KURAM VE UYGULAMADA EĞİTİM BİLİMLERİ EDUCATIONAL SCIENCES: THEORY & PRACTICE

Received: September 19, 2016
Revision received: March 6, 2017
Accepted: March 16, 2017
OnlineFirst: April 25, 2017

www.estp.com.tr
DOI 10.12738/estp.2017.4.0479 • August 2017 • 17(4) • 1203–1229

Research Article

Professional Learning Communities Assessment: Adaptation, Internal Validity, and Multidimensional Model Testing in Turkish Context

Selçuk Dogan[1]
University of Florida & Marmara University

R. Şamil Tatık[2]
Marmara University

Nihal Yurtseven[3]
Yıldız Technical University

Abstract

The main purpose of this study is to adapt and validate the Professional Learning Communities Assessment Revised (PLCA-R) by Olivier, Hipp, and Huffman within the context of Turkish schools. The instrument was translated and adapted to administer to teachers in Turkey. Internal structure of the Turkish version of PLCA-R was investigated by using confirmatory factor analysis (CFA). After examining four alternative CFA models that have the potential to validate the internal structure of Turkish version of PLCA-R, we decided to retain the six-factor model with correlated residuals because it best explained the perception of teachers in Turkey according to a variety of criteria. After completing the adaptation study, for elementary teachers, we also modeled the relationship between individual, interpersonal, and organizational dimensions of professional learning communities accounting for teacher characteristics and school contextual factors. We found that organizational capacity is a statistically significant predictor for interpersonal capacities. However, professional development, as a personal capacity, was not a statistically significant mediator of this relationship in the model. We provided discussion on the dimensionality, methodological issues, and appropriate use of the translated instrument as well as on how our tested model can be interpreted for directions to future studies.

Keywords

Professional learning communities • Communities of practice • Professional development • Multidimension • Internal Structure

1 **Correspondence to:** Selçuk Dogan, School of Teaching and Learning, Florida, USA. He is a researcher at University of Florida and Marmara University, interested in teachers' professional development, curriculum design (understanding by design), and professional learning communities. He uses large-scale national and international data to examine the intercorrelations and structural relationships among teachers, schools, and instruction from the teacher effectiveness and school improvement perspectives. Email: sdogan@ufl.edu

2 Atatürk College of Education, Marmara University. He is a research assistant. He researched about higher education, class size, teacher education, teachers' professional development, metaphor, distance education, school based management, and accountability. Email: r.samiltatik@gmail.com

3 School of Foreign Languages, Yıldız Techninal University. She researched about teacher education, teachers' professional development, the relationship between professional development and student achievement, and foreign language learning motivation within the scope of her doctoral dissertation, titled "Action Research Based UbD Practices in EFL Teaching." Email: yurtsevennihal@gmail.com

Citation: Dogan, S., Tatık, R. Ş., & Yurtseven, N. (2017). Professional learning communities assessment: Adaptation, internal validity, and multidimensional model testing in Turkish context. *Educational Sciences: Theory & Practice, 17*, 1203–1229. http://dx.doi.org/10.12738/estp.2017.4.0479

The idea of professional learning communities (PLCs) has become engrained into efforts of professional development around the globe. In the United States, there has been growing interest in developing PLCs within the school settings in an attempt to measure its effect on teacher practice (e.g., Mintzes, Marcum, Messerschmidt-Yates, & Mark, 2013) and student learning (e.g., Saunders, Goldernberg, & Gallimore, 2009). Review studies have also been abundant. Dogan and Adams (2016) reviewed the empirical evidence of PLC impact on teacher practice and student learning using research evidence up to 2015 which found only 15 studies that first met an established definition of PLC and then provided evidence of change in teacher practice and/or student learning. Fulton and Britton (2010) also reported a comprehensive literature synthesis of PLCs and their impact on science, technology, engineering, and mathematics teaching and learning. In addition to the findings from the previous reviews, Dogan, Pringle, and Mesa (2016) reported the positive impact of PLCs on teachers' pedagogical and disciplinary knowledge. Similarly, countries in Europe examined how PLCs are operationalized in their own school context. In England, Bolam et al. (2005) concluded that PLCs are a valuable vehicle to build school capacity for continuous improvement to student learning. In Iceland, Sigurðardóttir (2010) reported on the relationship between a school's level of effectiveness and its degree to become a PLC. In Asian countries, such as Taiwan, teachers' professional development was investigated when they were involved in PLCs (Chou, 2011). Overall, as Dogan and Adams (2016) have envisioned that PLCs have become an international approach to teachers' professional development.

Conversely, despite this rapid movement of inclusion of PLCs in schools and nations' research agendas (Dogan et al., 2016), very little systematic research has explicitly explored PLCs in Turkish school settings. Dervisogullari (2014) identified current state of PLCs using teacher views in Turkey. He found that collaboration, shared vision, and common practices are not clearly visible at the schools. Ilgan, Erdem, Cakmak, Erdogmus, and Sevinc (2011) evaluated schools to determine the extent to which they have became PLCs by adapting a "check list" to serve this purpose. As a result, they concluded that Turkish primary schools can function as PLCs. Moreover, Hunuk, Ince, and Tannehill (2012) examined the effects of PLCs on teachers' content and pedagogical content knowledge. The result of this study provided evidence for positive effects of PLCs on teaching practices and student learning. A more recent study using PLCs conducted by Kalkan (2016), she investigated the inter-relationship between PLCs, organizational trust, and bureaucratic structure in the schools, but this correlational study did not focus on the current status of PLCs in Turkish school context. Demir (2015) took advantage of PLC framework to examine relationship among trust, and teacher leadership, in which PLCs were neither focus nor a variable to be studied. As shown from above, there are only a few empirical studies in which PLCs were examined in the schools in Turkey. Furthermore, because each embraces a different definition of PLCs and were used in different contexts,

such as physical education or educational administration. Most of these studies are descriptive in nature, which proves problematic in efforts to systematically identify how PLCs function within Turkish school settings.

Context

Turkey has been known by its diverging nature from other countries, influenced by both Western and Eastern educational philosophies. On the one hand, Turkey adapts innovative and Westernized educational reforms by focusing on students' active construction of their own knowledge and collaborative nature on teachers' professional development. On the other hand, Eastern-based instructional approaches, such as didactic teaching methods and traditional ways of providing teachers with professional development through "one-shot" trainings and "sit-and-get" seminars and conferences are prevalent. Giving the complex nature of the educational and cultural context, Turkey can be considered as an adjective site to conduct research studies on teachers' professional development.

Moreover, a clear understanding of what PLCs look like and how teachers at the school work in the context of PLCs in Turkish schools is an unaddressed gap in the recent literature. The investigations from previous studies suggest that visualization and representation of PLCs in Turkish school settings have not been clearly sketched yet. To accomplish this goal, an instrument that reveals significant attributes and critical dimensions of PLCs is needed. Furthermore, we need to have a comprehensive description of organizational activities linked to particular school and classroom practices in order to further our investigation of PLCs in Turkey. Because it is a challenge for researchers, administrators, and teachers to identify their own school as PLCs, we also need systematic and evidence-based criteria that work in Turkish school context. Therefore, the first purpose of this study is to translate a PLC instrument into Turkish in order to establish the framework/foundation for achieving this need. We have decided to use the *Professional Learning Communities Assessment-Revised* (PLCA-R) (Olivier et al., 2010) because this instrument includes PLC dimensions that might be well suited for Turkish school contexts. The second purpose of this study is to validate the internal structure of a Turkish version of PLCA-R using confirmatory factor analysis (CFA). These findings will potentially provide evidence for both a clearly defined PLC construct in Turkish school settings, and determining whether the instrument produces similar internal structure to previous studies claimed by the literature and in the Westernized cultures. Additionally, this study seeks for the understanding of how to use PLCA-R in an appropriate and a methodologically correct way for Turkish school settings by examining its internal structure. This study adds to international literature on how teachers in Turkey experience PLCs that encompass the six dimensions of PLCs. Specifically, this study carries importance in using a Westernized instrument in a country with its mixed composition of teachers who are under the influence of both Western and Eastern instructional philosophies.

Professional Learning Communities

To date, there has been no universal definition of PLCs. The notion itself may have different interpretations within different contexts. Instead, researchers and practitioners draw more emphasis on various aspects of PLCs. However, previous PLC literature is in consensus with an eclectic definition: PLCs are a group of professionals who share and discuss their practice and student learning in a systematic, continuous, collaborative, and reflective manner (Dufour, 2004; Louis, Kruse, & Marks, 1996; Morrisey, 2000). With this comprehensive structure, PLCs have garnered much interest from both practitioners and policy makers inside and outside the school settings, as PLCs have begun to be perceived as a movement to promote teacher learning to meet students' needs (Vescio, Ross, & Adams, 2008).

Consistent with the aforementioned definition we embraced, the literature suggests six dimensions of PLCs, which are (i) shared and supportive leadership, (ii) shared values and vision, (iii) collective learning and application, (iv) shared personal practice, (v) supportive conditions: relationships, and (vi) supportive conditions: structures (Hord, 1997, 2008; Morrisey, 2000; Hipp & Huffman, 2003; Olivier et al., 2009; Olivier et al., 2010). Even though the name of the dimensions may differ from one author to another, the core tenets of PLCs focus on professionalism, community, and learning always stays strong (Hord & Sommers, 2008). The six dimensions are defined below.

Shared and Supportive Leadership

Shared and supportive leadership is an interaction in which both administrators/principals and teachers participate to make collective decisions within a safe environment (Hord, 1997). As administrators/principals equally distribute their power, authority, and decision making, leadership becomes "supportive and shared" (Hipp & Huffman, 2000, p. 14). Supportive principals lead from the center rather than the top with more learning, orchestrating, and leading than controlling, dictating, and commanding (Dufour & Eaker, 1998). Leaders champion teacher ownerships for professional development efforts toward improving student learning in the school. (Louis, Kruse, & Associates, 1995).

Shared Values and Vision

This dimension of PLCs refers to a sense of common purpose, belief, value, and/or mission among staff in the school. Kruse, Louis, and Bryk (1995) stressed on the importance of shared values and vision and posited without common purposes, practices, and behaviors, the other dimensions of PLCs cannot emerge. They argued that an effort that lacks a shared goal could cause misunderstanding, conflict, and mistrust among staff. Thus, Kruse and Louis (1993) suggested that school staff

should share their commitment fostering PLCs by utilizing the core dimensions of PLCs. Particularly, Hord (2004) drew attention to "an undeviating focus" on student learning, which is always a necessity in shared values.

Collective Learning and Application

This important dimension is salient both within an individual member and between members of a group. PLCs are mechanisms to promote both individual and collective types of learning, as all teachers are learners with their colleagues (Louis et al., 1995). Collective learning is manifested through knowledge creation (Louis, 1994) and PLCs both cultivate and foster this type of learning by continuing to communally interact, practice serious dialogue, discuss about data, and interpret findings (Bolam et al., 2005). Collective learning also includes collaboration and PLCs go beyond superficial sharing by generating knowledge not only for the individual, but also for the common good (Kruse & Louis, 1993). The essential purpose of collaboration in PLCs is to establish a common purpose and engage staff through collaborative activities and dialogue in order to accomplish this shared goal between accomplishment of common purpose and collaborative activities in which staff are engaged in (Bolam et al., 2005).

Shared Personal Practice

Shared personal practice is a collaborative work in which members of PLCs engage in conversation focused on students and instruction. These collaborative discussions help identify specific challenges, propose potential solutions, and can create a blueprint for the application of new knowledge (Louis et al., 1995). The purpose of shared personal practice is not a self-analysis or critique about a teacher's own practice, rather it refers to "rich and recurring discourse" (Kruse et al., 1995, p. 30) and "collective … search for answers" (Dufour & Eaker, 1998, p. 25) in a community toward a better understanding of what s/he can do. It also includes a regular review or examination of individual teachers' professional behaviors both by class observation and case studies to improve the teaching practice of those teachers (Kruse & Louis, 1993). these collective actions typically culminate with a changed behavior (Kruse & Louis, 1993) via a collective action of teachers.

Supportive Conditions: Relationships and Structures

Supportive conditions in PLCs determine the place, time, and activities in which teachers regularly meet. As Hord (1997) suggested two types of conditions, relationships and structures, are the two most essential conditions of PLCs. Relationships as supportive conditions refer to the capacities teachers have. For example, Kruse and Louis (1995) specified that it is important that relationships

within PLCs consist of members who are responsive/open to accepting feedback and willingness towards student learning as important structures. Hord (1997) also listed trust among teachers, cognitive and affective skills as human factors to support PLCs, and maintaining positive attitudes towards colleagues. Structures as supportive conditions refer to the physical factors that help PLCs function effectively (Kruse & Louis, 1993). Research identified a number of structures that comprise this category, such as time to collaborate, places to meet at the school, physical proximity of teachers, and mechanisms through which teachers communicate (Hord, 2008).

Instruments to Asses Professional Learning Communities

Generally, how schools function as PLCs is assessed through an instrument by which researchers collect data from not only teachers but also all staff who are responsible for instructional duties. Across the literature, there are numerous instruments used to assess PLCs and how they emerge in the school settings. Most of these instruments include a differing number of PLC dimensions and have slight nuances in the conceptualization of PLCs. For example, Olivier et al. (2010) developed PLCA-R, consistent with the PLC framework suggested by Hord (1997; 2004), which includes the six dimensions of PLCs to assess the perceptions of school staff on certain practices inside PLCs. This instrument has been used widely in different setting. For example, PLCA-R was used to relate PLCs with student outcomes in middle schools (e.g., Burde, 2016) and elementary schools (e.g., Mullis, 2016). PLCA-R was also used to assess teachers' perceptions from various countries, some of which are Egypt, Saudi Arabia, and Oman (Al-Mahdy & Sywelem, 2016) and Cyprus (Katsamba, 2016).

In addition to the PLCA-R instrument, Louis et al. (1995) developed a survey of professional communities containing five dimensions to analyze school-based communities. Across the literature, many researchers adapted this instrument to research on PLCs. One example is from Bryk, Camburn, and Louis (1999) who examined the effect of social and structural factors on PLCs. Another instrument was designed in England by Bolam et al. (2005) which consisted of eight features and five processes of PLCs to be effective in promoting school-wide capacity building. Bitterman (2010) drew on this instrument to investigate teachers' perception of PLCs in middle schools. Overall, researchers make a choice on a PLC instrument that best fits to their research purpose. Across the literature, while there are some nuances in the structure and foundational dimensions of PLCs, the instruments to assess PLCs have a common base and theory underlying them.

The Current Study

The current study includes two separate but complementary parts; internal validation of an instrument and testing its use with a different sample. A formal diagnostic tool is required to decide the extent to which a school forms a PLC (Olivier et al., 2009; Olivier et al., 2010). Equally important in this assessment is to scientifically validate an instrument that intends to measure the extent to which PLCs exist at schools. In this study, we used a confirmatory factor analysis (CFA) as a primary procedure to provide internal validity (dimensionality) as evidence of a Turkish version of the PLCA-R as it relates to implications for reliability, validity, and appropriateness of scale use.

After its construct validation, to test how the PLCA-R Turkish version puts into practice in Turkish schools, we provided results from the empirical study with elementary teachers from different schools. We drew mainly from Mitchell and Sackney's (2000) conceptualization of PLCs as a basis to develop a theoretical model. The researchers advocate that PLCs is a multidimensional concept and build teachers' capacity on individual (i.e., within teachers), interpersonal (i.e., between teachers), and organizational (i.e., school) levels. In brief, individual capacity is active construction of teachers about instruction and learning. Interpersonal capacity refers to the extent to which teachers collaborate with each other. Organizational capacity indicates structure and resources that support sustained organization and its various processes (Mitchell & Sackney, 2000). Together, three capacities are interrelated, but research on how these capacities interact with each other is scant.

In our theoretical model, we aligned the dimensions of PLCA-R with the multidimensional nature of PLCs. For personal capacity, we incorporated teachers' professional development experiences operationally defined by the amount of time they experience professional learning. For interpersonal capacity, collective learning and application and shared personal practice were used. Lastly, supportive conditions (both relationships and structures) represented organizational capacity. Because school contextual factors and teacher characteristics were shown as significant predictors in multidimensional conceptualization of PLCs (Louis et al., 1995; Morrisey, 2000; Sleegers, den Brok, Verbiest, Moolenaar, & Daly, 2013), we also took into account teachers' years of experience, the number of teachers they work together, education level, gender, and the number of students in their classroom. Using structural equation modeling (SEM), we tested the relationship between personal, interpersonal and organizational dimensions of professional learning communities accounting for teacher characteristics and school contextual factors.

Method

Participants

For the validation study, a total of 719 teachers from the schools in Istanbul were purposefully selected to participate in this study. Mean age of the participants was 42. There were 288 males and 431 females. Teachers from elementary schools were 150; from middle schools were 373; and from high schools were 196. For the model testing study, we sent the survey to 30 elementary schools electronically. Schools in which at least five teachers provided data with non-missing observations were accepted for the study. This sample included 133 elementary school teachers (86 males and 47 females) from 23 schools in Istanbul. 27 teachers had graduate degree. The mean of teaching experience was 13.85, ranging from 2 to 37.

Instrument

The PLCA-R provides information related to school members' perception and views about particular practices inside a community. These school level practices are (i) shared and supportive leadership, (ii) shared values and vision, (iii) collective learning and application, (iv) shared personal practice, (v) supportive conditions: relationships, and (vi) supportive conditions: structures. PLCA-R is the revised and updated version of the previous PLCA instrument which was designed to assess members' daily practices in a community. According to Olivier et al. (2010), the PLCA-R is more inclusive of school level practices related to communities. As such, the PLCA-R is used for many purposes: (i) to measure the extent to which a school functions as a PLC, (ii) to quantify the perceptions of members about characteristics of their community through a continuum, and (iii) to identify particular professional practices and PLC activities members are engaged in (Olivier et al., 2009).

Overall, PLCA-R is regarded as a formal diagnostic tool for effective in describing the condition of a school as a PLC and in determining the strength of each PLC dimension. Using aforementioned six dimensions, the PLCA-R represents school level practices that exist inside a community. Accordingly, each dimension includes specific practices that contribute to become a PLC. There are eleven items for shared and supportive leadership, nine items for shared values and vision, ten items for collective learning and application, seven items for shared personal practice, five items for supportive conditions: relationships, and four items for supportive conditions: structures. In all, the PLCA-R includes 46 items. PLCA-R uses a four-point Likert scale: 1: strongly disagree, 2: disagree, 3: agree, and 4: strongly agree. Sample items and definitions for each dimension are presented in Table 1.

Table 1
Professional Learning Communities Assessment-Revised

Factors	Definitions	Sample items
Shared and Supportive Leadership	Sharing power, authority, and decisions making within school boundaries	11 items: Staff members are consistently involved in discussing and making decisions about most school issues
Shared Values and Vision	Common goals toward which members work	9 items: A collaborative process exists for developing a shared sense of values among staff.
Collective Learning and Application	Intentional learning members agree on to pursue and act	10 items: Staff members work together to seek knowledge, skills and strategies and apply this new learning to their work
Shared Personal Practice	Peers helping peers by de-privatizing their practices	7 items: Staff members informally share ideas and suggestions for improving student learning.
Supportive Conditions-Relationships	Relational and human capacities and activities that members are engaged in	5 items: Caring relationships exist among staff and students that are built on trust and respect
Supportive Conditions-Structures	Structural and physical conditions that support members collaborate for learning	4 items: Time is provided to facilitate collaborative work

Previous validation study of the PLCA-R by Olivier et al. (2009) using 1209 teachers demonstrated that internal consistency calculated by Cronbach's alpha ranged from .82 to .97. Moreover, content validation was provided by expert opinions by a panel of educationalists. For the appropriate uses of the instrument, the researchers suggested that to determine the quality of each dimension, descriptive statistics are appropriate. They also recommended using single items to measure how school level practices work at a particular school.

Translation and Adaptation

A multiple-step approach was used to translate the PLCA-R into Turkish and adapt it to use of Turkish schools. This approach included translation committee (Nasser, 2005), back translation (Brislin, 1986), and a pilot study. As the first step, a translation committee was formed with five researchers, who have extensive experience in translation and knowledge on psychometrics, scale development, and PLCs. Two researchers translated the PLCA-R into Turkish as two different forms. By checking consistency, language equivalence, and cultural norms, another researcher combined these two forms into one form, which was designated as 'form TR,' representing Turkish (TR) form of the PLCA-R.

As the second step, three Turkish professors and two American professors were called to take part in back translation process. First, two Turkish professors translated the form TR into English. Another professor combined the English forms into one form by taking into account the original PLCA-R. Then, the final form was sent to two American professors. These native English speakers conducted an equivalency study using the last form and the original PLCA-R to verify the relevance of the

forms. They rated each item in terms of its similarity, language equivalency, and functionality. Based on the ratings and feedback they provided, the form was revised and no major issues were reported. After translation committee and back translation process, a final form of PLCA-R in Turkish was retained.

As the third step, a pilot study was conducted to assess the correlation between the final form and the original PLCA-R. The pilot study included 45 teachers who were capable of understanding both Turkish and English. The final form and the original PLCA-R were administered to these teachers on two occasions with a time lag of 10 days. The relationship between the final form and the original PLCA-R was estimated by correlation coefficient as r = .91. The correlation coefficients for the corresponding dimensions varied from .85 to .91. All the coefficients showed high correlation, which indicates sufficiently large correlation between the two forms. This step provided a translated and adapted form of PLCA-R in Turkish, as we might call it: *PLCA-R TR*.

Analytic Procedures

After the translation and adaptation process, we utilized a variety of analytic and statistical procedures to provide internal validity evidence of PLCA-R TR. This evidence was based on structural component, which is the extent to which relationships between the items in PLCA-R TR are representative of the hypothesized relationship between the items (Messick, 1989). Using the full information of the data, firstly, we tested unidimensional structure of PLCA-R TR using CFA. Secondly, we fitted four CFA models, which included a one-factor model, two six-factor models, one with correlated and one with uncorrelated residuals, and a model with a second-order construct. Moreover, testing higher order CFA models is often neglected in the model testing studies and PLC literature. Since a second-order factor can be measured indirectly through the dimensions underlying it (Kline, 2015), higher-order models of the six-factor model of PLCA-R TR were tested to understand whether hierarchical relations among the PLC dimensions existed.

Constructs measured by scales or surveys may often be much more complex and reflect different behaviors in different samples and various cultures. We did not allow PLC items to cross load on more than one factor, which kept us in the boundaries of PLC theory. As Keith (2015) suggests, by incorporating constraints or restrictions, we made use of the powerful and flexible nature of CFA methodology to test more models (including higher-order models) without sacrificing from theoretical underpinnings of PLCs. Indeed, to evaluate the dimensionality of an instrument, fitting competing models that are consistent with theoretical background of that instrument is a prevalent approach across the literature (e.g., Gamst & Meyers, 2014; Leite, Svinicke, & Shi, 2010). Furthermore, we expected to determine if a simpler or

a more complex model might be comparable (Kline, 2015) for a sample of teachers in Turkey, which contributed our likelihood of success in our search of re-specified models (MacCallum, 1986).

We focused on the extent to which the validity of score interpretations were supported by four types of CFA evidence: (i) model fit indices and standardized residuals, (ii) average variance explained (AVE), (iii) composite scale reliability coefficient, factor rho, ρ, (Raykov, 2004), and (iv) estimated factor (PLC dimensions) correlations and standardized factor loadings as well as evidence of convergent and discriminant validity.

Because providing all the information related to internal structure of PLCA-R TR would be overwhelming, we adopted a step-by-step procedure to choose the best model. Firstly, we fitted four alternative CFA models. Based on model fit indices and standardized residuals along with modification indices, we then eliminated models that provided poor or relatively lower fits. After we retained the models that showed better fits, we reported the remaining CFA evidence and factor rho coefficients. Graphical representations of the models we retained were provided as well as their statistical parameters.

For the model testing, we used the same analytical procedures as mentioned above. The latent variables included were collective learning and application, shared personal practice, and supportive conditions. The number of teachers in the school and in the department, the extent to the participation in departmental meetings, the number of professional development attended, years of teaching experience, and school size as continuous observed variables; and education level (binary: graduate degree), and gender were included as categorical observed variables. Based on the theoretical foundations and previous research on PLCs, we developed and tested a hypothesized model for elementary teachers, detailed in the results.

Model fit indices. To provide information related to model fit, we used different types of goodness-of-fit indices, which are the χ^2 statistics, Tucker-Lewis Index (TLI), the comparative fit index (CFI), standardized root mean square residual (SRMR), and the root mean-square error of approximation (RMSEA). A non-significant value of χ^2 was desired. We also adopted widely used cutoff values suggested by Hu and Bentler (1999), which are TLI > .95; CFI > .95; SRMR < .80; and RMSEA < .06. As Marsh, Hau, and Wen (2004) recommend, we regarded the model fit indices as validity evidence metrics that complement theoretical framework of PLCs while comparing alternative CFA models. We also reported Akaike (AIC) and Bayesian (BIC) information criteria to compare alternative models. In addition to global goodness-of-fit indices, localized area of strain obtained by standardized residuals and modification indices were taken into account to determine the final CFA model

that best represents the structural component of PLCA-R TR. Standardized residuals that are equal to or greater than the absolute value of 1.96 were regarded as non-problematic (Byrne, 2011). Largest modification indices were used as 3.84 (Brown, 2015).

Average variance explained and scale reliability. AVE and ρ values for each dimension in PLCA-R TR were used to obtain further evidence of validity in PLCA-R TR. AVE values provide information on the degree to which the dimensions explain item variance (Kline, 2015). The formulae used to compute AVE is $\frac{\text{Sum of squared standardized loadings}}{(\text{Sum of squared standardized loadings} + \text{Sum of indicator 's residual variance})}$. ρ values are scale reliabilities of each dimension based on CFA approach (i.e., model-based reliability). The formulae used to calculate ρ by Raykov (2004) is $\frac{(\text{Sum of unstandardized loadings})^2}{(\text{Sum of unstandardized loading})^2 + \text{Sum of indicator 's residual variance}}$. ρ was used since it is derived from factor model using unstandardized factor loadings and residual correlations and is a better alternative than Cronbach's alpha for estimating reliability (Widhiarso & Ravand, 2014).

Estimated factor correlations and loadings. Another validity evidence (e.g., criterion validity evidence) was based on estimated factor correlations and standardized factor loadings of PLCA-R TR. Parameter estimates for models we retained were compared to determine the best factor correlations and factor loadings of CFA models.

As for technical details, the dimensions of PLCA-R TR were scaled in that the factor variance of each dimension was fixed at 1 in first-order CFA models. For second-order models, the second-order factor's variance was fixed at 1. We treated four-point scale items as continuous and used robust maximum likelihood (MLR) procedure to estimate the parameters in the model by using Mplus 7.3. MLR enabled us to obtain standard errors that were corrected for normality violations. All error covariances were freely estimated with the CFA models without error correlations, and all indicator cross-loadings are fixed to 0.

Regarding the missing data in our sample, we had two cases with missing on all variables, which were excluded from the analysis. In the item level, the percent of the missingness ranged from .30 (n = 2) to 1.1 (n = 8). Little's missing completely at random (MCAR) test showed that the data were missing in a random way ($p >$ .05). For handling missing data, multiple imputation was carried out using Bayesian estimation. Five imputed data sets were used and parameter estimates from each imputed data set were averaged over the data sets. Standard errors were computed using Rubin's formula (Muthén & Muthén, 1998–2012).

Results for the Validation Study

First, we decided on the structural component of PLCA-TR using CFA. We tested four CFA models using the dimensions of PLCA-R TR. The information regarding fit indices of the models was presented in Table 2.

Table 2
Fit Indices of the Alternative Four CFA Models

Models	χ^2 (*df*)	RMSEA	CFI	TLI	SRMR	AIC	BIC
One-factor model with 46 items	5043 (989)*	.076	.760	.749	.060	57673	58305
Six-factor model	2932 (974)*	.053	.884	.877	.045	54804	55504
Six-factor model with nine correlated residuals	2533 (965)*	.048	.907	.900	.044	54293	55034
Second-order factor model with six factors and correlated residuals	2644 (974)*	.049	.901	.895	.047	54424	55125

Note. *$p < .001$.

Based on the cutoff values we embraced and residual correlations, we chose two models from four alternative CFA models to proceed. Six-factor model with nine correlated residuals (model A) provided good fit ($\chi^2(965) = 2533$, $p < .001$; RMSEA = .048, CFI = .907; TLI = .900; SRMR = .044; AIC = 54293; BIC = 55034). Second-order factor model with six factors and correlated residuals (model B) also showed relatively moderate fit ($\chi^2(974) = 2644$, $p < .001$; RMSEA = .049, CFI = .901; TLI = .895; SRMR = .047; AIC = 54424; BIC = 55125). We found out that the addition of the correlated residuals provided improvements in CFI and TLI. Other two CFA models were eliminated due to having relatively lower fit values and large number of high residual correlations (e.g., more than .50).

Second, we reported average variance explained (AVE) and composite scale reliabilities (*p*) for the models A and B in Table 3.

Table 3
Average Variance Explained and Composite Scale Reliabilities of the CFA Models

	Model A		Model B	
	AVE	*p*	AVE	*p*
Shared and Supportive Leadership	.51	.92	.44	.79
Shared Values and Vision	.55	.92	.46	.62
Collective Learning and Application	.61	.93	.51	.68
Shared Personal Practice	.55	.89	.45	.62
Supportive Conditions-Relationships	.52	.87	.32	.55
Supportive Conditions-Structures	.49	.64	.26	.28

Based on the AVE and composite reliability coefficients, looking at the model A and Model B, the AVEs differed in magnitude. The model A had higher AVEs for each dimension, which ranged from .49 to .61. They changed from .26 to .51 for the Model B. Additionally, reviewing scale reliability coefficients, the lowest value in the model A was ρ = .64 for the dimension Supportive Conditions-Structures. On the other hand, composite reliability coefficients for the Model B were lower, ρ = .28 for Supportive Conditions-Structures. Important to note that other reliability coefficients in the Model B were comparatively lower than the ones in the Model A. Ultimately, we needed to determine a CFA model that best represents the underlying theoretical nature of PLCs and valid internal structure and that provides sufficient reliability evidence. According to what we have found, we were in favor of the idea to retain the Model A because the Model B provided neither relatively higher AVEs nor adequate reliability for the dimensions. Therefore, we eliminated the Model B.

Lastly, we reported standardized and unstandardized factor loadings, and corresponding standardized residual variances for each item in the Model A, our final retained model, shown in Table 4.

Table 4 displays the standardized factor loadings in the final CFA model. The estimates in the Model B changed from .436 to .855. Even though there were a handful of relatively lower standardized factor loadings, our analysis provided convergent validity evidence that was considered to be moderately sufficient because the lowest value was .436. A figural representation of the final model is provided in Figure 1.

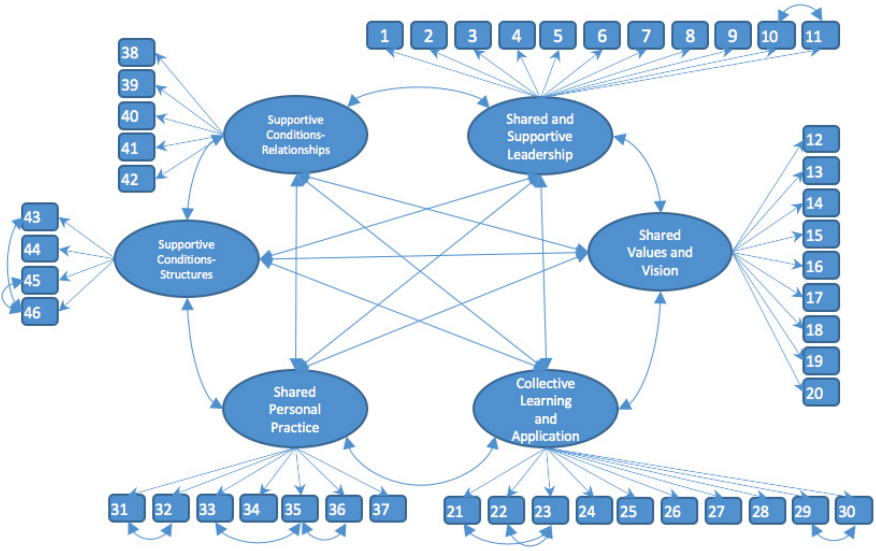

Figure 1. The Figural Representation of the Final CFA Model.

Note. Coefficients are omitted in the figure to avoid confusion. Double-headed arrows show covariation.

Table 4
Unstandardized and Standardized Parameter Estimates of the Final CFA Models

	Factor Loadings		Residuals
Items	Unstd (S.E.)	Std	Std
Shared and Supportive Leadership			
M1	.575 (.026)	.701	.508
M2	.636 (.025)	.783	.387
M3	.439 (.029)	.559	.687
M4	.521 (.026)	.693	.519
M5	.608 (.026)	.793	.372
M6	.675 (.027)	.778	.394
M7	.701 (.024)	.855	.269
M8	.567 (.025)	.712	.494
M9	.523 (.025)	.702	.507
M10	.430 (.026)	.590	.651
M11	.468 (.027)	.632	.601
Shared Values and Vision			
M12	.579 (.023)	.821	.326
M13	.484 (.024)	.752	.434
M14	.518 (.021)	.766	.413
M15	.573 (.024)	.807	.349
M16	.588 (.023)	.797	.365
M17	.573 (.027)	.679	.539
M18	.551 (.026)	.701	.508
M19	.559 (.025)	.733	.463
M20	.566 (.021)	.781	.390
Collective Learning and Application			
M21	.554 (.023)	.802	.356
M22	.546 (.024)	.761	.421
M23	.581 (.025)	.757	.427
M24	.564 (.022)	.780	.391
M25	.581 (.025)	.754	.431
M26	.475 (.025)	.688	.527
M27	.601 (.021)	.823	.323
M28	.622 (.023)	.786	.383
M29	.598 (.022)	.824	.321
M30	.602 (.021)	.831	.310
Shared Personal Practice			
M31	.562 (.025)	.741	.451
M32	.552 (.025)	.752	.434
M33	.556 (.023)	.788	.379
M34	.588 (.023)	.828	.315
M35	.550 (.028)	.653	.573
M36	.560 (.026)	.748	.440
M37	.560 (.026)	.748	.440
Supportive Conditions-Relationships			
M38	.498 (.027)	.700	.510
M39	.565 (.029)	.697	.514
M40	.597 (.029)	.748	.441
M41	.616 (.023)	.823	.323
M42	.565 (.023)	.837	.299
Supportive Conditions-Structures			
M43	.624 (.025)	.827	.315
M44	.602 (.029)	.436	.810
M45	.591 (.032)	.635	.596
M46	.559 (.033)	.609	.629

Note. All factor loadings were statistically significant at $p < .001$. M represents an item's code, Unstd: Unstandardized, S.E.: Standard errors, Std: Standardized.

Table 5 provides the amount of covariance among PLCA-R TR dimensions for the model we retained. The covariances among six dimensions changed from .689 to .875. Both covariances were relatively higher, which needed further discussion to report acceptable discriminant validity.

Table 5
Factor Covariances of the Final CFA Model

Dimensions	1	2	3	4	5
1. Shared and Supportive Leadership	1.000				
2. Shared Values and Vision	.808 (.019)	1.000			
3. Collective Learning and Application	.689 (.028)	.875 (.016)	1.000		
4. Shared Personal Practice	.693 (.026)	.801 (.022)	.864 (.019)	1.000	
5. Supportive Conditions-Relationships	.782 (.023)	.818 (.020)	.810 (.021)	.798 (.027)	1.000
6. Supportive Conditions-Structure	.756 (.030)	.782 (.028)	.781 (.029)	.788 (.038)	.869 (.025)

Note. All parameters were statistically significant at $p < .001$. Numbers in the parenthesis indicate standard errors.

Because of the high correlations between some dimensions in our model, we conducted a final test of construct distinctiveness by reducing the models to one-factor CFA model through collapsing some dimensions that are highly correlated, shown in Table 2. A significant reduction in model fit, problems in factor loadings and standardized residuals with this CFA model were observed. This result indicated more appropriate representation of the data would be evident, if we use the dimensions as distinct factors.

Table 6 reports correlated residuals in both standardized and unstandardized solutions. The minimum and maximum of unstandardized correlated residuals were -.067 and .235, respectively.

Table 6
Unstandardized and Standardized Correlated Residuals of the Final CFA Model

Parameters	Unstd (S.E.)	Std
E_{M10} with E_{M11}	.10 (.017)	.306
E_{M21} with E_{M23}	.048 (.010)	.227
E_{M22} with E_{M23}	.060 (.015)	.258
E_{M29} with E_{M30}	.054 (.010)	.324
E_{M31} with E_{M32}	.092 (.019)	.373
E_{M33} with E_{M35}	-.067 (.014)	-.240
E_{M35} with E_{M36}	.093 (.019)	.292
E_{M45} with E_{M46}	.235 (.031)	.450
E_{M43} with E_{M46}	-.009 (.018)	-.028

Note. All parameters were statistically significant at $p < .001$. E represents residuals. S.E.: Standard errors.

Overall, we started with four CFA models that were theoretically and methodologically appropriate to Turkish version of PLCA-R instrument. We eliminated two models using model fit indices. Then, we evaluated the remaining two potential models according to AVE and composite scale reliabilities. Finally, we decided to retain the model with six factors with nine correlated residuals as the best model to represent the internal structure of PLCA-R TR. Next, we discuss how PLCA-R instrument can be used in Turkish school settings in theoretically and methodologically sound ways.

Results for the Model Testing

Based on the conceptual information on PLCs and evidence from previous studies, we created and tested the model in Figure 2, which were well-aligned with the organizational capacity of PLCs conceptualized by Mitchell and Sackney's (2000). Our model was also consistent with the results of our validation study. The measurement model of the hypothesized model provided no major concerns related to internal validity, which provided estimates that are well-aligned with the internal structure of PLCA-R TR. The model provided moderate fit ($\chi^2(444) = 2513.2$, $p <$ .001; RMSEA = .058, CFI = .917; TLI = .903; SRMR = .074). Considering that the model was based on a theory-driven and empirically decided conceptualization of PLCs, they are not statistically notifiable. The standardized factor loadings of each latent variable were high, varied from .605 to .889. Composite reliability coefficients for the latent variables ranged from .88 to .97.

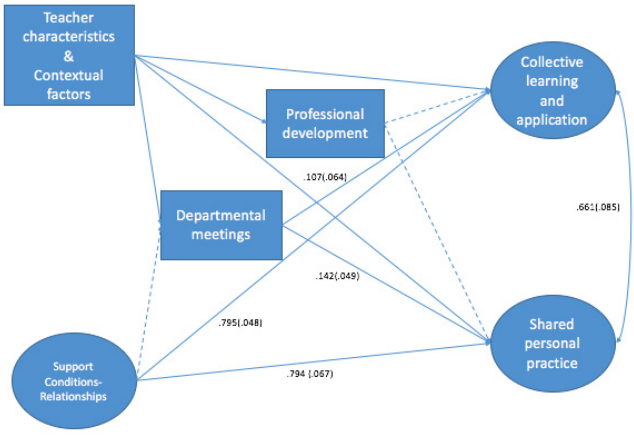

Figure 2. The Hypothesized Model to Test the Multidimensional Structure of PLCs.

Note. Items underlying the latent variables are omitted to save space. Teacher characteristics and contextual factors were shown as a collection; indeed, they were added to the model as single variables. Dashed lines represent statistically non-significant effects.

The magnitude of the effects (i.e., paths) of interest was reported in a standardized form in Figure 2. We kept statistically non-significant effects in the model as they provided statistical control over other relationships. The statistically significant effects from teacher characteristics and contextual factors to our variables of interest were presented in Table 7.

Table 7
Standardized Factor Loadings of the Model Tested

Effects	Standardized	S.E.
Number of teachers in the school-Shared personal practice	-.203	.096
Number of departmental meetings-Shared personal practice	.142	.049
Years of experiences in the same school-Shared personal practice	-.134	.104
Number of teachers in the school-Collective learning and application	-.297	.096
Number of teachers in the department-Collective learning and application	.191	.082
Years of experiences in the same school-Collective learning and application	-.109	.055
Number of students in the classroom-Collective learning and application	.120	.061

Note. All parameters were statistically significant at $p < .05$. S.E.: Standard errors.

Organizational capacity (support conditions-relationships) in PLCs had strong direct effects on interpersonal capacities (collective learning and application and shared personal practice), controlling for personal capacities and teacher characteristics ($\beta = .795$, $p < .01$ and $\beta = .794$, $p < .01$, respectively). There was no statistically significant indirect effect from organizational to interpersonal capacities. Departmental meetings, as a personal capacity, were a statistically significant predictor of interpersonal capacities, accounting for organizational capacity, contextual factors, and teacher characteristics ($\beta = .142$, $p < .01$ and ($\beta = .107$, $p < .01$, respectively). Interestingly, professional development, as another personal capacity, did not have statistically significant direct effect on interpersonal capacities.

Discussion and Implications

The primary focus of this study was to translate PLCA-R instrument and to validate the internal structure of the Turkish version of PLCA-R. We preferred to translate and adapt PLCA-R to developing a new PLC instrument because the concept of PLC is multifaceted and complex. We preferred to use PLCA-R due to its theoretically grounded structure highlighted by Hord (1997) and a wide range of research-informed use (Olivier et al., 2009). In addition, an adaptation study helped us reduce the time frame as well as monetary resources. On the other hand, for this adaptation study, we were aware that we could not assume that the psychometric properties of PLCA-R that was designed in the U.S. might prevail in Turkish school settings. Evidence of internal structure of PLCA-R TR needs to be empirically provided (van de Vijver & Hambleton, 1996).

At the end of the analytic approach we embraced, we found that the model with six dimensions was appropriate to measure the extent to which a school in Turkey functions as a PLC. The reliability of the scores (computed by *p*) collected using PLCA-R TR were satisfactory for the most of the dimensions in both models. The dimensions explained adequate amount of variance and provided sufficient factor structure. While exploring PLCA-R TR in terms of its items, we found that factor loadings of the items in the same dimension were high enough to claim unidimensionality. The results also provided discriminant validity that requires caution to interpret. We also noticed the existence of nine correlated errors in our best model of PLCA-R TR. Furthermore, using information from the validation study, we tested a theoretical model of multidimensional structure in PLCs using three dimensions of PLCA-R TR. Results of SEM analysis suggested that organizational and personal capacity were associated with interpersonal capacities, controlling for teacher characteristics and contextual factors. In the light of these results, we provide a discussion and implementation section in terms of dimensionality, appropriate use, and our methodological choices, as well as a brief conclusion on our tested model.

Dimensionality

This study reported that the six-dimension version of PLCA-R instrument, revealed with the data from conveniently sampled teachers, function well in the schools in Turkey. The hypothesized six-dimension structure of PLCA-R by Olivier et al. (2009) was validated in the context of this study. The CFA model provided adequate fit to data and produced higher factor loadings without a problem in residual variances. In conclusion, evidence from our psychometric analysis matched up with the theoretical foundations of PLCs. Having validated the internal structure of the instrument would have implication for future research in the field of psychometrics, test construction, model testing. First, additional studies are needed to strengthen the evidence of the CFA model we suggested. Using a larger sample of teachers in Turkey, the six-factor model might be tested to provide a more clear picture of how researchers should use PLCA-R TR. Researchers also further test the internal structure of PLCA-R TR to fine tune its underlying model, such as seeing if the same items warrant correlated residuals or conducting a re-specification search. Second, factor mixture models, which are combinations of latent class and common factor models (Lubke & Muthén, 2005) might be conducted to assess if PLCA-R TR scores come from a mix of sample with different factor structures. This could yield important information on unobserved population heterogeneity.

Another noteworthy finding was that the dimensions of PLCA-R TR had the same internal structure as in the original instrument. This could be an indication of the universality of PLCs. Teachers perceive different dimensions of PLCs as similarly

even if they are from other countries and experience different school atmosphere and collegial relationships. As Dogan and Adams (2016) concluded research studies on PLCs and PLC implementation in the school has been growing in Eastern countries in recent years and efforts to adopt PLCs inside their school systems as a school improvement model, despite the Westernized nature of the concept. This result ha also implication for future studies on PLCs. Using PLCA-R, cultural comparison studies to understand teachers' perception about PLCs and to investigate the nature of changes in teachers and students living in Eastern countries can provide an evidence-based foundation for future research purposes.

We also need to discuss about the correlation/covariation among the dimensions for the CFA model. After the notice of highly correlated PLC dimensions, we determined that the dimensions could likely measure almost the same construct. Thus, we re-specified the model by collapsing the dimensions that were correlated into a single factor. However, we deduced that this re-specification did not result in a significant improvement in the model fit. Even though we were confident that this process fostered more parsimony and clear interpretation of the model, this model led to some decrement. Furthermore, we are able to provide parallel findings regarding the highly correlated dimensions we found. In two studies in which PLCA-R was used, Al-Mahdy and Sywelem (2016) and Mullins (2016) reported similar high covariance among the dimensions. Indeed, the correlations were of a magnitude and direction that is consistent with conceptual reasoning. From a theoretical perspective, the dimensions of PLCs are close and sometimes intertwined (Louis et al., 1995). Hipp and Huffman (2003) explained the reported strong connection. For example, collective learning and application and shared personal practice are closely interrelated; as the former is more evident at the school, the latter will increase in frequency. Another example would be that shared and supportive leadership is related to all other dimensions as it leads the evolution of PLCs and helps making important decisions at the school. In addition, because supportive conditions are "the springboard for creating PLCs," they impact all other dimensions (p. 9). The dimensions of PLCA-R represent unique and individual constructs that have different characteristics on themselves, which are more evident in practice (Hord, 1997). As we consider the implications from the literature and theoretical underpinning of PLCs, a less parsimonious model with highly correlated dimensions is acceptable.

Appropriate Uses of PLCA-R TR

After our analysis, we concur the PLCA-R TR as an instrument to use as an assessment tool that measures professional practices related to PLCs in the schools. Principals could use PLCA-R TR to evaluate the extent to which teachers perceive their schools as PLCs. PLCA-R TR provides quantitative information on each domain

of PLC (e.g., shared and supportive leadership). For example, principals could identify the degree to which shared and supportive leadership exists in their own school setting. Based on the results, reform efforts might be implemented to promote leadership inside the schools. Because PLCs are one of the collaborative structures of professional development, it is imperative to encourage teachers to work in a group having shared values and vision. However, school leaders must first determine which particular aspect of teacher groups needs improvement. In this regard, PLCA-R can be used as a diagnostic tool to understand failing aspects of PLCs, and then to subsequently improve the functionality and productivity of PLCs.

In addition to the practical uses of PLCA-R TR, the instrument could also be useful for researchers and research studies. Firstly, PLCA-R TR could be used to report a status of current condition in Turkish schools in terms of PLCs. PLCs are garnering much attention from many international research institutions and international organizations around the world as they are a leverage to improve school effectiveness. However, recent literature suggests that little has been demonstrated about how schools in Turkey function as PLCs. Therefore, researchers could use PLCA-TR to provide a status report to stakeholders and policy makers to emphasize the importance of establishing PLCs in the schools. Secondly, researchers who wish to conduct advanced statistical modeling approaches, such as Multilevel Models (MLM) and SEM to investigate the association between school structure, teaching, instruction, or teachers' professional development could prefer to use PLCA-TR. Since we demonstrated that each dimension of PLCA-R TR could be used as individual latent (i.e., unobserved) variables, researchers might adopt the dimensions as separate variables to predict or explain their association with other school-related or teacher-related variables using a SEM approach. The dimensions could also be used to relate PLCs with other school-level variables, such as mean school achievement, school effectiveness, or school culture, within MLM framework. Thirdly, future directions to study PLCs using PLCA-R TR are encouraged using multi-group CFA to conduct invariance analysis as it provides information on the equivalence of PLC structure across diverse and multiple groups, such as administrators, leaders, and/or facilitators in the school.

Our final observation is to recognize that each dimension should be used as separate variables when analyzing data collected through PLCA-R TR. Because PLC dimensions did not show a unidimensional structure in the form of one latent variable (i.e., construct), computing a total score (either linear or latent) from six dimensions as one PLC score is not suggested. This is also supported by the previous studies using PLCA-R. The researchers used the individual dimensions in a separate way (Burde, 2016) and analyzed if each domain gets high or low scores (a score below 3.0 indicates lower degree of that particular dimension exists at the school) (Olivier et al.,

2009). Also, we recommend using each dimension as unique latent variables, instead of linear composites. In this way, studies take into consideration measurement error by each item, in turn, it provides more reliable estimates of each item and dimension. Accordingly, we suggest using the composite reliability coefficient by Raykov to provide reliability evidence of the data by PLCA-R TR. As most studies report the traditional ways of computing reliability coefficients (e.g., Cronbach's alpha), which could potentially include flaws (Kline, 2015; Widhiarso & Ravand, 2014). Method-wise decision to report evidence of reliability should be incorporated for further studies in which PLCA-R TR is used.

Methodological Choices

Our analytic procedure to construct validation of PLCA-R TR includes an assumption. Even though items constructed using Likert scale are mostly ordinal, we assumed the items in PLCA-R TR as continuous. This was one of our methodological choices due to the fact that we wished to benefit from the strength of MLR estimator. For future studies, we encourage researchers to use Weighted Least Squares (WLS) or Weighted Least Squares with Adjusted Means and Variances (WLSMV) by considering the items in PLCA-R TR as categorical.

Another methodological decision in this study was to allow the residuals of the items in the same dimensions of PLCA-TR to correlate. We preferred correlated residuals to investigate as many CFA models as possible and to avoid misspecification of the models. Moreover, we were aware that without the specification of residual covariances, we had to assert that all covariation was due to the latent dimension and all measurement error is random. However, we believe that some of the covariation among the items that might not be accounted for the latent variable should be due to another common cause (Brown, 2015). In our final models, we had nine correlated residuals. A close examination of the items whose residuals were correlated demonstrated that the items were satisfactorily translated and there were no similarly worded items. However, correlated residuals could imply that some of the shared variance may be attributable to a common cause that we did not take into account. This finding requires a further study on the original PLCA-R to find out how to improve and appropriately validate it.

Multidimensional Approach to PLCs

In an effort to provide evidence on how PLCA-R TR puts in practice, we tested the multidimensional nature of PLCs for elementary teachers. Our model testing study had both strengths and limitations. First, we used the same measurement model of PLCA-R TR and empirically replicated its structure in a different model while avoiding any new addition to the internal validity. This implies that researchers can use any dimension of PLCA-R TR according to choices of theoretical framework to

investigate interrelations among the dimensions. Future research may use separate dimensions of PLCA-TR to test other conceptual models in organizational learning, school-based leadership, or teacher collaboration. Second, we took the advantage of using control variables that are shown important in PLC research. In this way, we have separated out the effect of teacher and school characteristics, which helped provide better estimates of the relationship between the dimensions. However, holding other variables constant does not guarantee making valid inferences on multidimensional association of PLCs. We had a relatively small sample size, which might affect the study. Additionally, other influential variables could exist within the context of PLCs that need to be controlled over, such as student achievement, teacher self-efficacy, or schools' other organizational characteristics. Therefore, further studies should incorporate more control variables consistent with theory and previous studies. Third, SEM provided a framework to test multivariate relationships between the dimensions of PLCs in the form of latent constructs and observed variables of interest. However, our data has nested structure, meaning that teachers are nested in schools. We did not use MLM because the mean cluster size is below 10. As a recommendation, studies investigating multidimensional structure of PLCs would consider using MLM.

In conclusion, as a global implication for translation and adaptation studies, this study presents a strong case that hypothesized relationship between constructs in an instrument created in a setting might be different in other settings and diverse cultures. Even though this study did not change the instrument entirely, our work has considerable implications for validation studies. A close examination of the internal structure of an instrument must be conducted to reveal its unique nature in a particular environment. We recommend multiple uses of CFA and SEM to delve more deeply into the relationships among constructs and observed variables.

Acknowledgement

We would like to thank the editorial team at ESTP and anonymous reviewers for their constructive feedback on this article.

References

Al-Mahdy, Y. F. H., & Sywelem, M. M. G. (2016). Teachers' perspectives on professional learning communities in some Arab countries. *International Journal of Research Studies in Education, 5*(4), 45–57.

Bitterman, T. (2010). *Teacher perception of professional learning communities on teaching and learning in middle school science* (Unpublished doctoral dissertation). University of Alabama, Alabama.

Bolam, R., McMahon, A., Stoll, L., Thomas, S., Wallace, M., Greenwood, A., ... Smith, M. (2005). *Creating and sustaining effective professional learning communities* (Research Report 637). London, UK: DfES and University of Bristol.

Brislin, R. W. (1986). The wording and translation of research instruments. In W. J. Lonner & J. W. Berry (Eds.), *Field methods in cross-cultural research Vol 8. Cross-cultural research and methodology series* (pp. 137–164). Beverly Hills, CA: Sage.

Brown, T. A. (2015). *Confirmatory factor analysis for applied research* (2nd ed.). New York, NY: Guilford.

Bryk, A., Camburn, E., & Louis, K. S. (1999). Professional community in Chicago elementary schools: Facilitating factors and organizational consequences. *Educational Administration Quarterly, 35*(4), 751–781.

Burde, M. S. (2016). *The relationship between student achievement and professional learning communities at the middle school level* (Unpublished doctoral dissertation). Western Michigan University, Michigan. Available from ProQuest Dissertations & Theses Full Text. (1846129844)

Byrne, B. M. (2011). *Structural equation modeling with Mplus: Basic concepts, applications, and programming*. New York, NY: Psychology Press.

Chou, C. (2011). Teachers' professional development investigating teachers' learning to do action research in a professional learning community. *The Asia-Pacific Education Researcher, 20*(3), 421–437.

Demir, K. (2015). The effect of organizational trust on the culture of teacher leadership in primary schools. *Educational Sciences: Theory & Practice, 15*(3), 621–634.

Dervisogullari, M. (2014). *An examination of teachers' views about the dimensions of professional learning communities* (Unpublished master's thesis). Marmara University, Istanbul, Turkey. Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/

Dogan, S., & Adams, A. (2016, April). *Do professional learning communities (PLCs) impact teacher practice and student learning? An analysis of recent studies*. Paper presented at the Annual Meeting of the American Educational Research Association, Washington D. C. Abstract retrieved from http://www.aera.net/Publications/Online-Paper-Repository/AERA-Online-Paper-Repository.

Dogan, S., Pringle, R., & Mesa, J. (2016). The impacts of professional learning communities on science teachers' knowledge, practice and student learning: A review. *Professional Development in Education, 42*(4), 569–588.

Dufour, R. (2004). What is professional learning community? *Educational leadership, 61*(8), 6–11.

Dufour, R., & Eaker, R. (1998). *Professional learning communities at work: Best practices for enhancing student achievement*. Bloomington, ID: Solution Tree.

Fulton, K., & Britton, T. (2010). *STEM teachers in professional learning communities: A knowledge synthesis*. Arlington, VA: National Commission on Teaching & America's Future.

Gamst, G., & Meyers, L. S. (2014). Confirmatory factor analysis of the acculturation rating scale-II scale 2: The case for measurement of marginality. *Hispanic Journal of Behavioral Sciences, 36*(4), 435–451.

Hipp, K. A., & Huffman, J. B. (2003, January). *Professional learning communities: Assessment--development--effects*. Paper presented at the International Congress for School Effectiveness and Improvement, Sydney, Australia.

Hord, S. M. (1997). *Professional learning communities: Communities of continuous inquiry and improvement*. Austin, TX: Southwest Educational Development Laboratory.

Hord, S. M. (2004). Professional learning communities: An overview. In S. Hord (Ed.), *Learning together, leading together: Changing schools through professional learning communities* (pp. 5–14). New York. NY: Teachers College Press and Alexandria.

Hord, S. M. (2008). Evolution of the professional learning communities. *National Staff Development Council, 29*(3), 10–13.

Hord, S. M., & Sommers, W. A. (2008). *Leading professional learning communities: Voices from research and practice*. Thousand Oaks, CA: Corwin Press.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1–55.

Hunuk, D., Ince, M. L., & Tannehill, D. (2012). Developing teachers' health-related fitness knowledge through a community of practice: Impact on student learning. *European Physical Education Review, 19*(3), 3–20.

Ilgan, A., Erdem, M., Cakmak, A., Erdogmus, E., & Sevinc, O. S. (2011). Evaluation of professional learning community of primary schools. *Kastamonu Eğitim Dergisi, 19*(1), 151–166.

Kalkan, F. (2016). Relationship between professional learning community, bureaucratic structure and organizational trust in primary education schools. *Educational Science: Theory & Practice, 16*, 1619–1637.

Katsamba, E. (2016). *The professional learning community characteristics of public primary schools of the Famagusta district of Cyprus* (Unpublished doctoral dissertation). Northcentral University, California. Available from ProQuest Dissertations & Theses Full Text. (1793409658)

Keith, T. Z. (2015). *Multiple regression and beyond: An introduction to multiple regression and structural equation modeling* (2nd ed.). New York, NY: Routledge.

Kline, R. B. (2015). *Principles and practices of structural equation modeling* (4th ed.). New York, NY: Guilford.

Kruse, S. D., & Louis, K. S. (1993, April). *An emerging framework for analyzing school-based professional community*. Paper presented at the Annual Meeting of the American Educational Research Association, Atlanta, GA.

Kruse, S. D., Louis, K. S., & Bryk, A. S. (1995). An emerging framework for analyzing school-based professional community. In K. S. Louis, S. Kruse, & Associates (Eds.), *Professionalism and community: Perspectives on reforming urban schools* (pp. 23–44). Long Oaks, CA: Corwin.

Leite, W. L., Svinicki, M., & Shi, Y. (2010). Attempted validation of the scores of the VARK: Learning styles inventory with multitrait-multimethod confirmatory factor analysis models. *Educational and Psychological Measurement, 70*(2), 323–339.

Kruse, S. D., & Louis, K. S. (1995). Developing professional community in new and restructuring urban schools. In K. S. Louis, S. D. Kruse & Associates (Eds.), *Professionalism and community: Perspectives on reforming urban schools* (pp. 187–209). Thousand Oaks, CA: Corwin Press Inc.

Louis, K. S. (1994). Beyond "managed change": Rethinking how schools improve. *School Effectiveness and School Improvement, 9*(1), 1–27.

Louis, K. S., Kruse, S. D., & Associates. (1995). *Professionalism and community: Perspectives on reforming urban schools*. Thousand Oaks, CA: Corwin Press Inc.

Louis, K. S., Kruse, S. D., & Marks, H. (1996). Schoolwide professional community. In F. Newmann (Ed.), *Authentic achievement: Restructuring schools for intellectual quality* (pp. 179–203). San Francisco, CA: Jossey–Bass.

Lubke, G., & Muthén, B. O. (2005). Investigating population heterogeneity with factor mixture models. *Psychological Methods, 43*, 411–431.

MacCallum, R. C. (1986). Specification searches in covariance structure modeling. *Psychological Bulletin, 100,* 107–120.

Marsh, H. W., Hau, K. T., & Wen, Z. (2004). In search of golden rules: Comment on hypothesis testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler's (1999) findings. *Structural Equation Modeling, 11,* 320–341.

Messick, S. J. (1989). Validity. In R. L. Linn (Ed.), *Educational measurement* (3rd ed., pp. 13–104). New York, NY: American Council on Education and Macmillan.

Mintzes, J. J., Marcum, B., Messerschmidt-Yates, C., & Mark, A. (2013). Enhancing self-efficacy in elementary science teaching with professional learning communities. *Journal of Science Teacher Education, 24*(7), 1201–1218.

Mitchell, C., & Sackney, L. (2000). *Profound improvement: Building capacity for a learning community*. Netherlands: Swets & Zeitlinger.

Morrissey, M. S. (2000). *Professional learning communities: An ongoing exploration.* Austin, TX: Southwest Educational Development Laboratory.

Mullis, L. A. (2016). *A correlation study of a professional learning communities' (PLC) impact of state of Texas assessment of academic readiness (STAAR) results* (Unpublished doctoral dissertation). Lamar University, Texas. Available from ProQuest Dissertations & Theses Full Text. (1835835410)

Muthén, L. K., & Muthén, B. O. (1998–2012). *Mplus user's guide*. Los Angeles, CA: Muthén & Muthén.

Nasser, R. (2005). A method for social scientists to adapt instruments from one culture to another: The case of the Job Descriptive Index. *Journal of Social Sciences, 1*(4), 232–237.

Olivier, D. F., & Hipp, K. K., & Huffman, J. J. (2010). Assessing and analyzing schools as professional learning communities. In K. K. Hipp & J. B. Huffman (Eds.), *Demystifying professional learning communities* (pp. 29–42). Lanham, MD: Rowman & Littlefield Education.

Olivier, D. F., Antoine, S., Cormier, R., Lewis, V., Minckler, C., & Stadalis, M. (2009, March). *Professional learning communities assessment–revised*. Paper presented at the Annual Meeting of the Louisiana Education Research Association, Lafayette, LA.

Raykov, T. (2004). Behavioral scale reliability and measurement invariance evaluation using latent variable modeling. *Behavior Therapy, 35*, 299–331.

Saunders, W. M., Goldenberg, C. N., & Gallimore, R. (2009). Increasing achievement by focusing grade-level teams on improving classroom learning: A prospective, quasi-experimental study of Title I schools. *American Educational Research Journal, 46*(4), 1006–1033.

Sigurðardóttir, A. K. (2010). Professional learning community in relation to school effectiveness. *Scandinavian Journal of Educational Research, 54*(5), 395–412.

Sleegers, P., den Brok, P., Verbiest, E., Moolenaar, N. M., & Daly, A. J. (2013). A multidimensional, multilevel model of professional learning communities in Dutch elementary schools. *The Elementary School Journal, 114*(1), 118–137.

van de Vijver, F., & Hambleton, R. K. (1996). Translating tests: Some practical guidelines. *European Psychologist, 1*, 89–99.

Vescio, V., Ross, D., & Adams, A. (2008). A review of research on the impact of professional learning communities on teaching practice and student learning. *Teaching and Teacher Education, 24*(1), 80–91.

Widhiarso, W., & Ravand, H. (2014). Estimating reliability coefficient for multidimensional measures: A pedagogical illustration. *Review of Psychology, 21*(2), 111–141.