leadership practices of school principals, the literature highlights the TL roles in promoting equity and excellence in a school. When leadership is effectively distributed to teachers, they can contribute to decision-making and problem-solving for equity by considering diverse learners and various settings (Spillane, 2005; Woods, 2015). Lipman (1997) found that peer learning of teachers and teachers' decision-making involvements contribute to the restructuring and transforming of a high-poverty school by challenging the beliefs and

assumptions of educators. In other words, TL practices can deconstruct the deficit thinking of teachers and foster their use of an equity lens for racially/ethnically and socio-economically diverse students and families (García & Guerra, 2004). Collegial learning of teachers also could promote equitable instruction for academic success and the well-being of all students (Galloway & Ishimaru, 2017). In addition, teachers could build an equitable school culture by paying more attention to equity issues and the needs of all students (Galloway & Ishimaru, 2017; García & Guerra, 2004; Slavit, Kennedy, Lean, Nelson, & Deuel, 2011). Furthermore, Bryk, Gomez, Grunow, and LeMahieu (2015) showed that those TL practices are crucial in sustaining and enhancing equity in a school in the long run.

Contextual backgrounds

United States

TL is not a new concept in the US. In the 1980s, the idea of a "lead teacher" and various TL roles were introduced to improve student achievement and secure national competitiveness, precipitated by two reports: *A Nation at Risk* (National Commission on Excellence in Education, 1983) and *A Nation Prepared: Teachers for the Twenty-first Century* (Carnegie Corporation of New York, 1986). Moreover, numerous TL studies highlighted individual TL roles by challenging the egalitarian culture among teaching staffs as well as bureaucratic school structures (Smylie & Denny, 1990; Smylie & Smylie, 1995), and some studies shed light on the TL roles as a collective one (Miles, Saxl, & Lieberman, 1988). The TL initiative and literature addressed teacher professionalism, teacher empowerment, and shared responsibility to change teaching and learning culture (Little, 2003; Yendol-Silva & Fichtman Dana, 2004). Also, the TL approach was linked to site-based decision-making and school management (David, 1989; Muijs & Harris,

2006) by requiring teachers to actively participate in decision-making about curriculum and in solving organizational issues. In sum, TL is grounded in the literature that argues TL can be a critical internal driver for school reform and change based upon the decentralized educational governance.

However, TL roles have been constrained since accountability policies (e.g., the No Child Left Behind [NCLB] Act of 2002) were introduced (D. W. Jeong & Luschei, 2018). The NCLB Act increased the federal influence on school decisions and monitored the performance of schools and districts on standardized tests. Admittedly, the Act intended to secure qualified teachers by endorsing teacher professionalism, but teachers' autonomy in their professional learning and their decision-making responsibilities were hindered by high-stakes exams and scripted curricula (Barrett, 2009). For instance, the National Center for Education Statistics (NCES) shows that significantly higher percentages of teachers perceived that they have low autonomy in curriculum and instruction in 2013, compared with the percentages of teachers in 2003 (Sparks, Malkus, & Ralph, 2015).

Even though a TL policy does not exist at the federal level in the US, many states have recently promoted TL in order to retain effective teachers and support their professional growth. According to a report of (NCTQ, 2019), 35 states had their own formal TL policies in 2019. Other educational organizations, such as the Council of Chief State School Officers (CCSSO), endorse the TL initiatives as well. These TL initiatives usually focus on the formal TL roles in facilitating the professional development of teachers and becoming a mentor for novice teachers. Monetary incentives (e.g., additional compensation) and administrative supports (e.g., reduced course loads) are the major measurements to build TL policies

In addition, TL has informally and organically emerged again with a paradigm shift of teacher education, from professional "development" to professional "learning." "Development" implies a passive role for teachers in learning and a deficit in teachers' knowledge or skills for

teacher improvement, while professional "learning" implies a more active role for teachers in their professional growth (Webster-Wright, 2009). This professional learning approach also echoes constructivist approaches in teacher education, embedded in the daily activities of teachers in their schools (Labone & Long, 2016). In the professional learning processes, TL plays an important role in facilitating and sustaining the professional growth of teacher colleagues and securing the quality of peer learning.

Still, TL for equity and social justice was not well-documented (Wenner & Campbell, 2017). Some studies clearly suggest that teachers could contribute to ensuring equity in their schools by actively influencing peer learning and school decisions (e.g., Lipman, 1997) or as means of principals' equitable leadership practices (Galloway & Ishimaru, 2017; García & Guerra, 2004; Woods, 2015). Nevertheless, few policy documents emphasize the leadership roles of teachers for equity and social justice so far. There is a lack of generalizable evidence to support the significant relationships between TL and student achievement in high-poverty schools.

Korea

TL is an emerging concept in Korea. Kim (1998) first introduced TL in his doctoral dissertation work, which several researchers since have tried conceptualizing and measuring TL in the 2000s. For instance, Chung et al. (2008) framed TL with three major targets (e.g., students, colleagues, and parents), six domains (e.g., instructional leadership, disciplinary work, classroom management, collaborative work with colleagues, administrative work, and parental relations), and four major features (e.g., goal-orientation, communality, task initiative, and professionalism). This conceptual framework is often used in the TL literature in Korea (Joo & Kim, 2015; Joo, Kim, & Nam, 2012; S. A. Kim & Song, 2019; D.-Y. Oh & Lee, 2019; Yoon, 2017). Chung and colleagues (2008) also reported that the Korean teachers exercised their individual leadership

more on student disciplinary work and classroom management rather than collaborative and instructional work with peers. A systematic review also identified that the TL literature in Korea focused more on tasks of individual teachers to support student learning and teacher changes rather than shared visions and administrative work at the school level (Joo & Kim, 2015).

Recently, some studies pay more attention to the concept of TL as a *cooperative* learning process, including a professional learning community. Kim and Song (2019) defined TL as the influence of teachers on the professional relationships among school staff in order to transform their school, and the authors considered that *cooperation* and communication are the major TL practices. Jeon and Choi (2010) also highlighted not only the instructional nature of TL but also the participative and distributed characteristics of leadership that teachers exercise. Moreover, Choi (2014) measured TL as three components (i.e., teacher professionalism, caring, and *cooperation*) and investigated its relationship with student achievement of elementary school students in Korea.

In addition, the Korean government has adopted several policies and initiatives that support TL practices, which could be defined as the influence of teachers on the professional learning of colleagues and school decision-making processes. For instance, school councils were established in the 1990s to initiate school-based management systems. Not only school teachers and their principals but also parents, educational specialists, community leaders, and alumni started to be involved in the school and educational policy decisions (Jang, 2010). Additionally, the Korean government encourages teachers to partially participate in staffing decisions by adopting the 'Teacher Invitation Scheme' since 1996 and implemented 'the Open Recruitment System for Principals' since 2010, although school personnel systems are traditionally regulated by the government because all Korean teachers have the status of national civil servants. In particular, some specialized schools (e.g., Autonomous Schools, Innovation Schools) exercise significant responsibilities in curriculum and staffing related-school decisions. The specialized

schools are allowed to invite up to 50% of their teaching staff, and school teachers could influence the process of invitation as a member of the school board. On the other hand, the general public schools could invite teaching staff up to 20% of the total.

In the 2000s, the government introduced the 'Consulting Supervision,' an advisory service that supports school teachers by inviting their colleagues and educational experts to facilitate teachers' professional growth (Jin & Kim, 2005). A new career track, the 'Master Teacher' designation, was instituted in 2012, which expected the Master Teachers to encourage professional learning of peers, lead curriculum design, and play a role as a mentor inside and outside of schools. Recently, organic (professional) learning communities of teachers expanded (C. Oh, 2014), and this learning community initiative was systematically supported by the national and state government since 2016 (P. Chung & Lee, 2017).

Admittedly, these policies and movements seem to contribute to ensuring a delegation power of the central bureaus to local institutions and schools and the professional development of teachers. However, the literature illustrates that Korean teachers perceived that their autonomy is still constrained (S. Kim & Kim, 2015; Moon et al., 2018; OH, Kim, Jang, & Jung, 2010). Significant perception gaps also exist between teachers and their principals about the involvement of teachers in school decisions (Brezicha et al., 2019; M.-J. Chung & Park, 2006; Hwang & Hong, 2012). For example, only a few formal teacher leaders (e.g., department chairs) are allowed to be involved in shared decision-making (M.-J. Chung & Park, 2006). Moreover, professional development is often induced by "contrived collegiality," which means that educational administrators replace difficult-to-control, spontaneous, and unpredictable teacher-led c activities with contrived, captured, and contained forms of collegial work (Hargreaves, 1994; Jin & Kim, 2006). Sometimes, administrators forced novice teachers to engage in a peer learning activity: thus, the agency of teachers in their professional learning is restricted (P. Chung & Lee, 2017; Hong, 2019; S. H. Jeong, 2013).

Empirical studies on TL

United States

TL in peer learning and student achievement

The literature generally suggests that TL in supporting the professional learning of peers, which is often framed as teacher *collaboration* or *cooperation*, is significantly associated with greater student achievement (Darling-hammond, 2017; R. Goddard, Goddard, Kim, & Miller, 2015; Hargreaves & Fullan, 2012; Ronfeldt & Grissom, 2015; Saunders, Goldenberg, & Gallimore, 2009). For instance, Ronfeldt and Grissom (2015), using the dataset from 336 Miami-Dade County public schools, found significant relationships between teacher *collaboration/cooperation* (e.g., coordination and reviewing instructional strategies and curriculum, students, and assessment) and the effectiveness of teachers and schools at improving student academic performance in math and reading subjects. Based on the results from the value-added modeling, the researchers argued a possible causal effect of *collaboration* and *cooperation* quality on higher student achievement. Saunders et al. (2009) also conducted a quasi-experimental research project and identified the long-term effects of teacher *cooperation* (i.e., grade-level learning teams) on greater achievement growth.

However, some studies challenged the general assumption of positive associations between peer learning of teachers and student achievement by suggesting the associations vary according to the types of teacher *collaboration* and *cooperation* as well as educational systems. Some researchers insisted that the professional learning community is the form of teacher *cooperation* that shows a significant and positive relation to student achievement (Bruce, Esmonde, Ross, Dookie, & Beatty, 2010; Burns et al., 2018). In addition, Reeves et al. (2017) used the 2011 Trends in International Mathematics and Science Study (TIMSS) and illustrated

that among the five domains of teacher collaboration, "collaboration during lesson planning" was the only variable of higher math achievement in the US. However, any types of teacher *collaboration* and *cooperation* were significantly related to student math achievement in Japan. These results suggest that teacher *collaboration* and *cooperation* research should consider not only specific types of collegial learning but also cultural and systematic relevance .

Moreover, a few studies illustrated the negative consequences of teacher *collaboration* and *cooperation*. Johnson (2003) pointed out that teachers felt competitiveness, interpersonal conflict, and loss of autonomy due to teacher *collaboration* and *cooperation*. Some teachers also consider *collaborative* and *cooperative* work as a time-consuming task, therefore, resulting in an increase in their workload (Bovbjerg, 2006). From the school leader's standpoint, teacher *collaboration* and *cooperation* could be a means for monitoring the professionalism of the teachers, so it may foster conformity with existing norms and silence of members (Gunn & King, 2003).

TL in school decisions and student achievement

The empirical evidence generally shows the positive and (in)direct link between TL in school decisions and student academic achievement in the US. First, TL indirectly impacts student achievement. Sebastian et al. (2016, 2017) found that school learning climate, influenced by TL, ultimately was associated with better student academic performance in 534 elementary schools (Sebastian et al., 2016) and 121 high schools (Sebastian et al., 2017) in Chicago Public Schools. Both studies measured TL as the influence of teachers on the following core school policies: 1) Hiring new professional personnel; 2) Planning how discretionary school funds should be used; 3) Determining books and other instructional materials used in classrooms; 4) Establishing the curriculum and instructional program; 5) Determining the content of in-service programs; 6) Setting standards for student behavior. Each item for teacher influence was measured on a four-point scale from 1 (none) to 4 (great extent).

Second, Ingersoll et al. (2018) found a direct relationship between the decision-making participation of teachers and student academic achievement scores, including English Language Arts (ELA) and mathematics. The researchers used the Teaching, Empowering, Leading, and Learning (TELL) Survey, which targeted about 900,000 teachers in approximately 25,000 public schools in 16 states from 2011 to 2015. Interestingly, among the eight items regarding TL in school decisions, the teacher decision-making about student discipline (i.e., establishing student discipline procedures) exerts more influence on student achievement than curriculum-related decision-making (i.e., selecting textbooks, choosing grading practices, and devising one's classroom teaching techniques.), even after controlling other variables.

Third, TL framed by distributed leadership (or shared/collaborative/collective leadership) was related to student achievement. For instance, Louis et al. (2010) employed national representative data (i.e., 2005-08 teacher surveys, developed for a US research project funded by the Wallace Foundation, and annual yearly progress reports of NCLB), and the researchers endorsed the indirect effects of shared TL in six school-decision domains on student math and language test scores across several grade levels over five years, via improved instructional practices. Similarly, collaborative leadership positively influences the US elementary school students' achievement growth in reading and mathematics, through increasing the school's capacity for academic improvement (Hallinger & Heck, 2010). Furthermore, collective leadership was significantly and positively related to differences in student academic performance (Leithwood & Mascall, 2008). As a part of a large research project, Leithwood and Mascall (2008) used stratified random sampling procedures to select nine states, 45 districts within the nine states, and 180 schools within the 45 districts.

TL and student achievement in high-poverty schools

The positive associations between teacher *collaboration/cooperation* and student achievement in high-poverty schools were endorsed by several empirical studies. Goddard et al.

(2015) identified positive and significant relationships between teacher *collaboration/cooperation* and student achievement in rural and high-poverty areas located in a Midwestern state. The authors framed teacher *collaboration/cooperation* as a formality, frequency, and influence on school policy. The student achievement was measured by fourth graders' mathematics and reading test scores. Other studies demonstrated that socioeconomic gaps in student achievement in high-poverty schools were decreased by collective pedagogical teacher culture (Moller, Mickelson, Stearns, Banerjee, & Bottia, 2013) and professional learning communities (Burns et al., 2018). For the data analysis, Moller et al. (2013) obtained data from the Early Childhood Longitudinal Study (ECLS), and Burns et al. (2018) employed data from state representative data in Missouri. In contrast, a study found that teacher *collaboration* was negatively related to the math achievement trajectories of poor Lantino/a 3rd graders, using the ECLS dataset (Bottia, Moller, & Mickelson, 2016). The authors interpreted the results by focusing on students' English language skills because immigrant students with high language skills took advantage of frequent teacher collaboration (Bottia et al., 2016).

The associations between TL in decision-making and student achievement in high-poverty schools are still unclear. TL practices are restrained by the level of school poverty: Leadership is less distributed to teachers in high-poverty schools (Louis, Leithwood, & Anderson, 2010), and the most significant difference in teachers' involvement in school decisions is in accordance with school poverty (Ingersoll et al., 2018). However, a case study argued that the involvement of teachers in school decisions successfully transformed a high-poverty school and improved student learning outcomes (Lipman, 1997). TL can also contribute to equitable school culture by supporting the needs of all students (Galloway & Ishimaru, 2017; García & Guerra, 2004; Slavit, Kennedy, Lean, Nelson, & Deuel, 2011). Still, little research empirically tests the relationship between TL in school decisions and student academic achievement in high-poverty schools.

Summary

In short, the US literature generally suggests positive associations between TL in peer learning and student achievement, even in high-poverty schools. In particular, the professional learning community of teachers was the form that significantly related to greater student achievement scores. In addition, prior studies showed (in)direct relationships between TL in school decisions—especially in student disciplinary and instructional/curricular decisions—and greater student academic learning outcomes across the states, grade levels, and subjects. Still, we do know much about the different associations among TL in school decisions, student achievement, and school poverty level.

Korea

TL in peer learning and student achievement

In Korea, several studies identified a positive relationship between TL in collegial learning and student achievement, but the results were inconsistent and mixed yet. Some researchers found a positive link between teacher *cooperation* and student learning outcomes (J.-H. Choi, 2014; H.-S. Lee & Chung, 2011). Choi (2014) used the data from the 'Analysis on school education and its level: Study of elementary school II,' and she demonstrated that *cooperation* among teachers was positively associated with elementary school students' reading scores. Teaching professionalism was also positively related to students' math scores. Moreover, Lee and Chung (2011) used using the 2007 TIMSS and identified a positive relationship between a *cooperative* activity (i.e., communicating with colleague teachers on preparing teaching materials) and students' math scores.

However, other studies stated that the teacher *collaboration/cooperation* and student achievement associations are not significant (J. Y. Chung, Lee, & Kim, 2014; Han & Yang,

2011). Chung et al. (2014) used the 2011 TIMSS and found that the overall teacher peer learning index was not statistically related to the math achievement of middle school students (i.e., eighth graders). Similarly, Han and Yang (2011) employed data from the Korean Education Longitudinal Study (KELS) and showed that teacher *cooperation* was not statistically associated with math achievement of Korean middle school students. Kim and Hong (2015) obtained data from a nationally representative survey, the 'Analysis of the level of school education and its actual condition,' and identified that the relationships between school-based teacher *cooperation* and elementary school students' reading/math achievement were not significant after controlling school-level variables. Prior studies often pointed out that the measurement of *collaboration* /*cooperation* was a considerable limitation in assessing the relationship between *collaboration/cooperation* and student achievement. Those studies also suggested that the quality of *collaboration/cooperation* and teacher agency in peer learning should be considered when investigating the impact of TL on student learning.

Furthermore, another study illustrated the negative relationships between teacher *cooperation* and student achievement (S.-H. Lee et al., 2016). When Lee and his colleagues (2016) employed data from a panel study in Gyeonggi province, teacher *cooperation* (i.e., school-based team meetings for curriculum) was negatively associated with middle school students' English and math achievement, and high school students' reading and math achievement. Only Innovative Schools, providing a progressive education in Gyeonggi province, showed the positive association between team meetings and reading achievement scores of elementary and middle school students. The authors used the concept of "contrived collegiality" (Hargreaves 1994, p. 196) that has the opposite effect of teacher *cooperation.* In other words, teacher *cooperation* in Innovative Schools could positively influence student achievement because teachers might be willing to engage in it, but teacher *cooperation* in general schools would negatively impact student achievement since participation was "contrived*."*

TL in school decisions and student achievement

Only a few studies in Korea explored the relationship between TL in school decisions and student achievement yet, even though the literature showed the positive influence of TL on teachers and their school changes (Joo et al., 2012; S. Park, 2018). Moon and his colleagues (2018) used the 'Actual status and the quality of school education' data and found that teacher decision-making responsibility in curriculum was positively associated with the middle school students' average achievement scores in reading, math, and English). In particular, the positive associations between teacher responsibility and student achievement were significantly strengthened in low achieving schools with active teacher *cooperation* (i.e., curricular meetings). In contrast, Han and Yang (2011) illustrated the positive association between teachers' shared responsibilities and middle school students' math achievement was not statistically significant after controlling school-level variables. Also, the involvement of teachers in school decisions was not related to student achievement.

School poverty

Little literature in Korea examined the TL in school decisions and student achievement associations in high-poverty schools yet. Even though a couple of studies investigated the other factors of teachers (e.g., academic pressure, enthusiasm) in closing SES-based achievement gaps, the findings were mixed so far. Teacher autonomy and enthusiasm were negatively associated with the reading and math achievement scores of middle school students with middle-/higher SES (Namgung, Kim, & Kim, 2012). Some studies argued that the academic press of teachers might increase the SES-based achievement gaps (Baek, 2013; K. Kim & Jang, 2016). Baek (2013) used the data from Seoul Educational Longitudinal Study (SELS) and found that high school students with higher- and middle-SES took more advantage of teachers' academic press in achievement scores in reading, math, and English language. Using the same data, Kim and Chang (2016) also

demonstrated that the greater academic pressure of teachers was positively related to the math achievement scores of middle school students with higher SES.

However, other researchers (Namgung et al., 2012; Ryu & Kim, 2006) insisted that the academic press of teachers could close the SES-based reading achievement gaps based on a large study—'Analysis of the level and actual condition of school education' that used nationally representative data. Ryu and Kim (2006) identified that the academic press of teachers at the school level was positively related to the English scores of middle school students from lower SES families. In addition, Nam et al. (2012) found that middle school students with middle- or higher-SES benefit more from the academic pressure of teachers in increasing academic achievement, particularly in reading achievement scores.

Summary

In Korea, the literature investigated how TL is related to student achievement by assuming a positive association between TL and student achievement, but the empirical results did not reach a general agreement on the relationships: several studies showed positive relationships, but other research illustrated that TL was not significantly or negatively associated with student achievement. In addition, only a few studies examined TL in school decisions and its relationships with student achievement. To date, no research has identified the role that TL might play in the relationship between school poverty and student achievement, yet these potential roles are critical in order to discuss TL as an equitable leadership practice.

Hypotheses

To distinguish this research from prior studies, I highlight TL in peer learning and school decisions and its relationship with student achievement in the US and Korea. For this research purpose, I investigated the TL practices (i.e., *collaboration, coordination, distributed leadership,*

decision-making responsibility) in both countries by utilizing the PISA 2015, a comprehensive international dataset. Then, I statistically analyzed the association between TL and student achievement. Finally, I examined whether the school poverty level moderates the association TL and student achievement.

For the first research question, I descriptively reported the variables included in this study and did not create a hypothesis. I focused more on examining the characteristics of sampled students and schools for each country and statistical differences between the US and Korea, rather than on testing a particulary hypothesis.

For the second and third research questions, I statistically tested how TL is associated with student achievement (the second research question) and the moderating role of school poverty on the association between TL and student achievement (the third research question). The specific hypotheses are as follows:

H_1: In the US and Korea, students attending a school with greater TL practices will show higher levels of academic achievement, with other things being equal.

The US literature generally supports that greater leadership among teachers at the school level was positively associated with student achievement (the average of mathematics, science, and reading scores). In Korea, several studies argued that there is a positive association between TL practices and student achievement despite some mixed and inconsistent results. Therefore, I hypothesize that TL practices (i.e., *collaboration, coordination, distributed leadership, decision-making responsibility*) would be positively related to student achievement with the PISA 2015 samples in both countries.

H_2: In the US, the relationship between school poverty and student achievement will be weaker for students attending schools with a higher degree of TL practice, compared with students attending schools with a lower degree of TL practice.

Research in the US suggested a possible equitable leadership role of teachers in improving student achievement in high-poverty schools and closing SES-based achievement gaps. Still, we do not know much about whether the equitable teacher leadership framework could statistically explain the TL roles on the relationship between school poverty and student achievement across the US.

For Korea, I did not develop a hypothesis on the moderating role of TL in the association between school poverty and student achievement. Few studies have investigated TL roles in high-poverty schools in Korea. Even if I considered other teacher-related factors (e.g., academic pressure, enthusiasm), research on the moderating roles of teachers has been inconsistent so far. Therefore, the third research question for Korea was exploratory in nature, and I intended to deepen our understanding of the effect that TL roles might have on the association between school poverty and student achievement.

Chapter 3

Method

I used data from the 2015 PISA and employed hierarchical linear modeling (HLM) to test hypotheses regarding the moderating role of school poverty in the relationships between TL and student achievement.

Data: PISA 2015

I used the PISA database for 15-year-old students around the world. The Organization for Economic Co-operation and Development (OECD) has conducted PISA—a large-scale international assessment of student achievement—every three years since 2000. This international database collected extensive information through the unique items in a particular country (e.g., student's race/ethnicity in the US) as well as the common items in the international PISA questionnaires. PISA provides nationally representative datasets by employing a two-stage stratified sampling design: the first stage sampled individual schools in which 15-year-old students were enrolled; the second stage of the selection process consisted of sampling students within the sampled schools (OECD, 2017b).

For the current study, I employed PISA 2015 data over other national and international datasets because PISA is "not only the world's most comprehensive and reliable indicator of students' capabilities, it is also a powerful tool that countries and economics can use to fine-tune their education policies" (OECD, 2019, p. 4). Also, PISA 2015 cycle firstly added teacher questionnaires to consider the teaching and learning contexts further (OECD, 2017a). The most recent 2018 PISA assessment data, released in 2019, did not include items regarding teacher decision-making; as such, the PISA 2015 data is used as it offers both the most recent and

comprehensive data on key variables for this study. In the PISA 2015 cycle for the US, the total school sample is *n*=177, the total teacher sample is *n* =3,680, and the total number of student samples is *n* =5,712. For Korea, the total school sample is *n*=168, the total teacher sample is *n*=3,013, and the total number of student samples is *n*=5,581.

Measures

Dependent variable: Academic achievement (Level 1: Student)

The dependent variable is the academic achievement of 15-year-old students. It was measured as the average literacy score of each subject (e.g., mathematics, science, and reading), which has a mean of 500 and a standard deviation of 100 (OECD, 2017b). Each literacy is defined as follows:

- *Reading literacy* is understanding, using, reflecting on and engaging with written texts, in order to achieve one's goals, develop one's knowledge and potential, and participate in society (OECD, 2017b, p. 51).
- *Mathematical literacy* is an individual's capacity to formulate, employ and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to recognize the role that mathematics plays in the world and to make the well-founded judgements and decisions needed by constructive, engaged and reflective citizens (OECD, 2017b, p. 4).
- *Scientific literacy* is the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen. A scientifically literate person is willing to engage in reasoned discourse about science and technology, which requires the competencies to 1) Explain phenomena scientifically – recognize, offer and evaluate explanations for a range of natural, and technological phenomena; 2)Evaluate and design scientific enquiry – describe and appraise scientific investigations and propose ways of addressing questions scientifically; and 3) Interpret data and evidence scientifically – analyze and evaluate data, claims and arguments in a variety of representations and draw appropriate scientific conclusions (OECD, 2017b, p. 22).

Independent variables: TL practices and school poverty (Level 2: School)

The independent variables include TL in peer learning (i.e., *cooperation* and *cooperation*) and school decisions (i.e., *distributed leadership* and *decision-making responsibility*). The three independent variables from teacher questionnaires (i.e., *cooperation*, *cooperation*, and *distributed leadership)* were aggregated to school-level to link them to student- and school-level data.

Collaboration and *cooperation* – TL in peer learning was measured by teachers' responses on how often (1 = never to 6 once a week) they do the following *collaborative* and *cooperative* activities in their school: (a) "Teach jointly as a team in the same class," (b) "Observe other teachers' classes and provide feedback," (c) "Engage in joint activities across different classes and age groups (e.g., projects)," (d) "Exchange teaching materials with colleagues," (e) "Engage in discussions about the learning development of specific students," (f) "Work with other teachers in my school to ensure common standards in evaluations for assessing student progress," (g) "Attend team conferences," and (h) "Take part in collaborative professional learning." The factor analysis predicted the eight collaborative activities as two composite factors: (a), (b), (c) indicated *collaboration;* (d), (e), (f), (g), (h) implies *cooperation*. Thus, I obtained standardized composite scores (i.e., mean [M]=0, standard deviation [SD]=1), using the factor scores for these variables by aggregating the score at the school level (see Table 3-1, next page).

Table 3-1. Factor loadings for the teacher *collaboration* and *cooperation*

US sample	Factor 1 (*cooperation*)	Factor 2 (*collaboration*)	Cronbach Alpha
Joint teaching	0.11	0.72	
Observing and providing feedback	0.18	0.72	0.58
Joint activities	0.14	0.75	
Exchanging teaching materials	0.74	0.13	
Engaging in discussions about students	0.69	0.20	
Ensuring common standards together	0.80	0.12	0.79
Attending team conferences	0.67	0.13	
Engaging in collaborative professional learning	0.72	0.14	
Eigenvalue	3.17	1.24	
KMO			0.82
Bartlett's Test of Sphericity		Chi-Square	3816.96
		df(p)	28(.00)
Korean sample	**Factor 1 (*cooperation*)**	**Factor 2 (*collaboration*)**	**Cronbach Alpha**
Joint teaching	0.16	0.79	
Observing and providing feedback	0.37	0.59	0.66
Joint activities	0.16	0.81	
Exchanging teaching materials	0.80	0.10	
Engaging in discussions about students	0.68	0.30	
Ensuring common standards together	0.81	0.19	0.84
Attending team conferences	0.75	0.20	
Engaging in collaborative professional learning	0.62	0.47	
Eigenvalue	3.91	1.04	
KMO			0.81
Bartlett's Test of Sphericity		Chi-Square	5540.65
		df(p)	28(.00)

Data source. Program for International Student Assessment of 2015
Samples. US teacher sample is *n*=3,680, Korean teacher sample is *n*= 3,013.

Distributed leadership – TL in decision-making was measured by two different practices: *distributed leadership* and teacher *decision-making responsibility.* First, *distributed leadership* was measured by the teacher's response to what extent does a teacher disagrees or agrees (1 = Strongly disagree to 4 = Strongly agree) with the following statements regarding her/his school: (a) "The principal tries to achieve consensus with all staff when defining priorities and goals in school," (b) "The principal treats teaching staff as professionals," and (c) "The principal ensures

our involvement in decision making." The factor analysis predicts these three activities as one factor (see Table 4-2). Again, I obtained standardized composite scores (i.e., M=0, SD=1) and used the factor scores for this variable by aggregating the score at the school level.

Table 3-2. Factor loadings for the *distributed leadership*

US sample	Factor 1 (collaboration)	Cronbach Alpha
Defining priorities and goals	0.90	
Treating teachers as professionals	0.88	0.88
Involving in decision making	0.91	
Eigenvalue	2.41	
KMO		0.74
Bartlett's Test of Sphericity	Chi-Square	3309.163
	df(p)	3(.00)
Korean sample	**Factor 1 (collaboration)**	**Cronbach Alpha**
Defining priorities and goals	0.91	
Treating teachers as professionals	0.89	0.89
Involving in decision making	0.92	
Eigenvalue	2.46	
KMO		0.74
Bartlett's Test of Sphericity	Chi-Square	3653.58
	df(p)	3(.00)

Data source. Program for International Student Assessment of 2015
Samples. US teacher sample is *n*=3,680, Korean teacher sample is *n*= 3,013.

Teacher decision-making responsibility – teacher decision-making responsibility variable was measured by 11 items from the school principal's questionnaires that measure responsibilities in the curriculum and instruction domains: (a) "hiring teachers," (b) "firing teachers," (c) "establishing teachers' starting salaries," (d) "determining teachers' salary increases," (e) "formulating the school budget," (f) "deciding on budget allocations within the school," (g) "establishing student disciplinary policies," "(h) establishing student assessment policies," (i) "choosing which textbooks are used," (j) "determining course content," and (k) "deciding which courses are offered."

An index for measuring overall teacher decision-making responsibility was created with a series of 11 questions related to responsibility in school decisions in the following sub-domains: Staffing ([a] selecting teachers for hire, [b] firing teachers, [c] establishing teachers' starting salaries, and [d] determining teachers' salary increases); budgeting ([e] formulating the school budget and [f] deciding on budget allocations within the school); curriculum and instruction ([g] deciding which courses are offered, [h] choosing which textbooks are used, [i] determining course content, [j] establishing student assessment policies), and discipline ([k] establishing student disciplinary policies). If a school principal responded that teachers have considerable responsibility for "(i) determining course content in their school," then it is assigned a value of 1. Thus, the overall responsibility value falls between 0 and 11. Each sub-domain was be calculated as the *overall decision-making responsibility* index: Staffing ranges from 0 to 4; budgeting ranges from 0 to 2; curriculum and instruction range from 0 to 4; and discipline ranges from 0 to 1.

School poverty – The socioeconomic composition of school (i.e., school poverty) was measured by the percentage of socioeconomically disadvantaged students in a school, which school principals reported.

Control variables

Control variable (Level 1: Student)

I controlled gender, immigration status, SES, academic motivation in the student level equation based on previous literature (Byun, Henck, & Post, 2014; Nam, 2014; Robinson & Lubienski, 2011). Nevertheless, PISA does not provide us to control for the prior achievement of students, the most significant variables for the current achievement scores. I admit that the lack of prior achievement information is a limitation of this study, but I hope to address this issue by

additionally controlling the academic motivation of each student, following the recommendations of Byun et al. (2014). High-achieving students might be academically motivated more than low-achievers.

Gender – The male student is coded as 0, and the female student is coded as 1.

Immigration status – Non-immigrant student is coded as 0, and the immigrant student is coded as 1.

SES – The PISA 2015 index of economic, social, and cultural status (ESCS), measuring student SES on the basis of the following variables: The index of the highest educational level of parents (HISCED), the highest occupational status of parents (HISEI), and the summary index of all household and possession (HOMEPOS). The index is a standardized composite score, which has a mean of 0 and a standard deviation of 1).

Achievement motivation – The achievement motivation index (MOTIVAT) of PISA 2015, standardized to having an OECD mean of '0' and a standard deviation of '1,' on the basis of the five items: (a) "I want top grades in most or all of my courses," (b) "I want to be able to select from among the best opportunities available when I graduate," (c) "I want to be the best, whatever I do," (d) "I see myself as an ambitious person," and (e) " want to be one of the best students in my class." Each student was asked, "To what extent do you disagree or agree with the following statements about yourself?" with the four-point Likert scale ranging from "strongly agree," "agree," "disagree," to "strongly disagree. The index is a standardized composite score, which has a mean of 0 and a standard deviation of 1).

Out of school study time – The out-of-school study hours per week.

Control variable (Level 2: School)

I also controlled school-level variables such as type, location, and student-teacher ratio (Young, 1998; Zanzig, 1997).

School type – Public school is coded as 0, and private school is coded as 1.

School location – School in rural (less than 100,000) is coded as 0 or school in a city (100,000 or more people)

The student-teacher ratio – The student-teacher ratio index (STRATIO) of PISA 2015, which has the minimum number of teachers at 1, and the maximum number at 100.

All variables and their coding scheme are summarized in the following Table 3-3.

Table 3-3. The names and coding schemes of the PISA variables used in the analysis.

Variables	2015 PISA Data Sources	
	Name	Coding scheme
Level 1—Students (Variables from the student questionnaire survey [SQ])		
Reading scores	PV01~10READ	Continuous, 10 plausible values in math
Math scores	PV01~10MATH	Continuous, 10 plausible values in reading
Science scores	PV01~10SCIE	Continuous, 10 plausible values in science
Female	ST005Q01TA	Dummy, 1 = female student, 0 = male student
Immigration	IMMIG	Dummy, PISA index of immigration index
Family SES	ESCS	Continuous, PISA index of economic, social, and cultural status
Motivation	MOTIVAT	Continuous, PISA index of student achievement motivation
Final student weight	W_FSTUWT01~80	Continuous. It consists of the school base weight, within-school base weight, and five adjustment factors.
Level 2—Teachers (Variables from the teacher questionnaire [TQ] averaged for each school)		
Collaboration	TC046Q01NA, TC046Q02NA, TC046Q03NA	Continuous, the index was driven from five questions about the teacher cooperation in the teacher questionnaire: Teach jointly as a team in the same class; observe other teachers' classes and provide feedback; and Engage in joint activities across different classes and age groups (e.g., projects)
Cooperation	TC046Q04NA, TC046Q05NA, TC046Q06NA, TC046Q07NA, TC046Q08NA	Continuous, the index was driven from five questions about the teacher cooperation in the teacher questionnaire: Exchange teaching materials with colleagues; engage in discussions about the learning development of specific students; work with other teachers in my school to ensure common standards in evaluations for assessing student progress; attend team conferences; and take part in collaborative professional learning

Distributed leadership	TC060Q02NA, TC060Q07NA, TC060Q09NA	Continuous, the index was driven from three questions about the principal leadership in the teacher questionnaire: the principal tries to achieve consensus with all staff when defining priorities and goals in school; the principal treats teaching staff as professionals; the principal ensures our involvement in decision making
Level 2—Schools (Variables from the principal questionnaire [PQ])		
Teacher *(decision-making) responsibility*	SC010Q01TB ~SC010Q12TB	Continuous, the index was driven from 12 items about the teachers' responsibility in the school questionnaire. The index was created with the sum of the number of checks across the 12 items: selecting teachers; firing teachers; establishing teachers' starting salaries; determining teachers' salary increases; formulating the school budget; deciding on budget; allocations within the school; establishing student disciplinary policies; establishing student assessment policies; approving students for admission to the school; choosing which textbooks are used; determining course content; and deciding which courses are offered.
Principal *responsibility*	SC010Q01TA ~SC010Q12TA	Continuous, the index was driven from the 12 items about the principal responsibility in the school questionnaire. This index was calculated in the same way as for the teacher autonomy/responsibility index.
School board *responsibility*	SC010Q01TC ~SC010Q12TC	Continuous, the index was driven from the 12 items about the school board responsibility in the school questionnaire. This index was calculated in the same way as for the teacher autonomy/responsibility index.
Government *responsibility*	SC010Q01TD ~SC010Q12TD	Continuous, the index was driven from the 12 items about the government responsibility in the school questionnaire. This index was calculated in the same way as for the teacher autonomy/responsibility index.
School poverty	SC048Q03NA	% of students coming from socio-economically disadvantaged homes
Type	SC013Q01TA	Dummy, 1 = private, 0 = public
Location	SC001Q01TA	Dummy, 1 = city (100,000 or more people), 0 = rural (less than 100,000)
Student-teacher ratio	STRATIO	Continuous, PISA index

Analytic Strategy

First, I presented descriptive statistics for the variables used in the analysis for the US and Korea. I also presented correlations between key variables such as student achievement scores, TL practices, and school poverty.

Second, I performed HLM analyses to investigate the relationships among TL practices, student achievement, and school poverty. Given the multilevel structure of the PISA data, with students (level 1) being nested within schools (level 2), HLM was used to examine the relationships among the key variables of interest at the two levels, which enables us to examine the amount of variation explained at each level, such as student-/ school-level (Raudenbush & Bryk, 2002).

H_1: Students attending a school with greater TL practices will show higher levels of academic achievement, with other things being equal. In this analysis, four models were tested progressively in HLM 8. First, an "unconditional" or "null" model (model 1) was tested to examine the amount of the total variation in student academic achievement (Ach) accounted for both levels (i.e., students and schools). The unconditional model can be written as:

$$\begin{aligned} &\text{Level 1: Student} && Ach_{ij} = \beta_{0j} + \epsilon_{ij} \\ &\text{Level 2: School} && \beta_{0j} = \gamma_{00} + \mu_{0j} \end{aligned}$$

where β_{0j} is the grand mean for students in school *j*, γ_{00} is the grand mean across schools, μ_{0j} is a random effect for school *j*, and ϵ_{ij} is a random effect for student *i* in school.

Second, the TL model (model 2) was tested next. I included four TL practice variables (i.e., *collaboration* [CLB], *cooperation* [CPR], *distributed leadership* [DL], and *decision-making responsibility* [DMR]) at the school level, with the equations can be written as:

$$\begin{aligned} &\text{Level 1: Student} && Ach_{ij} = \beta_{0j} + \epsilon_{ij} \\ &\text{Level 2: School} && \beta_{0j} = \gamma_{00} + \gamma_{01}CLB + \gamma_{02}CPR + \gamma_{03}DL + \gamma_{04}DMR \\ & && \quad + \mu_{0j} \end{aligned}$$

where γ_{00} indicates the average of each of the student achievement by subject (e.g., reading, mathematics, and science); $\gamma_{01}CRD$, $\gamma_{02}CLB$, $\gamma_{03}DL$, and $\gamma_{04}DMR$ indicate the relationships between each TL practice variable and the school mean of student academic achievement.

The third model included all student-level variables as level 1 control variables, with the equations can be written as:

$$\text{Level 1: Student} \quad Ach_{ij} = \beta_{0j} + \sum_1^K \beta_{kj} X_{kij} + \epsilon_{ij}$$

$$\text{Level 2: School} \quad \beta_{0j} = \gamma_{00} + \gamma_{01} CLB + \gamma_{02} CPR + \gamma_{03} DL + \gamma_{04} DMR + \mu_{0j}$$

$$\beta_{kj} = \gamma_{k0}$$

where β_{kj} is the association between *K* student-level covariates, X_{kj}, and each student outcome. Additionally, I presume that the association between school-level covariates and each of the TL variables do not vary across schools, indicated by no error terms for the regression coefficients of school-level covariates as they are fixed across schools.

The fourth and final model tested included all the control variables both at the student and school levels. The analysis models can be written as:

$$\text{Level 1: Student} \quad Ach_{ij} = \beta_{0j} + \sum_1^K \beta_{kj} X_{kij} + \epsilon_{ij}$$

$$\text{Level 2: School} \quad \beta_{0j} = \gamma_{00} + \gamma_{01} CLB + \gamma_{02} CPR + \gamma_{03} DL + \gamma_{04} DMR + \sum_1^Q \gamma_{0(q+4)} W_{qj} + \mu_{0j}$$

$$\beta_{kj} = \gamma_{k0}$$

where γ_{0q} indicates the association between each of the remaining school-level covariates and the school mean of student achievement.

In addition, I tested the relationship between sub-domains of each TL practice and student achievement. The final model remained the same except for the four TL practice variables (i.e., *collaboration* [CLB], *cooperation* [CPR], *distributed leadership* [DL], and *decision-making responsibility* [DMR]). Instead of using the TL practice variables, I used disaggregated variables of each TL practice.

H_2: The relationship between school poverty and student achievement will be weaker for students attending schools with a higher degree of TL practice, compared with students attending schools with a lower degree of TL practice. To test this hypothesis, I added the interaction terms between the TL practices and school poverty variables into the two-level HLM described above. The level-1 model remains the same as the final, and the second level (school-level) of HLMs

estimates the school-specific intercept (α_{0j}) as a function of aggregated TL variables, interaction terms between the TL variables and school poverty, and other school-level covariates, which can be written as:

$$\text{Level 1: Student} \quad Ach_{ij} = \beta_{0j} + \sum_1^K \beta_{kj} X_{kij} + \epsilon_{ij}$$

$$\text{Level 2: School} \quad \beta_{0j} = \gamma_{00} + \gamma_{01} CLB + \gamma_{02} CPR + \gamma_{03} DL + \gamma_{04} DMR + \gamma_{05} PVT + \gamma_{06} CLB * PVT + \gamma_{07} CPR * PVT + \gamma_{08} DL * PVT + \gamma_{09} DMR * PVT + \sum_1^Q \gamma_{0(q+9)} W_{qj} + \mu_{0j}$$

$$\beta_{kj} = \gamma_{k0}$$

where γ_{00} indicates the average of each of the student achievement by subject (e.g., reading, mathematics, and science); $\gamma_{01} CLB$, $\gamma_{02} CRP$, $\gamma_{03} DL$, and $\gamma_{04} DMR$ indicate the relationships between each TL variable and the school mean of student academic achievement; γ_{05} indicates the relationships between school poverty (PVT), and the school mean of student academic achievement; γ_{06} , γ_{07}, γ_{08}, and γ_{09} indicate the differing associations between each variable of TL and the school mean of student achievement scores by the school poverty variable; γ_{0q} indicates the association between each of the remaining school-level covariates and the school mean of student achievement; and u_{0j} indicates the school-specific error. Again, it is assumed that the association between student-level covariates and student achievement does not vary across schools. Moreover, I created the interaction terms between disaggregated variables of each TL practice and school poverty, as the second hypothesis test, to identify different associations between school poverty and student achievement by sub-domains of each TL practice.

Data aggregation

I aggregated the three independent variables from teacher questionnaires (i.e., *collaboration*, *cooperation*, and *distributed leadership)* to school-level to link them to student-

and school-level data. Admittedly, direct links between teachers and their students preferable, but the survey design of PISA 2015 does not offer the direct link option. However, my research questions are about the relationships between collective TL practices at the school level and student achievement, so the aggregation of teacher data to the school level would be acceptable. Some empirical evidence also endorses that this type of aggregation to the school level does not create a significant downward bias (Blazar, 2015; Gershenson, Hart, Hyman, Lindsay, & Papageorge, 2018).

Missing data

Following recommendations (D. R. Johnson & Young, 2011), I employed multiple imputations to replace missing data for the variables used in this study (see Table 4-1). I utilized the *ice* option in the STATA16 software package to generate 20 imputed datasets by including all of the dependent, independent, and control variables in the imputed model to predict missing values (Royston, 2004). With the 20 imputed datasets, I used the *multiple imputation* option in HLM8 and averaged the coefficients and standard errors from analyses across the datasets.

Correction for design effects

I used the final student weight (W_FSTUWT) provided by PISA to correct for the normalization design effect for each country, according to the recommendation of PISA (OECD, 2017b). This correction allows making the results generalizable to the US and Korean student population. In addition, I utilized the robust standard error estimation in HLM8 to adjust for the inflated standard errors as a result of the violation of the independent errors assumption (Rogers, 1994).

Methodological Limitations

Several methodological limitations exist to be addressed for future research. First, rigorous causal inferences are limited due to the usage of cross-sectional data. In other words, variables used in this study were collected in the same time period, so it was not able to make clear causal inferences without controlling for longitudinal information. Employing longitudinal data may be desirable to estimate of the TL effects on students by considering the changes of TL practices and student achievement. Nevertheless, I used the PISA 2015 because this data collected relevant information on both TL practices (i.e., TL in collaborative learning and school decisions) and allowed me to investigate two different countries by controlling many covariates (e.g., family and school SES).

Second, the measurement of key variables needs to be elaborated. Prior studies often pointed out the inconsistent results regarding the association between TL and student achievement were caused by limited measures of TL practices (J. Y. Chung et al., 2014; Han & Yang, 2011; H. Kim & Hong, 2015). Those studies also suggested measuring the quality of TL practices such as usefulness (J. Y. Chung et al., 2014) or teacher agency in TL activities (H. Kim & Hong, 2015). Still, the PISA 2015 data did not consider the 'quality of TL' or 'agency in TL' but measured just the frequency of teacher *collaboration* and *cooperation* and the extent do teachers (dis)agree with a couple of statements regarding *distributed leadership* with 4-Likert scales.

In addition, even though I used teacher responses to measure three TL practices (i.e., *collaboration, cooperation*, and *distributed leadership),* another TL practice (i.e., *teacher decision-making responsibility*) should be reported by teachers rather than principals. This is because significant perception gaps exist between teachers and their principals regarding

teachers' decision-making involvement in both countries (Brezicha et al., 2019). Prior studies also endorsed teacher response was demonstrated to be highly consistent with observation (Clunies-Ross, Little, & Kienhuis, 2008; Koziol, S. M. & Burns, 1986).

Finally, as I described in this chapter, direct data links between students and their teachers are preferable for future research than linking student data to aggregated teacher data at the school level. If so, individual teacher characteristics (e.g., gender, race/ethnicity, educational attainment, certification, teaching experience) would be controlled more effectively. The relationships between individual TL and student achievement are more directly addressed. Nonetheless, it is worthy to note again that this study is interested in collective TL at the school level and its relation to student achievement.

Chapter 4

Results

This chapter first reports the descriptive statistics obtained from the analysis of the data and the correlations among the key variables in this study. Next, the relationships between TL and student achievement scores are addressed. Finally, the interaction terms between TL practices and school poverty are examined to see the moderating roles of TL practices on the associations between socioeconomic composition of schools and student achievement.

Descriptive Findings

Descriptive statistics

First, Table 4-1 (see next page) shows descriptive statistics for the TL practices (i.e., *collaboration, cooperation, distributed leadership, and decision-making responsibility*) and other variables of the US and Korea for 15-year-old students and their schools in 2015. Additionally, the percentages of missing cases of each variable were reported in the right column of each country, which was imputed in the HLM analysis.

For the US, students' achievement scores were lower than the OECD average (M=500, SD=100): Reading (M=496.63, SD=93.56), math (M=468.75, SD=82.61), and science (M=495.82, SD=94.38). Regarding TL variables, five *cooperation* activities (4.36 on average) were the form that the US teachers engaged in more frequently, compared to three *collaboration* activities (2.31 on average). Among the eight *collaboration* and *cooperation* activities, "engage in discussions about the learning development of specific students" took place the most frequently (M=4.81, SD=.49).

Table 4-1. Descriptive statistics for analysis

Variables	The United States M	S.D.	Missing (%)	Korea M	S.D.	Missing (%)
Student characteristics (Level 1)						
Reading***	496.63	93.56	0.00	516.71	90.06	0.00
Mathematics ***	468.75	82.61	0.00	523.39	92.69	0.00
Science ***	495.82	94.38	0.00	515.20	91.43	0.00
Female	49.96%	-	0.00	47.82%	-	0.00
Immigration (=1) ***	23.46%	-	4.20	0.08%	-	0.79
Index of family SES***	0.08	1.00	1.30	-0.20	0.68	0.59
Index of academic motivation***	0.66	0.94	2.14	0.34	0.98	0.61
Index of out-of-school study time per week***	20.55	14.28	20.94	19.84	14.34	9.28
School characteristics (Level 2)						
Collaboration [a] ***	0.00	0.37	2.64	0.00	0.41	9.37
Joint teaching	2.42	0.73	2.64	2.32	0.57	9.37
Observing and providing feedback ***	2.24	0.57	2.64	2.79	0.31	9.37
Joint activities **	2.27	0.49	2.64	2.10	0.41	9.37
Cooperation [a] ***	0.01	0.48	2.64	0.00	0.41	9.37
Exchanging teaching materials ***	4.57	0.65	2.64	3.46	0.50	9.37
Engaging in discussions about students ***	4.81	0.49	2.64	2.87	0.43	9.37
Ensuring common standards together ***	4.29	0.67	2.64	3.06	0.36	9.37
Attending team conferences **	3.77	0.77	2.64	3.51	0.49	9.37
Engaging in professional learning ***	4.20	0.73	2.64	2.83	0.50	9.37
Distributed leadership (DL) [a] ***	-0.01	0.45	2.64	0.01	0.47	9.37
Defining priorities and goals ***	3.06	0.33	2.64	2.81	0.36	9.37
Treating teachers as professionals ***	3.34	0.35	2.64	2.94	0.33	9.37
Involving in decision making ***	2.93	0.38	2.64	2.67	0.35	9.37
Decision-making (DM) responsibility [a] ***	3.78	2.61	0.00	4.31	2.40	0.00
Staffing ***	0.41	0.50	0.00	0.11	0.41	0.00
Budgeting	0.52	0.83	0.00	0.60	0.70	0.00
Curriculum and instruction ***	2.33	1.52	0.00	2.95	1.34	0.00
Student discipline	0.48	0.50	0.61	0.54	0.50	2.14
Private ***	5.56%	-	1.73	33.65%	-	0.00
City ***	38.02%	-	1.12	85.63%	-	0.00
School Poverty ***	51.36	26.31	12.39	16.27	17.03	0.59
Student-teacher ratio **	16.31	4.76	5.23	15.12	2.94	4.86

Data & Sample. PISA 2015 USA school *n*=177, student *n* =5,712; KOR school *n*=155, student *n*=5,581.

Note. The estimates are an average of the results across 20 imputed datasets by using Rubin's rule. [a] These variables are standardized (i.e., M = 0, S.D. = 1) within each country. * indicates significant mean difference between Korea and the US at ***p<.001, **p<.01, *p<.05 (two-tailed tests).

For the three *distributed leadership* activities, the US teachers agreed that "the principal treats teaching staff as professionals" more (M=3.34, SD=.35) than that "the principal tries to achieve consensus with all staff when defining priorities and goals in school (M=3.06, SD=.33)" and "the principal ensures our involvement in decision making (M=2.93, MD=.38)." When it comes to the 11 different *decision-making responsibilities,* US teachers had 3.78 responsibilities on average (SD=2.61).

For the school-level variables of the US sample, approximately 5.56% of schools are private, and 38.02% of schools were located in a city. The US also showed that more than half of students were from socioeconomically disadvantaged families (M=51.36%, SD=26.31) and 16.32 student-teacher ratio on average (SD=4.76). For the student-level variables, approximately half of the students were female (M=49.96%), and 23.46% of students had immigrant backgrounds. The PISA indices (i.e., standardized composite values) showed that US students had a higher level of family SES (M=.08, SD=1) and academic motivation (M=.66, SD=.94), compared to the OECD average (M=0, SD=1). On average, out-of-school study time was 20.55 hours per week (SD=14.28).

When it comes to the Korean sample, Korean students' achievement scores were higher than the OECD average (M=500, SD=100) in the three subjects: Reading (M=516.71, SD=90.06), math (M=523.39, SD=92.69), and science (M=515.20, SD=91.43). Similar to the US, five *cooperation* activities (3.14 on average) were the form that the US teachers engaged in more frequently, compared to three *collaboration* activities (2.40 on average). Among the eight *collaboration* and *cooperation* activities, "team conferences (M=3.51, SD=.49)" and "exchanging teaching materials with colleagues (M=3.46, SD=.5)" were the activities that Korean teachers engaged in more frequently. Regarding *distributed leadership*, the Korean teachers agreed more with that "the principal treats teaching staff as professionals" more (M=2.94, SD=.33) and "the principal tries to achieve consensus with all staff when defining priorities and goals in school

(M=2.81, SD=.36)" than that "the principal ensures our involvement in decision making (M=2.67, MD=.35)." Finally, among the 11 different *decision-making responsibilities,* Korean teachers had 4.31 responsibilities on average (SD=2.40).

For the school-level variables of Korea, 33.65% of schools are private, and 85.63% of schools were located in a city. The Korean sample reported that approximately 16.27% of students were from socioeconomically disadvantaged families in a school (SD=17.03) and 15.12 student-teacher ratio on average (SD=2.94). For the student-level variables, 47.82% of students were female, and less than 1% of students (M=.08%) had immigrant backgrounds. The indices of PISA (i.e., standardized composite values) presented that US students had a lower level of family SES (M=-.20, SD=.68) and the higher level of academic motivation (M=.34, SD=.98), compared to the OECD average (M=0, SD=1). Finally, out-of-school study time was 19.84 hours per week on average (SD=14.34).

When I compared the descriptive statistics of the US with those of Korea, the US generally showed higher standard deviations between students as well as between schools, which implies the decentralized and heterogeneous features of the US schools. Regarding the mean values of the variables used in this study, the U.S. teachers engaged in five *cooperative* activities more frequently (e.g., 4.36 on average in the US; 3.14 on average in Korea), but Korean teachers were involved more in a *collaborative* activity: "observation and providing feedback (e.g., 2.24 in the US; 2.79 in Korea)." Another collaborative activity, "joint teaching as a team," didn't show a significant mean difference between the two countries. Three leadership practices were *distributed* more in the U.S (e.g., 3.11 on average in the US; e.g., 2.81 on average in Korea). For decision-making authority, teachers in Korea had more *responsibility in curriculum and instruction domains* (e.g., 2.33 in the US; 2.95 in Korea), while teaching staff in the US took more *responsibility in staffing* domains (e.g., .41 in the US; .11 in Korea). *Decision-making*

responsibilities of teachers in budgeting and discipline were not statistically different from each other.

When it comes to dependent variables, Korean students showed higher achievement in all of the subjects (i.e., reading, mathematics, and science), compared with American students. For the school poverty variable, the US showed a much higher poverty level (51.21%) than Korea (16.24%). Regarding control variables, most variables illustrated significant mean differences between Korea and the US. Compared to Korean students, US students had more immigrant backgrounds and an average higher grade level. Students in the US also had higher family SES and academic motivation than those in Korea. Gender ratio and out-of-school time were not significantly different between the two countries. For school-level variables, Korea had higher percentages of private schools (34%) and schools located in a city (86%) than the US (private school = 6% and schools located in a city = 38% respectively). The student-teacher ratio of Korea was significantly lower (15.11) than that of the US (16.32).

For missing cases of key variables, the dependent variables (i.e., student achievement in reading, math, and science) and principal-reported teacher *decision-making responsibility* variables had no missing values in both countries. However, teacher-reported TL practices in Korea (i.e., *collaboration, cooperation,* and *distributed leadership)* were missed by approximately 9.37%, which shows another methodological limitation of this study. The missing values of the teacher-reported variables in the US were relatively lower than those in Korea (2.64%). Regarding the school poverty variable, the missing value was higher in the US (12.39%) but lower in Korea (.59%). Other control variables showed relatively lower missing cases (e.g., less than 5%) except for the Index of out-of-school study time per week (20.94% in the US; 9.28% in Korea) and the student-teacher ratio (5.23 in the US).

Correlation

Second, Table 4-2 presents correlations between the key variables of this study. In the US, the student achievement scores in three subjects were weakly correlated to TL in school decisions (i.e., *distributed leadership* [.06 on average] and *decision-making responsibility* [.09 on average]) but hardly correlated to TL in *collaboration* (.01 on average) and *cooperation* (-.01 on average). Also, student achievement was negatively correlated to school poverty (-.33).

Table 4-2.Correlations between key variables

USA	1	2	3	4	5	6	7	8
1. reading score	1							
2. math score	0.89	1						
3. science score	0.93	0.94	1					
4. *collaboration*	0.00	0.01	0.01	1				
5. *cooperation*	-0.02	0.00	0.00	0.46	1			
6. *distributed leadership (DL)*	0.07	0.06	0.06	0.07	-0.03	1		
7. *decision-making (DM) responsibility*	0.10	0.08	0.09	-0.03	-0.17	0.05	1	
8. school poverty	-0.30	-0.36	-0.33	0.03	0.02	-0.11	-0.10	1
KOR	1	2	3	4	5	6	7	8
1. reading score	1							
2. math score	0.87	1						
3. science score	0.91	0.93	1					
4. *collaboration*	-0.03	-0.04	-0.04	1				
5. *cooperation*	0.07	0.09	0.07	0.67	1			
6. *DL*	0.01	0.01	0.01	0.17	0.18	1		
7. *DM responsibility*	0.00	-0.02	-0.01	0.00	-0.03	0.00	1	
8. school poverty	-0.17	-0.21	-0.19	0.00	-0.11	-0.07	0.12	1

Data & Sample. PISA 2015 USA school *n*=177, student *n*=5,712; KOR school *n*=155, student *n*=5,581.
Note. The estimates are an average of the results across 20 imputed datasets by using Rubin's rule. *These variables are standardized (i.e., M = 0, SE = 1) within each country

Collaboration was positively and highly correlated to *cooperation* (.46), and tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (*e.g., collaboration*, Tolerance = .75, Variance inflation factor [VIF] = 1.33; *cooperation*, Tolerance = .66, VIF = 1.53). When the Tolerance is less than 0.1, or the VIF value is greater than 10, then the data has concerns over multicollinearity, but the PISA 2015 data that I used has met the assumption of collinearity. *Collaboration* was weakly correlated to *distributed leadership* (.06)

and *decision-making responsibility* (.09). School poverty was negatively correlated to *distributed leadership* (-.11) and *decision-making responsibility* (-.10) but positively and weakly correlated to *collaboration* (.03) and *cooperation* (.02).

In Korea, student achievement was positively correlated to TL *cooperation* (.08 on average) but negatively correlated to *collaboration* (-.03 on average). On the other hand, student achievement was hardly correlated to TL Tn school decisions (i.e., *distributed leadership* [.01 on average] and *decision-making responsibility* [-.01 on average]). *Collaboration* was positively and highly correlated to *cooperation* (.67), but tests to see if the data met the assumption of collinearity showed that multicollinearity was not a concern (*e.g., collaboration*, Tolerance = .52, VIF = 1.93; *cooperation*, Tolerance = .48, VIF = 2.07). Also, *cooperation was* positively correlated to *distributed leadership* (.17), while *collaboration* was hardly correlated to *decision-making responsibility* (00). School poverty was negatively correlated to student achievement (-.19 on average), *cooperation* (-.11), and *distributed leadership* (-.07). However, school poverty was positively associated with *decision-making responsibility* (.12) and was not correlated to *collaboration* (.00).

In brief, the major TL practices (i.e., peer learning and school decisions) had a weak correlation to each other in both countries. Also, the correlations between TL practices and student achievement differed by country. For instance, TL in school decisions had some correlations to student achievement in the US, while TL in peer learning was correlated to student achievement in Korea. Regarding the relationship between TL practices and school poverty, TL in peer learning was positively correlated to school poverty, whereas TL in school decisions was negatively correlated to school poverty in the US. In Korea, school poverty was negatively correlated to *cooperation, distributed leadership* but positively correlated to decision-making responsibility.

HLM Results

I present the HLM results in this section by separating the US and Korean analyses. First, I elaborated for each of the four models (i.e., unconditional model [model 1], TL model [model 2], level 1 full model [model 3], and level 1 & 2 full model [model 4]) by country to consider the sequential model testing process.

Second, I employed additional HLMs to examine how the TL and student achievement association vary according to decomposed indicators of *collaborative/cooperative* and decision-making activities. *The collaboration* included "teaching jointly as a team in the same class," "observing other teachers' classes and provide feedback," and "engaging in joint activities across different classes and age groups (e.g., projects)."

Cooperation consisted of "exchanging teaching materials with colleagues," "engaging in discussions about the learning development of specific students," "work with other teachers in my school to ensure common standards in evaluations for assessing student progress," "attending team conferences," and "taking part in collaborative professional learning."

Distributed leadership practices contained "the principal tries to achieve consensus with all staff when defining priorities and goals in school," "the principal treats teaching staff as professionals," and "the principal ensures our involvement in decision making."

Finally, *overall decision-making responsibility* consisted of the *responsibility in staffing, budgeting, curriculum, and student discipline*. I used these disaggregated types of each activity as an independent variable and controlled all other student-level and school-level variables like the final model (level-1 & level-2 full model).

Association between TL and student achievement

United States

Composed TL variables

I first tested the US sample with the unconditional model to account for initial variance components at each level (i.e., student-level [level 1] and school-level [level 2]). The intraclass correlation was 0.22 for reading performance, 0.23 for math, and 0.21 for science achievement. The intraclass correlations showed that more than 21% of the total variation in student PISA achievement existed at the school level. These results supported the test of additional models with student-level and school-level variables (See Table 4-3).

Table 4-3. HLM results for the unconditional and TL models in the US

	Unconditional Model (Model 1)						TL Model (Model 2)					
	Reading		Math		Science		Reading		Math		Science	
Variables	*B*	SE	*B*	SE	*B*	SE	*B*	SE	*B*	SE	*B*	SE
Fixed Effect Part												
Level 2: Schools												
Grand mean	495.14	3.54***	467.33	3.20***	493.73	3.54***	495.09	3.40***	467.30	3.13***	493.68	3.45***
Collaboration							-5.36	10.32	-2.39	9.37	-4.22	10.81
Cooperation							-3.75	7.79	-2.97	7.34	-1.21	7.94
DL							**17.69**	**8.01***	11.69	6.90	14.94	7.90
DM responsibility							**3.38**	**1.27****	2.39	1.23	**3.00**	**1.34***
Unexplained Random Effects Variance Component (Standard Deviation)												
School level	1943.23	44.08	1604.21	40.05	1946.57	44.12	1777.63	42.16	1526.65	39.07	1824.62	42.71
Student level	6965.17	83.46	5292.31	72.75	7111.90	84.33	6965.02	83.46	5292.23	72.75	7112.24	84.33
Intraclass correlation (ICC)	0.22		0.23		0.21		0.20		0.22		0.20	

Data & Sample. The PISA 2015 sample for the US: school *n*=177, student *n*=5,712.
Note. The estimates with robust standard errors are an average of the results across 20 imputed datasets by using Rubin's rule. ***p<.001, **p<.01, *p<.05 (two-tailed tests)

Second, as shown in Table 4-3, the TL model (model 2) explained 8.5% of the school-level variability in the US students' reading scores, 4.8% of the school-level variability in math, and 6.3% of the school-level variability in science, as determined in model 1. In model 2, *distributed leadership* was positively associated with students' reading (p<.05) only. *Decision-*

making responsibility was also positively related to student achievement in reading ($p<.01$) and science ($p<.05$). However, *collaboration* and *cooperation* were not significantly associated with student achievement.

Third, as shown in Table 4-4, when I added student-level (level 1) variables in the "level 1 full model" (model 3), model 3 accounted for 10.6% of the total variability in reading, 10.9% of that in math, and 9.9% of that in science, compared to the unconditional model (model 1).

Table 4-4. HLM results for the level 1 & 2 full models in the US

	Level 1 Full Model (Model 3)						Level 1 & 2 Full Model (Model 4)					
	Reading		Math		Science		Reading		Math		Science	
Variables	*B*	SE	*B*	SE	*B*	SE	*B*	SE	*B*	SE	*B*	SE
Fixed Effect Part												
Level 2: Schools												
Grand mean	495.00	3.41***	467.18	3.14***	493.52	3.46***	494.81	2.83***	467.09	2.36***	493.45	2.65***
Collaboration	-5.99	10.15	-1.09	9.50	-5.00	10.85	-4.08	8.38	-1.01	7.09	-2.80	8.41
Cooperation	-4.20	7.61	-1.91	6.94	0.84	7.49	-5.52	7.06	-2.97	5.97	-1.38	6.51
DL	**16.64**	**8.26***	10.93	7.06	12.98	8.04	10.02	6.57	3.90	4.86	5.52	5.78
DM responsibility	**3.65**	**1.24****	**2.85**	**1.15***	**3.50**	**1.21****	**3.00**	**1.00****	**1.88**	**0.91***	**2.52**	**0.97****
Private							-16.72	12.41	-15.31	11.07	-23.09	12.66**
City							6.05	7.35	3.05	6.30	0.78	6.92
School Poverty							-0.98	0.13***	-1.04	0.11***	-1.06	0.12***
Student-teacher ratio							0.01	0.66	-0.19	0.52	0.03	0.60
Level 1: Students												
Female (=1)	17.21	2.25***	-11.68	1.98 ***	-9.33	2.32 ***	17.21	2.26***	-11.56	1.98 ***	-9.23	2.32 ***
Immigration (=1)	-1.57	3.91	-0.14	3.11	-5.83	3.84	-1.43	3.94	0.15	3.16	-5.15	3.90
Index of family SES	17.38	1.58***	20.50	1.33***	20.23	1.59***	17.33	1.57***	20.43	1.33***	20.20	1.58***
Academic motivation	12.14	1.34***	11.05	1.18***	10.25	1.38***	12.20	1.34***	11.21	1.18***	10.43	1.38***
Out-of-school study	-0.59	0.08***	-0.47	0.07***	-0.53	0.09**	-0.60	0.08 ***	-0.47	0.07***	-0.53	0.09***
Unexplained Random Effects Variance Component (Standard Deviation)												
School level	2458.80	49.59	2578.74	50.78	2081.78	45.63	1177.14	34.31	808.26	28.43	1007.51	31.74
Student level	5004.89	70.75	5200.51	72.11	5373.28	73.30	6154.51	78.45	4586.85	67.73	6301.06	79.38
ICC	0.33		0.33		0.28		0.16		0.15		0.14	

Data & Sample. The PISA 2015 sample for the US: school n=177, student n=5,712.

Note. The estimates with robust standard errors are an average of the results across 20 imputed datasets by using Rubin's rule. ***$p<.001$, **$p<.01$, *$p<.05$ (two-tailed tests)

Decision-making responsibility was still positively associated with student achievement in the three subjects, but *distributed leadership* was only related to reading performance after

controlling student-level variables. Some variables (e.g., SES, academic motivation, out-of-school time) were positively associated with student achievement in all the subjects. Most of the student-level (level 1) variables were significantly associated with student achievement, but the immigrant status of students was not significantly related to student achievement.

Finally, I contained school-level (level 2) variables to consider the further amount of the total variation in student achievement scores. The "levels 1 and 2 full model" (model 4) explained 16.1% of the total variability in reading achievement, 20.9% of that in math, and 18.2% of that in science, compared to the unconditional model (model 1). *Decision-making responsibility* was still positively related to student achievement in reading ($p<.01$), math ($p<.05$), and science ($p<.01$), but *distributed leadership* was not significantly associated with student achievement. School poverty, a school-level variable, was significant in explaining students' achievement scores. Private school was negatively associated with students' science scores ($p<.05$).

To summarize, model 4 was consequently considered the final and most parsimonious model for the US sample. Among the four TL practices, only teachers' *decision-making responsibility* explained the variances of student achievement at the school level positively and significantly, even after considering the student- and school-level control variables.

Decomposed indicators of TL

Next, I investigated how the TL and student achievement association differ by decomposed indicators of TL variables. For instance, I deconstructed the *collaboration* variable into three indicators (i.e., joint teaching, observing and providing feedback, and joint activities) and analyzed the relationship between each indicator of the *collaboration* and student achievement in three subjects (i.e., reading, math, and science).

First, three *collaboration* activities (i.e., joint teaching, observing and providing feedback, and joint activities) were not significantly associated with student achievement. Second, five indicators of *cooperation* (i.e., exchanging teaching materials, discussing students,

ensuring common standards together, attending team conferences, and engaging in professional learning) were not significantly related to student achievement in the three subjects. Third, no statistically significant relationship exists between three disaggregated indicators of *distributed leadership* and student achievement in the US. Finally, significant associations exist between some domains of *teacher decision-making responsibility* and student achievement (see Table 4-5).

Table 4-5. HLM results for *decision-making responsibility* in the US

	Reading							
	Panel 1		Panel 2		Panel 3		Panel 4	
Decision making responsibility	B	SE	B	SE	B	SE	B	SE
Staffing	3.73	5.05						
Budgeting			**6.09**	**2.74***				
Curriculum and instruction					**5.38**	**1.80****		
Student discipline							8.13	5.60
	Math							
Staffing	5.40	4.50						
Budgeting			4.12	2.40				
Curriculum and instruction					**3.20**	**1.57***		
Student discipline							3.25	4.64
	Science							
Staffing	7.58	5.02						
Budgeting			**6.18**	**2.51***				
Curriculum and instruction					**4.16**	**1.67***		
Student discipline							2.78	5.40

Data & Sample. The PISA 2015 sample for the US: school *n*=177, student *n*=5,712.
Note. The estimates with robust standard errors are an average of the results across 20 imputed datasets by using Rubin's rule and included all control variables. ***p<.001, **p<.01, *p<.05 (two-tailed tests)

Teacher decision-making responsibility in budgeting (i.e., formulating the school budget, deciding on budget allocations within the school) was positively related to student reading scores (p<.05) and science scores (p<.05). Teacher *decision-making responsibility in curriculum and instruction* (i.e., deciding which courses are offered, choosing which textbooks are used, determining course content, establishing student assessment policies) was also associated with reading (p<.01), math (p<.05), and science achievement (p<.05).

In summary, two domains of teacher *decision-making responsibility* were positively associated with student achievement—*the responsibility in budgeting and curriculum* in the US. However, TL in *collaboration*, *cooperation, and distributed leadership* did not have a significant relationship with student achievement scores.

Korea

Composed TL variables

As with the US analysis, I first tested the unconditional model with no variables (model 1) to examine initial variance components at student-level (level 1) and school-level (level 2). The intraclass correlation was 0.31 for reading achievement, and 0.33 for math achievement, and 0.28 for science achievement. In other words, the intraclass correlations indicated that more than 28% of the total variation in student PISA performance was at the school level. These results suggested the multilevel nature of the PISA 2015 data and provided a rationale for testing additional models with variables (see Table 4-6).

Table 4-6. HLM results for the unconditional and TL models in Korea

	Unconditional Model (Model 1)						TL Model (Model 2)					
	Reading		Math		Science		Reading		Math		Science	
Variables	*B*	SE	*B*	SE	*B*	SE	*B*	SE	*B*	SE	*B*	SE
Fixed Effect Part												
Level 2: Schools												
Grand mean	515.06	4.03***	513.59	3.85***	521.55	4.18***	515.12	3.95***	521.63	4.03***	513.67	3.75***
Collaboration							**-28.09**	**13.85***	**-38.38**	**13.71****	**-31.04**	**12.69***
Cooperation							**32.96**	**14.58***	**44.36**	**14.46****	**34.32**	**13.55***
DL							-0.31	8.80	0.05	9.12	1.41	8.57
DM responsibility							0.55	1.81	0.01	1.83	0.14	1.77
Unexplained Random Effects Variance Component (Standard Deviation)												
School level	2547.73	50.48	2744.74	52.39	2292.52	47.88	2439.78	49.39	2548.79	50.49	2170.85	46.59
Student level	5613.91	74.93	5917.66	79.92	6101.41	78.11	5614.10	74.93	5917.92	76.93	6101.65	78.11
ICC	0.31		0.33		0.28		0.30		0.30		0.26	

Data & Sample. The PISA 2015 sample for Korea: school *n*=155, student *n*=5,581.

Note. The estimates with robust standard errors are an average of the results across 20 imputed datasets by using Rubin's rule and included all control variables. ***p<.001, **p<.01, *p<.05 (two-tailed tests)

Second, as shown in Table 4-6, the TL model (model 2) accounted for 4.2% of the school-level variability in reading scores, 7.1% of the school-level variability in math, and 5.3% of the school-level variability in science, as determined in model 1. In model 2, TL in *cooperation* was positively associated with students' reading performance ($p<.05$), math performance ($p<.01$), and science performance ($p<.05$). However, *collaboration* was negatively associated with student reading achievement ($p<.05$), math achievement ($p<.01$), and science achievement ($p<.05$).

Third, as shown in Table 4-7, I included student-level (level 1) variables in the "level 1 full model" (model 3). Model 3 explained 8.6% of the total variability in reading, 10.2% of that in math, and 11.2% of that in science, compared to the unconditional model (model 1).

Table 4-7. HLM results for the level 1 & 2 full models in Korea

	Level 1 Full Model (Model 3)						Level 1 & 2 Full Model (Model 4)					
	Reading		Math		Science		Reading		Math		Science	
Variables	*B*	SE	*B*	SE	*B*	SE	*B*	SE	*B*	SE	*B*	SE
Fixed Effect Part												
Level 2: Schools												
Grand mean	489.33	118.08***	521.61	4.04***	513.67	3.76***	515.16	3.41***	521.70	3.41***	513.76	3.19***
Collaboration	-22.92	14.08	**-32.40**	**13.22***	-27.43	11.89	-20.43	11.16	**-27.93**	**10.75***	**-22.72**	**9.58***
Cooperation	25.16	14.97	**37.36**	**14.05****	27.32	12.77	**25.57**	**12.02***	**33.03**	**11.89****	**25.05**	**10.58***
DL	-0.03	8.34	-0.99	8.88	0.56	7.99	5.27	7.22	3.85	7.51	5.40	6.81
DM responsibility	0.89	1.70	0.42	1.75	0.34	1.70	1.24	1.47	1.03	1.49	0.73	1.43
Private							31.08	7.95***	25.72	8.01**	27.41	7.41***
City							-6.27	9.81	-0.38	9.94	-5.08	8.98
School Poverty							-0.88	0.25***	-1.03	0.29***	-0.92	0.24***
Student-teacher ratio							4.90	1.39***	5.17	1.38***	4.74	1.28***
Level 1: Students												
Female (=1)	29.23	7.66***	-2.24	2.89	0.01	3.06	30.69	3.07***	-2.39	2.88	-0.17	3.04
Immigration (=1)	-19.98	26.40	-67.45	42.66	-68.02	36.47	-20.39	26.87	-66.72	43.12	-67.25	36.36
Index of family SES	16.10	4.24***	23.73	1.76***	17.88	1.83***	16.96	1.74***	23.75	1.76***	17.90	1.83***
Academic motivation	12.57	3.23***	17.66	1.18***	12.62	1.17***	13.24	1.14***	17.67	1.18***	12.62	1.17***
Out-of-school study	0.15	0.09	0.18	0.08*	0.22	0.08*	0.17	0.08*	0.19	0.08*	0.22	0.08**
Unexplained Random Effects Variance Component (Standard Deviation)												
School level	2458.80	49.59	2578.74	50.78	2081.78	45.63	1802.33	42.45	1798.27	42.41	1540.14	39.24
Student level	5004.89	70.75	5200.51	72.11	5373.28	73.30	5004.91	70.75	5201.33	72.12	5656.58	75.21
ICC	0.33		0.33		0.28		0.26		0.26		0.21	

Data & Sample. The PISA 2015 sample for Korea: school n=155, student n=5,581.

Note. The estimates with robust standard errors are an average of the results across 20 imputed datasets by using Rubin's rule and included all control variables. ***$p<.001$, **$p<.01$ (two-tailed tests)

TL in *cooperation* was still positively associated with students' math achievement (p<.01), whereas *collaboration* was also negatively related to students' math achievement (p<.05). Some variables (e.g., SES, academic motivation, out-of-school time) were positively associated with student achievement in all the subjects. Gender (i.e., female) was positively related to reading achievement only, and immigration status was not significantly associated only with student achievement.

Lastly, I added school-level (level 2) control variables to account for the further amount of the total variation in student achievement scores. The "levels 1 and 2 full model" (model 4) accounted for 15.5% of the total variability in reading performance, 17.3% of that in math, and 13.0% of that in science, compared to the unconditional model (model 1). TL in *cooperation* was still positively related to students' reading (p<.05), math (p<.01), and science achievement (p<.05), while *collaboration* was negatively related to students' math (p<.05) and science achievement (p<.05). Even these TL variables showed large coefficients: Teacher *cooperation* for student math achievement (B= 33.03); teacher *collaboration* for student math scores (B= -27.93). The school-level variables, including school type (i.e., private), school poverty, student-teacher ratio, were significant in explaining students' achievement scores.

To sum up, model 4 was considered the final and most parsimonious model for Korean samples like the results from the US samples. TL in *collaboration* and *cooperation* was significantly related to student achievement, even after controlling other variables. *The collaboration* had a negative relation to student achievement, but *cooperation* had a positive association with student achievement in Korea. Still, no significant relationships exist between TL in school decisions (i.e., *distributed leadership* and *decision-making responsibility).*

Decomposed indicators of TL

Next, I examined the relationships between decomposed TL variables and student achievement again. First, among the three indicators of *collaboration*, "observing other teachers'

classes and providing feedback" was negatively associated with student achievement (p<.01) after controlling other student-level and school-level variables (see Table 4-8, next page).

Table 4-8. HLM results for *collaboration* in Korea

	Reading					
	Panel 1		Panel 2		Panel 3	
Collaboration	B	SE	B	SE	B	SE
Joint teaching	-0.84	8.70				
Observing and providing feedback			**-37.29**	**12.24** **		
Joint activities					-12.87	9.02
	Math					
Joint teaching	-3.90	8.63				
Observing and providing feedback			**-40.67**	**13.05** **		
Joint activities					**-12.87**	**9.02** *
	Science					
Joint teaching	-3.90	8.63				
Observing and providing feedback			**-34.78**	**11.75** **		
Joint activities					**-16.79**	**8.18** *

Data & Sample. The PISA 2015 sample for Korea: school n=155, student n=5,581.
Note. The estimates with robust standard errors are an average of the results across 20 imputed datasets by using Rubin's rule and included all control variables. ***p<.001, **p<.01, *p<.05 (two-tailed tests)

Also, "Engaging in joint activities across different classes and age groups" was negatively related to student math and science achievement (p<.05). "Teach jointly as a team in the same class" was negatively associated with student achievement as well, but the association was not statistically significant.

Second, statistically significant relationships exist between some types of *cooperation* and student achievement (see Table 4-9, next page). For instance, frequent "ensuring common standards in evaluations for assessing student progress" was positively related to student academic performance in all of the three subjects (p<.01). Frequent "exchanging teaching materials with colleagues" was also positively associated with student achievement in reading, math, and science subjects (p<.05). Lastly, more "attending team conferences" was positively associated with student achievement in math (p<.01) and science (p<.05).

Table 4-9. HLM results for *cooperation* in Korea

	Reading									
	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5	
Cooperation	B	SE	B	SE	B	SE	B	SE	B	SE
Exchanging teaching materials	**19.01**	**8.48***								
Discussing about students			10.69	11.46						
Ensuring common standards					**36.07**	**11.67****				
Attending team conferences							15.00	7.99		
Engaging in professional learning									1.76	8.28
	Math									
Exchanging teaching materials	**19.87**	**8.11***								
Discussing about students			14.08	11.21						
Ensuring common standards					**37.62**	**11.27****				
Attending team conferences							**22.59**	**8.14****		
Engaging in professional learning									8.84	8.26
	Science									
Exchanging teaching materials	**16.57**	**7.39***								
Discussing about students			12.28	10.24						
Ensuring common standards					**29.19**	**10.50****				
Attending team conferences							**16.93**	**7.33***		
Engaging in professional learning									2.53	7.37

Data & Sample. The PISA 2015 sample for Korea: school n=155, student n=5,581.
Note. The estimates with robust standard errors are an average of the results across 20 imputed datasets by using Rubin's rule and included all control variables. $^{***}p<.001$, $^{**}p<.01$, $^{*}p<.05$ (two-tailed tests)

Third, three disaggregated variables of *distributed leadership* (i.e., "the principal tries to achieve consensus with all staff when defining priorities and goals in school," "The principal treats teaching staff as professionals," and "the principal ensures our involvement in decision making") were not significantly related to student achievement in the three subjects in Korea.

Finally, any sub-domains of teacher *decision-making responsibility* were significantly related to student achievement.

To recap, I examined the relationship between the decomposed indicators of TL practices (i.e., *collaboration, cooperation, distributed leadership*, and *decision-making responsibility)* and student achievement in Korea. As a result, some *cooperation* activities (i.e., exchanging teaching materials, ensuring common standards together, attending team conferences) were positively

associated with student achievement. On the other hand, some *collaboration* activities (i.e., observing and providing feedback, engaging in joint activities) were negatively associated with student achievement. *Distributed leadership* and *decision-making responsibility* did not significantly explain student achievement scores.

The role of TL on the association between school poverty and student achievement

I included interaction terms between four TL practices (i.e., *collaboration*, *cooperation*, *distributed leadership*, and *decision-making responsibility*) and school poverty as well as between decomposed indicators of each TL practice and school poverty to examine the moderating roles of TL on the associations between school poverty and student achievement. Like the previous section, I presented the HLM results by separating the US and Korea analyses.

United States

Composed TL variables

The HLM results with interaction terms were presented in Table 4-10.

Table 4-10. TL in the school poverty and student achievement association in the US

	Reading		Math		Science	
Variables	*B*	SE	*B*	SE	*B*	SE
Grand mean	494.77	2.80***	467.04	2.32***	493.41	2.60***
TL						
Collaboration	-10.08	18.00	1.22	15.56	-1.08	18.94
Cooperation	-5.27	14.63	-7.86	12.63	-9.55	14.27
DL	-15.96	12.50	**-19.60**	**9.33***	**-24.94**	**10.93***
DM responsibility	2.27	2.31	1.28	2.07	2.31	2.33
School poverty	**-1.00**	**0.23*****	**-1.05**	**0.20*****	**-1.04**	**0.21*****
Interactions						
Collaboration×school poverty	0.15	0.32	-0.01	0.26	0.01	0.30
Cooperation×school poverty	-0.02	0.29	0.08	0.24	0.14	0.27
***DL*×school poverty**	**0.50**	**0.20***	**0.45**	**0.15****	**0.57**	**0.17*****
DM responsibility×school poverty	0.01	0.04	0.01	0.04	0.00	0.04

Data & Sample. The PISA 2015 sample for the US: school n=177, student n=5,712.
Note. The estimates with robust standard errors are an average of the results across 20 imputed datasets by using Rubin's rule and included all control variables. ***p<.001, **p<.01, *p<.05 (two-tailed tests)

In the US, the interaction term between *distributed leadership* and school poverty was significantly related to student academic achievement in reading ($^{*}p<.01$), mathematics ($^{**}p<.01$), and science ($^{***}p<.001$). However, other interaction terms (e.g., between *collaboration* and school poverty; between *cooperation* and school poverty; between *decision-making responsibility* and school poverty) were not statistically associated with student achievement scores.

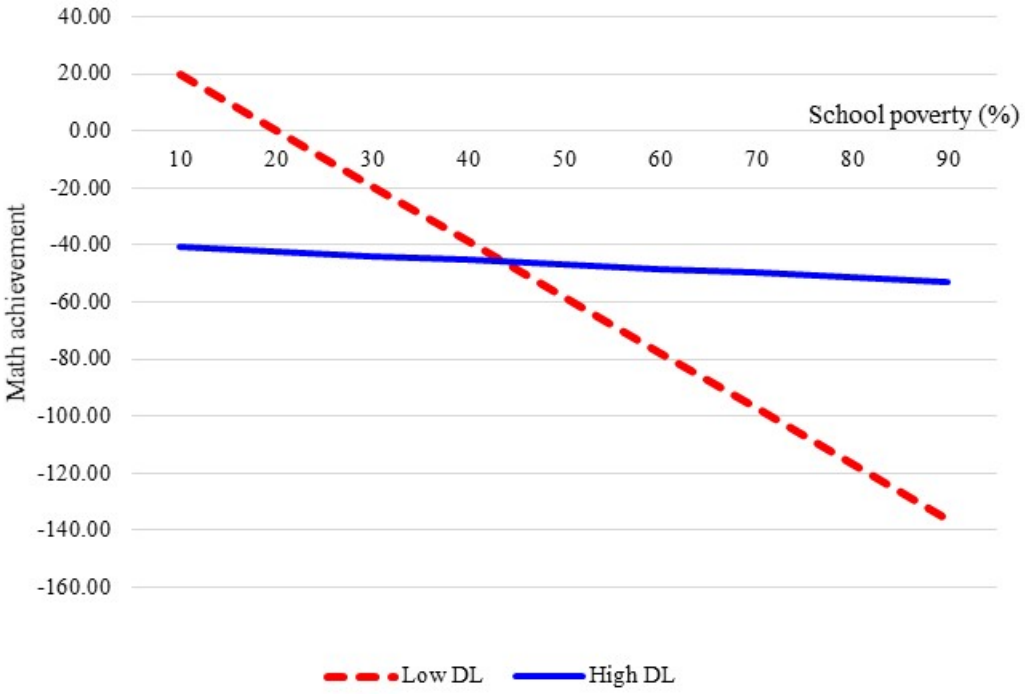

Figure 4-1. *Distributed leadership* on the association between school poverty and student achievement in the US

The result indicated that the negative association between the school poverty level and student achievement was much less in the schools in which had greater *distributed leadership,* as the blue line of Figure 4-1, while the negative relationship between the school poverty level and student achievement was higher in the schools in which had lower *distributed leadership,* as the red squared dots of Figure 4-1.

Decomposed indicators of TL

Regarding decomposed TL, first, the interaction terms between each *collaborative* activity and school poverty were not significantly related to student achievement. Second, the interaction terms between each of the five *cooperative* activities and school poverty were not significantly related to student achievement. Third, some disaggregated indicators of the *distributed leadership* variable were significantly related to student achievement. The interaction between each indicator (i.e., defining priorities and goals, treating teachers as professionals, and involving in decision making) and school poverty were significantly related to math and science achievement. Further, one indicator (i.e., defining priorities and goals) and school poverty were also significantly associated with student reading achievement. The results imply that the negative associations between school poverty and achievement were weaker in the schools with higher *distributed leadership* practices (see Table 4-11, next page). Finally, any interaction terms between four domains of teacher *decision-making responsibility* and school poverty were significantly associated with student achievement.

Table 4-11. *Distributed leadership* on the school poverty and achievement association in the US

	Reading					
	Panel 1		Panel 2		Panel 3	
	B	SE	B	SE	B	SE
Grand mean	494.76	2.79***	494.84	2.81***	494.71	2.82***
TL in *DL*						
Defining priorities and goals	**-35.99**	**16.83***				
Treating teachers as professionals			-8.56	16.21		
Involving in decision making					-13.05	14.61
School poverty	**-3.72**	**0.87*****	**-2.37**	**0.90****	**-2.28**	**0.71****
Interactions						
Defining priorities and goals×school poverty	**0.90**	**0.28****				
Treating teachers as professionals×school poverty			0.43	0.27		
Involving in decision making×school poverty					0.45	0.24
	Math					
Grand mean	467.05	2.32***	467.11	2.33***	467.00	2.34***
TL in *DL*						
Defining priorities and goals	**-35.33**	**12.18****				
Treating teachers as professionals			-11.49	12.07		
Involving in decision making					-22.29	11.98
School poverty	**-3.30**	**0.61*****	**-2.30**	**0.65*****	**-2.36**	**0.53*****
Interactions						
Defining priorities and goals×school poverty	**0.74**	**0.20*****				
Treating teachers as professionals×school poverty			**0.38**	**0.19***		
Involving in decision making×school poverty					**0.45**	**0.18***
	Science					
Grand mean	493.42	2.60***	493.49	2.61***	493.34	2.63***
TL in *DL*						
Defining priorities and goals	**-45.94**	**14.55****				
Treating teachers as professionals			**-17.16**	**14.34***		
Involving in decision making					**-25.86**	**13.88***
School poverty	**-3.95**	**0.71*****	**-2.76**	**0.77*****	**-2.76**	**0.63*****
Interactions						
Defining priorities and goals×school poverty	**0.95**	**0.23*****				
Treating teachers as professionals×school poverty			**0.52**	**0.23***		
Involving in decision making×school poverty					**0.58**	**0.21****

Data & Sample. The PISA 2015 sample for the US: school n=177, student n=5,712.

Note. The estimates with robust standard errors are an average of the results across 20 imputed datasets by using Rubin's rule and included all control variables. ***p<.001, **p<.01, *p<.05 (two-tailed tests)

Korea

Composed TL variables

Among the four interaction terms, the interaction term between *collaboration* and school poverty was statistically related to student achievement in math ($^{*}p<.05$) and science ($^{*}p<.05$), as shown in Table 4-12.

Table 4-12. TL on the association between school poverty and student achievement in Korea

	Reading		Math		Science	
Variables	*B*	SE	*B*	SE	*B*	SE
Grand mean	515.17	3.36***	521.71	3.34***	513.77	3.13***
TL						
Collaboration	-5.47	15.06	-6.72	14.32	-5.27	12.42
Cooperation	15.25	15.58	16.66	15.63	8.59	13.61
DL	13.17	10.26	12.13	11.57	11.85	10.03
DM	-0.38	2.09	-0.24	1.95	-0.90	1.85
School poverty	**-1.28**	**0.48****	**-1.32**	**0.60***	**-1.33**	**0.54***
Interactions						
***Collaboration*×school poverty**	-1.03	0.63	**-1.41**	**0.62***	**-1.16**	**0.55***
Cooperation×school poverty	0.70	0.71	1.05	0.71	1.13	0.68
DL×school poverty	-0.43	0.40	-0.46	0.56	-0.36	0.49
DM responsibility×school poverty	0.10	0.09	0.08	0.11	0.11	0.10

Data & Sample. The PISA 2015 sample for Korea: school n=155, student n=5,581.

Note. The estimates with robust standard errors are an average of the results across 20 imputed datasets by using Rubin's rule and included all control variables. $^{***}p<.001$, $^{**}p<.01$, $^{*}p<.05$ (two-tailed tests)

The results suggest that the negative association between school poverty and student achievement was stronger in the schools in which teachers actively engaged in *collaboration,* as the blue line of Figure 4-2 (next page). In contrast, the positive association between school poverty and student achievement was greater in the schools in which teachers were less engaged in *collaboration,* as the red squired dots of Figure 4-2 (next page).

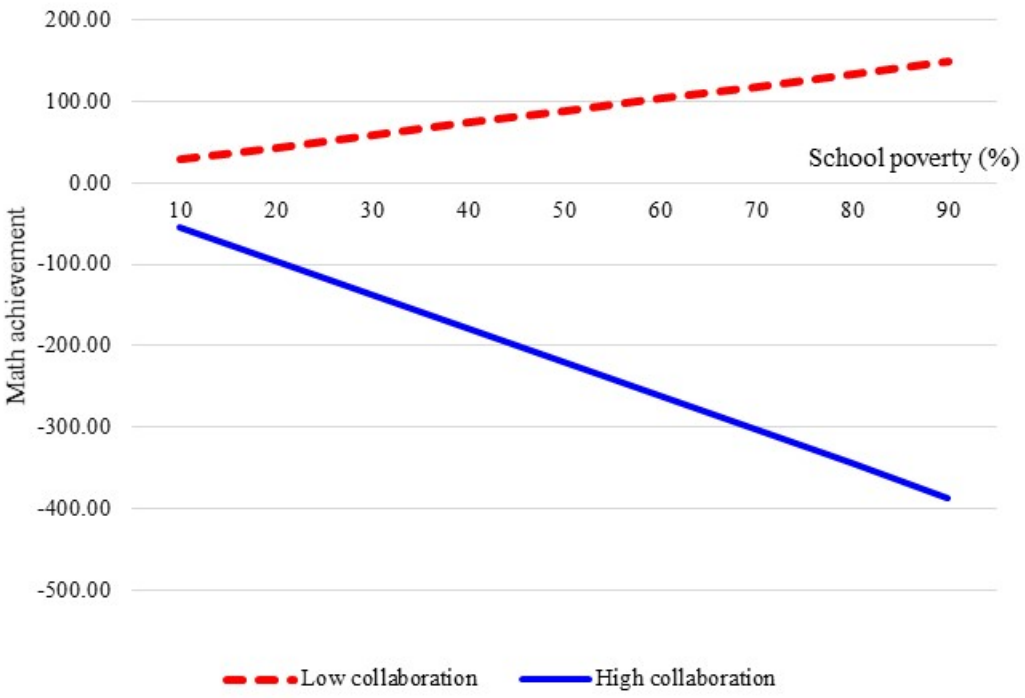

Figure 4-2. *Collaboration* on the association between school poverty and student achievement in Korea

Decomposed indicators of TL

When I considered disaggregated indicators of each TL variable, first, the interaction term between one *collaborative* indicator (i.e., "observing other teachers' classes and provide feedback") and school poverty was negatively related to student achievement in the three subjects: reading ($p<.01$), math ($p<.05$), and science ($p<.01$) as with the HLM result (see Table 4-13, next page). The results showed that the negative association between school poverty and student achievement was stronger in the schools in which teachers actively engaged in "observing and providing feedback" like Figure 4-2.

Table 4-13. *Collaboration* on the association between school poverty and achievement in Korea

	Reading					
	Panel 1		Panel 2		Panel 3	
	B	SE	B	SE	B	SE
Grand mean	515.12	3.44***	515.19	3.31***	515.13	3.41***
TL in *collaboration*						
Joint teaching	-3.56	10.76				
Observing and providing feedback			-10.01	13.05		
Joint activities					-1.46	11.70
School poverty	-1.29	0.88	**3.85**	**1.74***	0.58	1.21
Interactions						
Joint teaching×school poverty	0.17	0.42				
Observation & feedback×school poverty			**-1.66**	**0.58****		
Joint activities×school poverty					-0.68	0.51
	Math					
Grand mean	521.64	3.46***	521.71	3.30***	521.65	3.41***
TL in *collaboration*						
Joint teaching	-8.10	10.35				
Observing and providing feedback			-7.88	14.20		
Joint activities					-7.60	12.56
School poverty	-1.67	0.99	4.67	2.42	**0.63**	**1.48*****
Interactions						
Joint teaching×school poverty	0.27	0.49				
Observation & feedback×school poverty			**-1.99**	**0.80***		
Joint activities×school poverty					-0.77	0.60
	Science					
Grand mean	513.70	3.23***	513.78	3.10***	513.71	3.19***
TL in *collaboration*						
Joint teaching	-6.27	9.55				
Observing and providing feedback			-8.36	12.89		
Joint activities					-9.17	10.90
School poverty	**-1.54**	**0.87**	**3.67**	**1.81***	0.07	1.25
Interactions						
Joint teaching×school poverty	0.26	0.41				
Observation & feedback×school poverty			**-1.61**	**0.60****		
Joint activities×school poverty					-0.46	0.52

Data & Sample. The PISA 2015 sample for Korea: school n=155, student n=5,581.
Note. The estimates with robust standard errors are an average of the results across 20 imputed datasets by using Rubin's rule and included all control variables. ***p<.001, **p<.01, *p<.05 (two-tailed tests)

Second, any interaction term between five indicators of cooperation and school poverty was statistically related to student achievement.

Third, any interaction term between three indicators of *distributed leadership* and school poverty was statistically related to student achievement.

Finally, the interaction terms four sub-domains of *teacher decision-making responsibility* and school poverty were included (see Table 4-14).

Table 4-14. *Responsibility* on the association between school poverty and achievement in Korea

	Reading							
	Panel 1		Panel 2		Panel 3		Panel 4	
Decision making responsibility	B	SE	B	SE	B	SE	B	SE
Grand mean	515.16	3.37***	515.17	3.38***	515.15	3.37***	515.16	3.41***
TL in *DM responsibility*								
DM in staffing	**22.00**	**10.21***						
DM in budgeting			1.33	7.44				
DM in instruction and curriculum					-4.11	2.79		
DM in student discipline							-0.40	9.60
School poverty	**-0.85**	**0.27****	**-1.05**	**0.28*****	**-2.14**	**0.69****	-0.74	0.46
Interactions								
Staffing×school poverty	-0.25	0.34						
Budgeting×school poverty			0.29	0.33				
Instruction and curriculum×school poverty					**0.39**	**0.19***		
Student discipline×school poverty							-0.23	0.51
	Math							
Grand mean	515.16	3.37***	521.70	3.40***	521.69	3.38***	521.70	3.41***
TL in *DM responsibility*								
DM in staffing	22.00	10.21						
DM in budgeting			1.39	1.39				
DM in instruction and curriculum					-3.53	3.03		
DM in student discipline							2.28	10.23
School poverty	**-0.85**	**0.27****	**-1.14**	**0.29*****	**-2.13**	**0.73****	-0.82	0.54
Interactions								
Staffing×school poverty	-0.25	0.34						
Budgeting×school poverty			0.19	0.34				
Instruction and curriculum×school poverty					0.34	0.19		
Student discipline×school poverty							-0.37	0.58
	Science							
Grand mean	513.76	3.16***	513.77	3.18***	513.75	3.15***	513.76	3.19***
TL in *DM responsibility*								
DM in staffing	21.98	10.26						
DM in budgeting			0.37	7.20				
DM in instruction and curriculum					-4.32	2.88		
DM in student discipline							0.07	9.12
School poverty	**-0.89**	**0.26*****	**-1.02**	**0.26*****	**-2.11**	**0.66****	-0.80	0.43
Interactions								
Staffing×school poverty	-0.30	0.36						
Budgeting×school poverty			0.16	0.33				
Instruction and curriculum×school poverty					**0.37**	**0.18***		
Student discipline×school poverty							-0.22	0.49

Data & Sample. Program for International Student Assessment of 2015. School n=155, Student n=5,581.
Note. The estimates with robust standard errors are an average of the results across 20 imputed datasets by using Rubin's rule and included all control variables. ***p<.001, **p<.01, *p<.05 (two-tailed tests)

The results show that the interaction term between *teacher decision-making responsibility in curriculum* and school poverty was significantly associated with student achievement in reading and science (p<.05). The results imply that the negative association between the school poverty level and student achievement was much less in the schools in which had a greater *teacher decision-making responsibility in curriculum,* as the blue line of Figure 4-3. In contrast, the negative relationship between the school poverty level and student achievement was higher in the schools in which had a lower *teacher decision-making responsibility in curriculum,* as the red squared dots of Figure 4-3.

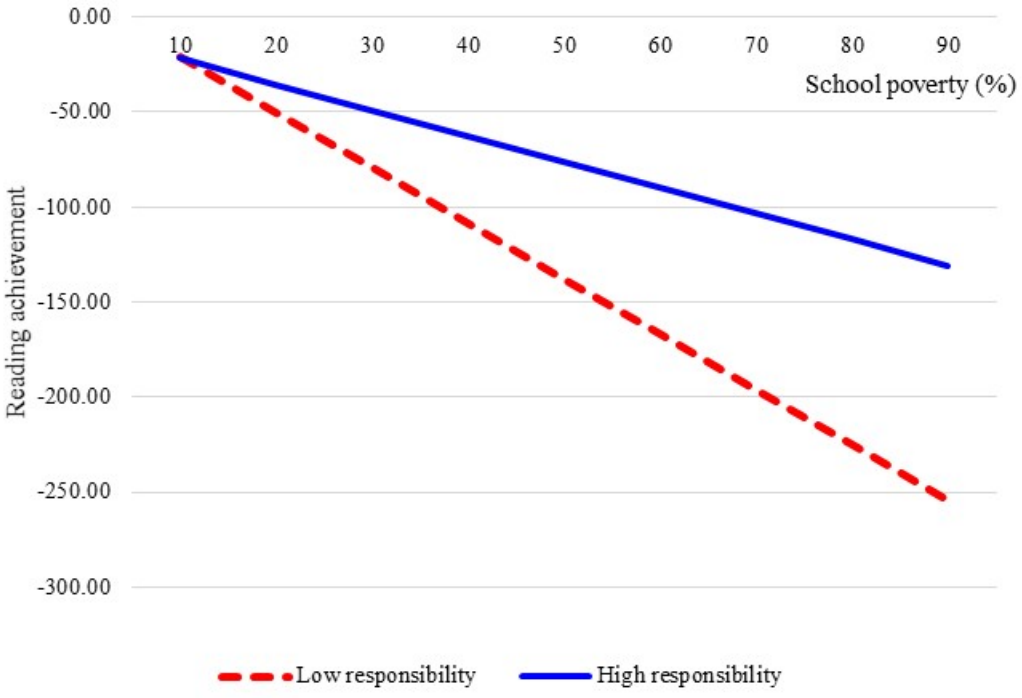

Figure 4-3. *Teachers' curricular decision-making responsibility* on the association between school poverty and student achievement in Korea

Summary of the HLM Results

The results from the statistical analysis of this study partially supported the first hypothesis—that there are significant, positive relationships between TL practices (i.e.,

collaboration, cooperation, distributed leadership, and *decision-making responsibility*) and student achievement. Among the four different TL practices, only *decision-making responsibility* was statistically associated with higher student achievement in all the subjects (i.e., reading, math, and science) in the US, even after controlling the student-and school-level variables. In particular, *teacher decision-making responsibility in curriculum* positively and significantly explained the school-level variances of student achievement in the three subjects. Teacher *decision-making responsibility in budgeting* was positively associated with student achievement in reading and science. By contrast, the associations between *distributed leadership* and student achievement were not significant after including those control variables. *Collaboration* and *cooperation* were not statistically associated with student achievement as well.

In Korea, the results showed different patterns from the US. *Collaboration* and *cooperation* statistically explained the student achievement variations at the school level, even after controlling all other variables. Those two significant TL practices were highly correlated with each other (.67), but *collaboration* was negatively associated with student achievement, while *cooperation* was positively related to student achievement. In particular, "observing and providing feedback," an activity of *collaboration*, was negatively associated with student achievement. Among the five *cooperation* activities, three activities (i.e., exchanging teaching materials, ensuring common standards together, and attending team conferences) were positively related to student achievement scores. Additionally, teacher *decision-making responsibility* in staffing was positively associated with student reading achievement.

Regarding the second hypothesis—that TL moderates the relationship between school poverty and student achievement in the US, the empirical analysis partially supported it. Only the associations between school poverty and student achievement were significantly moderated by *distributed leadership*. When I considered each of *distributed leadership* activities (i.e., defining priorities and goals with teachers, treating teachers as professionals, and involving teachers in

decision making), the relationships between school poverty and student math/science achievement were significantly moderated by all three *distributed* activities. Furthermore, the relationships between the school poverty level and reading achievement statistically vary according to one of the *distributed leadership* activities (i.e., defining priorities and goals with teachers). These results suggest that the negative association between school poverty and student achievement was weaker when the schools showed a higher level of *distributed leadership* practices.

When it comes to the exploratory analysis on the moderating roles of TL on the association between school poverty and student achievement in Korea, the HLM presented different results from the US. The association between school poverty and student math/science achievement was statistically moderated by *collaboration*, particularly by "observing/providing feedback." These results imply the SES-based achievement gaps were increased in the schools with a higher level of *collaboration*. On the other hand, the associations between school poverty and student reading/science achievement were significantly moderated by *teacher decision-making responsibility in curriculum*. In other words, the negative association between school poverty and student achievement was weaker when the schools showed a higher level of curricular *teacher decision-making responsibility* in Korea.

Chapter 5

Discussion

Overview

The concept of TL addresses the importance of teachers' voice and involvement in their collaborative professional growth, sustainable school change, and ultimately influencing student learning outcomes at the school level. Clearly, teachers are the single most influential factor that influences student learning (Darling-Hammond, 2000; Hattie, 2003; RAND, 2012; Rivkin et al., 2005). From a policy standpoint, contemporary education reform around the world focuses on attracting, developing, and retaining effective teachers as a core part of national efforts to promote student learning over the last few decades (OECD, 2005). However, the association between TL and student learning outcomes, particularly equitable student learning, has not been fully examined (Wenner & Campbell, 2017). Previous studies usually illustrated the positive impacts of TL on teacher changes and school learning climates, but to date, no one has undertaken an exhaustive investigation of the association between TL and student learning. In addition, many TL studies were based upon the US contexts, so the TL and student learning outcome relationships needed to be explored in other national contexts in order to deepen our understanding of TL.

In this study, I examined the relationship between TL and students' academic learning outcomes and also examined the moderating role that TL plays in the association between school poverty and student achievement in two different countries—the United States and Korea. First, I focused on two particular TL practices based upon the recent systematic review by Wenner and Cambell (2017): (a) supporting the professional learning of peers and (b) influencing school decisions. I measured the first TL practice (i.e., supporting the collaborative learning of

colleagues) as *collaboration* and *cooperation*, and I also included teacher-perceived *distributed leadership* as well as principal-reported teacher *decision-making responsibilities* to measure the second TL practice (i.e., influencing school decisions).

In addition, I decomposed each composite variable of TL practices (i.e., *collaboration, cooperation, distributed leadership,* and *decision-making responsibility*) to identify which specific practice is associated with student achievement in the two countries. As prior studies claimed (Ingersoll et al., 2018; Luschei & Jeong, 2020; Reeves et al., 2017), TL research should examine the unique relationship between each collegial activity and different outcome variables in order to propose interventions and structural changes in more detail. Thus, this study investigated three *collaboration* activities, five *cooperation* activities, three *distributed leadership* activities, and four subdomains of *decision-making responsibilities*.

Finally, I used TL practices and activities as critical variables moderating the relationship between school poverty and student achievement scores. Because I aggregated some of the teacher-responded variables (i.e., *collaboration, cooperation,* and *distributed leadership*) at the school level, the aggregated TL variables would affect the relationship between concentrated levels of school poverty and student learning outcomes. Even though TL practices are often constrained in schools with high-poverty levels as well as students in high-poverty schools showed significantly lower achievement scores, this study used equitable leadership as a conceptual framework to discuss the role of TL for student learning in high-poverty schools.

For the analysis, I descriptively examined these key variables in the US and Korea. This research tested two hypotheses related to the relationship between TL practices and student achievement scores in three subjects (i.e., reading, math, and science) and the moderating roles of TL on the relationship between school poverty and student achievement using PISA 2015 data. For Korea, this study did not test a particular hypothesis regarding TL as a moderator but

explored relationships among TL, student achievement, and school poverty due to a lack of pre-existing studies and inconsistent results of prior research.

Teacher Leadership, Student Achievement, and School Poverty

This study extends the existing literature by examining the relationships among the TL practices (i.e., *collaboration, cooperation, distributed leadership,* and *decision-making responsibility*), student achievement, and school poverty in two distinct educational systems—the US and Korea. Some findings of this study align with the literature, but inconsistent results also exist by country.

TL and student achievement

In the US, teacher *decision-making responsibility* was positively and significantly related to student achievement. This finding is consistent with the results from prior studies that argue that there are significant roles for teachers to play in school decisions (Ingersoll et al., 2017; Luschei & Jeong, 2020). The US might be a bit of an exceptional case when I considered that the teacher responsibility and student achievement association was significant in non-OECD countries (i.e., largely developing countries) other than in OECD countries (Luschei & Jeong, 2020). Regarding the domains of *decision-making responsibility*, this research illustrated that curricular and budgeting-related *decision-making responsibility* had a statistically stronger relationship with higher student achievement. These results endorse that teachers' role in curricular and instructional decisions matter (Ingersoll et al., 2017; Luschei & Jeong, 2020) and newly suggest a possible link between teachers' roles in formulating/allocating the school budget and students' academic learning outcomes in schools across the country. However, the

association between teachers' responsibility in student discipline and student achievement was not statistically significant, even though a recent study (Ingersoll et al., 2017) revealed strong and positive associations.

On the other hand, *distributed leadership* was not statistically related to student achievement after controlling student-level and school-level variables. In other words, the relationships between *distributed leadership* and student achievement are not significant if other student factors and school factors are equal. The results of this study reveal that the impact of *distributed leadership* might not be enough to overcome other student and school issues. The results are also inconsistent with the findings of prior research, in which prior studies demonstrated the positive associations between those two variables (e.g., Hallinger & Heck, 2010; Leithwood & Mascall, 2008). The inconsistent results might be caused by the measurement of *distributed leadership*. For instance, Leithwood and Mascall (2008) conceptualized and measured *distributed leadership* in a broad sense, including distributed student and parent leadership as well as distributed teacher leadership: However, this study focused on distributed teacher leadership only, thus the results of this study seem to be different from those of Leithwood and Mascall (2008).

In addition, because the measurement of *distributed leadership* was similar to that of another study (Hallinger & Heck, 2010), the mixed results would be caused by differences in data collection, such as school levels of the samples (e.g., 15-year students [this study] vs. elementary school students [Hallinger & Heck, 2010]), the data collecting period (e.g., year in 2015 [this study] vs. years from 2003 to 2006 [Hallinger & Heck, 2010]), or the data collecting location (e.g., across the US [this study] vs. a western state [Hallinger & Heck, 2010]). As the authors highlighted, studies on school improvement leadership should be contextualized because every school has its own unique "improvement trajectory (Hallinger & Heck, 2010, p. 106)." In other words, leadership exercised by teachers and the school principal needs to be linked to the school

environments at any point in time. For these reasons, this study presented different findings from the prior studies using different data.

Furthermore, none of the three indicators of *collaboration* and five indicators of *cooperation* were significantly related to student achievement in the US. The indicators included on the PISA might not represent the full scopes of *collaborative* and *cooperative* activities that occur in the US; however, the results are still surprising because indicators of *collaboration* and *cooperation* were statistically associated with student achievement even before including student-level and school-level control variables. Consequently, the findings of this study seem more aligned with previous work that found a mixed association between *collaboration/cooperation* and student achievement (e.g., Reeves et al., 2017; Vangrieken, Dochy, Raes, & Kyndt, 2015), rather than supporting the positive and clear relationships between two variables (e.g., Darling-hammond, 2017; Goddard, Goddard, Kim, & Miller, 2015; Ronfeldt & Grissom, 2015).

In Korea, among the four different TL practices, *collaboration* and *cooperation* had a significant relationship with student achievement. Even the coefficients of the variables were quite large (e.g., teacher *cooperation* for student math achievement [B= 33.03]; teacher *collaboration* for student math achievement [B= -27.93]). These results endorse the importance of these two collegial learning practices for student learning in Korea. Interestingly, the peer learning practices were highly correlated to each other (.67), but the associations between each practice and student achievement were different: Teacher *cooperation* was positively associated with student achievement, but *collaboration* was negatively associated with student academic performance.

To be specific, I found that three indicators of *cooperation* (i.e., exchanging teaching materials, ensuring common standards together, and attending team conferences) had a clear and positive relationship with student achievement. These activities are organically occurring practices among teachers that could positively influence colleagues (Fairman & Mackenzie, 2015;

Spillane et al., 2004; Sun et al., 2013). The results endorse the literature that argues that there is a positive influence of teacher *cooperation* on student achievement (J.-H. Choi, 2014; H.-S. Lee & Chung, 2011), even though other studies indicated that *cooperation* and student performance were not significant after controlling for student-level and school-level variables (Han & Yang, 2011; H. Kim & Hong, 2015). The inconsistent results in the *cooperation* studies indicate that we should examine the nature of *cooperative* activities more carefully.

In contrast, *collaboration* activities were negatively associated with student achievement in Korea. The results might reflect the fact that Korean teachers could be uncomfortable with joint teaching and planning activities that require more time and energy to sustain. Prior studies criticized the Consultative Supervision policy because the government requires "contrived collegiality (Hargreaves 1994, p. 196)" for teachers, especially novice teachers, to open their classes to receive feedback from external "educational experts" as well as their colleagues (Hong, 2019; S. H. Jeong, 2013). Admittedly, the "contrived collegiality" approach intended to replace spontaneous and unpredictable peer learning of teachers with contrived and contained forms of peer learning by educational administrators. However, teacher *collaboration* in Korea (e.g., observing and providing feedback) becomes a compulsory and mandatory activity, lacking teacher autonomy and agency and thus undermining the true spirit of *collaboration*. Additionally, the correlation between *collaboration* and student achievement may be affected due to the nature of cross-sectional data: teachers in low-achieving schools might be required to engage in "observing and providing feedback" to increase the student achievement scores of their students, again undermining any sense of *collaboration*.

Moreover, TL in school decisions did not significantly explain the school-level student achievement variances in Korea except in the area of *decision-making authority* in staffing. This finding was in line with the cross-national patterns among the PISA 2015 participating countries, other than the patterns in OECD countries (Luschei & Jeong, 2020), indicating Korea might be

an outlier in OECD countries. The non-significant relationships between *decision-making responsibilities* and student achievement might be because actual teacher autonomy and decision-making involvement are still constrained, as prior studies pointed out (Moon et al., 2018; Weng, 2004). Moon and his colleagues (2018) found that Korean teachers could not exercise their decisional leadership in their schools as principal autonomy has significantly increased over the recent decades. Other literature also insisted that cultural values (e.g., the Confucian hierarchy, higher power distance, seniority) might also affect the "bound" roles of teachers as a decision-maker in a school (Ho & Tikly, 2012; Hwang & Hong, 2012; Li, 2015).

In summary, I argue that the relationship between TL and student achievement has a complex nature that is affected by differences in national educational systems and national cultural patterns of teaching. The relationships might also vary according to specific types or forms of TL practice studies. There might not be one 'magic key' to improve student learning outcomes across all countries, and some particular practices could be more relevant in certain educational systems and cultural contexts. Further investigation is needed to articulate those relationships in different systems and cultures more clearly.

The importance of TL in a high-poverty school

This study advocates that TL could be a more equitable leadership practice, but the moderating role of TL on the relationship between school poverty and student achievement is highly complex in both countries. For instance, I found that the negative association between school poverty and student achievement was weaker when a school had a higher level of TL practices (i.e., *distributed leadership* practices in the US; curricular *decision-making responsibility* in Korea). In these cases, students in high-poverty schools seemed to benefit more from TL practices in their academic achievements. TL practices might establish equitable student

learning outcomes (i.e., closing achievement gaps) in high-poverty schools by ameliorating the effect of school poverty (e.g., García & Guerra, 2004; Lipman, 1997), although those TL practices did not ensure higher student achievement.

On the other hand, the negative association between some *collaborative* activities and student achievement was stronger in high-poverty schools in Korea. Because of the inconsistent results from the literature regarding the roles of teachers in improving the achievements of low-SES students (e.g., Baek, 2013; K. Kim & Jang, 2016; Namgung, Kim, & Kim, 2012), it is difficult to interpret the findings of this study. Nevertheless, the results could be interpreted in another direction since the PISA 2015 is a cross-sectional dataset. It also seems that teachers in low-achieving and high-poverty schools participated more in *collaboration,* especially in "observing and providing feedback:" However, teachers in high-achieving and socio-economically advantaged schools were less involved in *collaborative* activities. When I considered that "observation and feedback" is the most common and formal collaborative activity in Korea, Korean teachers in underachieving and high-poverty schools might be required to be involved in the *collaborative* activity more in order to improve the academic learning outcomes of their students.

To summarize, this study is an initial trial to explore the concept of equitable TL by using a large-scale dataset, and the findings propose a significant moderating role of TL on the association between school poverty and student achievement. Still, the results are difficult to interpret, and further studies are thus required to deepen our understanding of TL for social justice and equity issues by addressing the methodological challenges present in using cross-sectional data.

Theory and Policy Implications

Building on Wenner and Cambell's (2018) systematic review, this study empirically demonstrated some positive associations between TL and student achievement at the school level as well as different TL-achievement associations by school poverty and country. This work has powerful implications for theory, policy, and future research as follows.

The concept of TL

The results from the statistical analysis of this study suggest that the conceptualization of TL needs to consider different educational systems and cultural contexts. Even though the recent systematic review (Wenner & Campbell, 2017) identified the general construct of TL as two practices (i.e., supporting professional learning of teacher colleagues and influencing school decisions), the relationships between TL and student achievement were partially significant and intriguingly, the relationships were different based on the country. "Influencing school and policy decisions" is a more relevant concept in the US, while "supporting professional learning of teacher colleagues" is more critical in Korea to explain the school-level variations of student achievement. These results presented that the TL and student achievement associations vary according to educational systems and cultural differences.

Among the four different TL practices (i.e., *collaboration, cooperation, distributed leadership,* and *decision-making responsibility*), only TL in *decision-making responsibility* was significantly and positively associated with student academic performance in the US, even after controlling other school and student factors. These results are supported by policy reports (e.g., National Commission on Teaching and Learning, 1996) as well as empirical studies in the US (e.g., Ingersoll, Dougherty, & Sirinides, 2017), which argue in favor of teacher autonomy and

decision-making authority. In addition, even though TL in school decisions has been constrained by accountability policies (e.g., NCLB) over the last few decades, the decentralized nature of the U.S. educational system might still encourage US teachers to take significant responsibility in decision-making processes and to have a positive association with student academic performance within a school.

However, *collaboration* and *cooperation* should be reexamined in the US as constructs and elements of TL. As some studies pointed out, the quality and nature of teachers' peer learning vary according to school climates and national cultures (Kinney, 1997; Shimahara & Sakai, 1995; Vangrieken et al., 2015). Also, the PISA 2015 might not capture the full scope of *collaborative* and *cooperative* practices that may occur in the US. Moreover, peer learning in the US might need solid knowledge and skills to positively influence student learning outcomes even though it would have the solidarity of group because cooperation takes place almost biweekly (Hargreaves & O'Connor, 2018). Hargreaves and O'Connor (2018) claimed that peer learning should be based on not only the "solidarity" of the group (such as a trust) but also the "solidity" of its idea and methods (such as solid expertise). Additionally, those *collaborative* and *cooperative* activities might be significantly related to teacher qualities (e.g., efficacy, satisfaction), rather than be directly associated with student achievement scores (Louis, Dretzke, & Wahlstrom, 2010b; Sebastian et al., 2016, 2017).

In Korea, "supporting professional learning of teacher colleagues" is a significant TL practice, and *cooperation* had a positive relationship with student academic performance. In particular, organically or naturally occurring *cooperation* activities were positively related to student achievement, such as exchanging teaching materials, ensuring common standards together, and attending team conferences. Korean teachers also might have both "solidarity" of the group and "solidity (e.g., the professional knowledge and skills)" that make *cooperation* significant. In contrast, *collaborative* activities, including "observing and providing feedback,"

were negatively associated with student achievement, perhaps because these were formally imposed requirements. Furthermore, *distributed leadership* and *decision-making authority* were not significantly related to student achievement in Korea.

These results are in line with the Korean literature that usually focuses on the active roles of teachers in peer learning processes. Many prior studies in Korea conceptualized TL as a *cooperative* activity (e.g., S. A. Kim & Song, 2019; Nam-Ick & Eun-Soo, 2010) and highlighted the professional relationships among teaching staff (J.-H. Choi, 2014; B. Kim, 2015). Nevertheless, only a few studies in Korea have shed light on TL in school decisions so far. Pre-existing research emphasizes teacher autonomy and the voluntary participation of teachers in *cooperative* activities.

When it comes to the relationships between two major TL practices (i.e., supporting professional learning of teacher colleagues and influencing school decisions), this study found that these two TL practices were weakly correlated to each other in both countries. These findings imply that these two major TL practices that Wenner and Cambell (2017) identified may be two independent constructs rather than interconnected concepts. This formulation also aligns with the results of this study: there are different associations between each practice and student achievement by country. However, prior studies argued that *collaborative* and c*ooperative* learning could positively influence teachers to make better decisions for student learning with improved knowledge and broaden perspectives (Vernon-Dotson, 2008). Vice versa, TL in school decisions could support meaningful peer learning of teachers more effectively and efficiently (Louis, Marks, & Kruse, 1996; Marks & Louis, 1997). Therefore, additional studies are needed to understand the weak link between these two TL practices across the schools in both countries and also to support both TL practices that could create a synergy effect in improving student learning outcomes.

Regarding the TL roles on the association between school poverty and student achievement in high-poverty schools, the findings of this study did not clearly establish a role for TL as an equitable leadership practice in both countries. Instead, this study identified two different and significant patterns by showing the complex nature of the relationships among TL, student achievement, and school poverty. First, the negative association between TL practices (i.e., *distributed leadership* in the US, curricular *decision-making responsibility* in Korea) and student achievement was weaker in high-poverty schools with a higher degree of TL practice. Second, the negative association between teacher *collaboration* in Korea and student achievement was more significant in high-poverty schools. These results require more studies to understand the various aspects of how TL affects student achievement.

In conclusion, there is a need to scrutinize the concept of TL by reviewing national school systems with various organizational patterns of teachers' work and different cultural expectations for TL roles. The concept of TL has largely been developed from studies based in the US and may simply not hold up cross-nationally. An analysis of TL in school decisions was not associated with variation in student achievement among Korean schools. Even in the US, current theories of *collaboration* and *cooperation* should be re-examined in order to deepen our understanding of the constructs and elements of TL. TL as an equitable leadership practice also requires further investigations to understand the complex and mixed results from the PISA 2015 data.

TL initiative

This study first suggests that policymakers need to consider the different associations between TL practices and student achievement by country. Global governance (e.g., European Unions, OECD, UNESCO) exercises significant powers on national policies, and national

policymakers try to borrow "the best practices" by referring to the recommendations of global organizations (Steiner-Khamsi, 2004). Teacher policies, including decentralization of educational systems and empowerment of teachers, are the cases that are affected by transnational governance. For instance, global policymakers recommend teachers get involved in school and policy decisions in order to achieve a bottom-up school reform (OECD, 2016). However, the findings of this study imply policymakers should conceptualize TL based on the national/local contexts and then investigate systemic/cultural relevance and initiate TL for improving student learning outcomes. Luschei and Jeong (2020) study identified a cross-national relationship between TL and student achievement, but the relationship varied by country: Any TL practices in school decisions were significantly related to student achievement in Korea, even controlling other student factors and school factors.

In addition, global policymakers and researchers could include more countries in order to examine cross-national or regional patterns regarding the relationships among TL, student achievement, and school poverty. This study analyzed the relationships by focusing on only two educational systems and identified different associations by country, but the results might not be the case for other countries. The TL literature is growing and incorporating more international work (e.g., Harris & Muijs, 2003; Muijs & Harris, 2001, 2006); thus, the TL/student achievement association in high-poverty schools might be more thoroughly investigated given a more detailed literature base. For instance, studies targeting Australia, Canada, or the UK might deepen our knowledge of TL in decentralized educational systems. Likewise, if future studies investigate TL in East Asian countries (e.g., China, Japan, Singapore), it enables us to understand the relevance of centralized educational systems in conditioning t TL and student achievement associations.

Leadership arrangements within a school should also be investigated in future research to understand TL with possible tradeoffs. As prior studies pointed out (Luschei & Jeong, 2020; Shen & Xia, 2012), *teacher decision-making responsibility* would be restrained by power-sharing

arrangements in a school among other stakeholders such as school principals, school boards, and local/national educational authorities. For instance, TL would be decreased if school principals take more responsibility for curricular decisions. On the other hand, there is the possibility for win-win power-sharing that can lead to enlarged "pies." If a school gains more authority, it could redistribute more power to teachers.

Second, this study offers country-specific recommendations. For the US, *decision-making responsibility* should be secured for teachers to exercise their leadership in improving student academic learning outcomes. The results of this study revealed an imbalance: US teachers had a lower degree of *responsibility in budget-related and curricular decisions*. Educational administrators thus need to encourage teachers to be more involved in budgeting (e.g., formulating and allocating the school budget within the school). Administrators should also support TL in curricular and instructional decisions such as determining course offerings, choosing textbooks, designing course content, and establishing student assessment policies. The *decision-making responsibility in curriculum* is not only the core domain of teacher agency and autonomy (Lai & Cheung, 2015), but it has often been constrained in the accountability era (D. W. Jeong & Luschei, 2018). Additionally, policymakers need to identify best practices in *distributed leadership* and peer learning (e.g., *collaboration, cooperation)* so that they can disseminate evidence that has significant relationships with student achievement.

For Korea, the government should encourage schools to build *cooperative* cultures of peer learning among teaching staff. The descriptive statistics of this study represented that the significant activities of teacher *cooperation* with a large coefficient (i.e., exchanging teaching materials, ensuring common standards together, and attending team conferences) were more frequently implemented in schools. Policymakers and administrators in Korea should continue to support and encourage those *cooperative* activities rather than requiring or inducing teachers to engage in them. Accumulated research highlights the fact that Korean teachers feel highly

reluctant to engage in top-down professional and peer learning (P. Chung & Lee, 2017; Hong, 2019; S. H. Jeong, 2013). Moreover, excessive administrative work is a chronic problem that interrupts teachers' participation in professional learning (OECD, 2014, 2019b). The national and local educational authorities must thus secure time for school teachers to *cooperate* with their colleagues.

Moreover, educational administrators need to explore TL in school decisions more by allowing 'actual' autonomy and responsibility for Korean teachers to significantly influence school decisions. Many studies consistently pointed out that teachers (more than principals) perceived that their meaningful involvements in school decision-making processes are still constrained (Brezicha et al., 2019; Hwang & Hong, 2012; Moon et al., 2018), even though Korean teachers are often referred to as highly qualified professions who have the capacity to make a professional decision (Ingersoll et al., 2007; W. J. Kim, 2019).

For both countries, policymakers and educational administrators should pay attention to TL as an equitable leadership practice. In the US, this study explored some significant associations among *distributed leadership,* student achievement, and school poverty. This study also demonstrated that school poverty is much more severe in the US. More than half of schools in the US were socio-economically disadvantaged, with a huge variation between schools (M=51.36%, SD=26.31), while the proportion of disadvantaged schools in Korea was only 16.27 percent with a standard deviation of only 17.03. It is worth noting that schools hindered by concentrated poverty have been shown to have a negative school climate (e.g., truancy, bullying, drug addiction, gun violence) and inequitable access to qualified educators (Akiba, LeTendre, & Scribner, 2007; Banks, 2001). For these reasons, the equitable leadership roles of teachers in high-poverty schools should be continuously investigated.

In Korea, over the recent decades, SES-based achievement gaps have been increasing, whereas this trend was less clear for the US (Byun & Kim, 2010). Despite increasing educational

inequality, prior studies in Korea did not reach an agreement on which teacher and school factors could close the SES-based student achievement gaps. Like the prior research, this study also represented mixed results of relationships among TL practices, student achievements, and high-poverty schools. Nevertheless, this work proposes a possible role of TL as an equitable leadership practice in decreasing the negative association between school poverty and student achievement. Further studies are required to deepen our understanding of TL as an equitable leadership practice.

Finally, developing a more valid and reliable database is essential for future researchers to assess the impact of both TL practices (i.e., peer learning and decision-making) on student learning outcomes and the moderating roles of TL more rigorously. Even though this study utilized the PISA 2015 data, a comprehensive international survey, the measurement of TL should be further elaborated to make a consensus on the construct and elements of TL. This is because of the importance of these TL constructs in the field as well as the mixed results that both previous studies and I found. The PISA 2015 depends on only a few items for constructs like *collaboration, cooperation,* and *distributed leadership*. In particular, *collaboration* and *cooperation* in Korea were significantly related to student achievement with pretty large coefficients, suggesting that more careful study is needed on how researchers measure the TL constructs. In addition, developing longitudinal data on TL could allow us to infer more accurate relationships. The findings of this study showed the mixed relationship among TL, student, achievement, and school poverty, but the results were difficult in inferring the direction of causality due to the use of cross-sectional data. The equitable leadership roles of teachers could also be addressed by the improved database.

Furthermore, an improved database could enable us to investigate the TL roles in other student learning outcomes (e.g., socio-emotional growth), although this study focused on cognitive learning outcomes. Even though there are methodological difficulties in measuring non-

cognitive learning outcomes, recent surveys try to capture those domains. For example, PISA 2015 assessed students' collaborative-problem solving skills, which implies a socio-cognitive learning outcome. PISA 2018 investigated students' "well-being" to discuss students' socio-emotional development. Of course, more studies are required to articulate the TL roles in students' non-cognitive learning beyond arguing that teachers can lead the holistic learning of students as well as teaching academic subjects.

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SELECTED PUBLICATIONS

Woo, H., LeTendre, G. K., Pham, T., & Xiong, Y. (2021). The use of social robots in classrooms: A review of field-based studies. *Educational Research Review, 31.* Advance online publication. https://doi.org/10.1016/j.edurev.2021.100388

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Byun, S., Kim, J., & **Woo, H.** (2019). 교사를 희망하는 일반고 학생들의 특성 변화: 학업성취를 중심으로 [Changes in the characteristics of academic high school students who want to be a teacher: Focusing on academic achievement]. *교육사회학연구 [Korean Journal of Sociology of Education], 29*(1), 27-51.

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AWARDS

2019–2021 *Barbara Jackson Scholar*, University Council for Educational Administration
2018–2020 Student Writing Group Awards (Department of Education Policy Studies)

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2018–2020 *President (2019–2020); Communicate officer (2018–2019),* the International Education Student Association, the Pennsylvania State University Comparative and International Education program, University Park, PA

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