

## **Development of a model for building professional learning communities in schools: teachers' perspectives in Thai educational context**

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### **Abstract**

The objective of this study was to develop a model for building professional learning communities (PLCs) in schools. Samples were public primary schools that consisted of 1,826 teachers from 185 schools in Thailand. They randomized by using two-stage random sampling. The questionnaire was used to survey the level or magnitude of teacher performance in their professional learning communities. The reliability coefficient or Cronbach's alpha of questionnaire was 0.983. Descriptive statistics and second-order multilevel confirmatory factor analysis (second-order MCFA) were employed in data analysis. The results of model for building professional learning communities in schools revealed that its consisted of five sub-factors, i.e., (1) shared norms and values, (2) collective focus on student learning, (3) collaboration, (4) deprivatized practice, and (5) reflective dialogue. As for each sub-factors contained five indicators. Moreover, this model fitted well with the empirical data set ( $\chi^2 = 631.319$ ,  $df = 439$ ,  $\chi^2/df = 1.438$ ,  $CFI = 0.995$ ,  $TLI = 0.993$ ,  $RMSEA = 0.015$ ,  $SRMR_W = 0.014$ ,  $SRMR_B = 0.022$ , respectively).

**Keywords:** professional learning communities, multilevel confirmatory factor analysis (MCFA), composite indicator, teachers' perspectives, Thai educational context

## Introduction

The international findings of educational research on education reform from many countries revealed that its development or evolution depended on teachers' capacity at individual level and group level too. Teachers' capacity at these levels associated to a total capacity of schools for supporting and enhancing the students' learning. Thus, the building teachers' capacity is more importance for school system. The processes of building teachers' capacity produced the learning of individual, group, team, unit, and/or school system. In addition, its powered teachers toward the creating and sustaining professional learning communities of them at school (King & Newmann, 2001; Wiley, 2001; Forde et al., 2006).

From the 1980s to present (A.D. 2011) are approximately 30 years. Educators and educational researchers have been addressed the challenge to improve teachers' capacity throughout school system for managing the impacts of globalization or complexity of social. Furthermore, government sector and public sector intended to improve the instruction and students' outcome through high level of effectiveness and efficiency too (Bryk, Camburn & Louis, 1999; Wiley, 2001). Hence, many educational researchers have been investigated the social organization of teachers in schools, and explored the source of variance that influencing the quality of instruction and students' learning. The educational researchers suggested that teachers should be worked and learned together. These increased the study on teachers' experiences, and influence of professional learning communities that affecting students' outcome (Wiley, 2001; Borko, 2004; Bulkley & Hicks, 2005).

The present decade, educational researchers emphasized the study on professional learning communities through more sophisticate and deep notion (Louis, Kruse & Bryk, 1995 cited in Bulkley & Hicks, 2005). There divided the studies into two aspects (Bulkley & Hicks, 2005), i.e., (1) its based on schoolwide community, and (2) its based on subgroup within school. However, the current of education reform, educational development, and educational quality assurance aimed at schoolwide learning. Thus, mostly educational researchers emphasized the study on school professional learning communities (American Educational Research Association: AERA cited in Borko, 2004; Bulkley & Hicks, 2005).

The recent literature revealed that the word of professional learning communities has been no universal definition. However, mostly educational researchers accepted that the professional learning communities is the characteristic of personal group who interchanged, criticized, reflected, and collaborated their works for learning together, and enhanced their professional growth (Mitchell & Sackney, 2000; Toole & Louis, 2002).

The elements of professional learning communities, Bryk, Camburn, & Louis (1999), and Kruse, Louis, & Bryk (1995 cited in Bulkley & Hicks, 2005) identified that its consisted of five components, namely, (1) shared norms and values, (2) collective focus on student learning, (3) collaboration, (4) deprivatized practice, and (5) reflective dialogue. These components are no hierarchy. However, these components are isolated, but some components are more closely relationship or its affected to other components.

Consequently, the measurement of professional learning communities should be based on the principle of constructing composite indicators. Nardo et al. (2005) as the authors of "Handbook on constructing composite indicators: Methodology and user guide" suggested that the constructing any composite indicators should be developed the conceptual framework with more clarity, and selected the variables and methodology choices with more sophisticate.

However, according to the reviewed literature in this study, there found that it has been no research which constructed the composite indicator of professional learning communities based on a nested data or multilevel of data (Silins, Mulford & Zarins, 2002; Mulford, 2006; Giles & Hargreaves, 2006). Whereas, the recent educational research in Thailand revealed that there have been no research on professional learning communities.

On the one hand, Thai educational standard of educational provision stated that the instruction should be based on students-centered, and school management should be based on school-centered. These are core characteristic of professional learning communities. The success of educational provision may come from individual factors, and management factors. The individual factors, i.e., students prepared the readiness for learning, teachers endeavor and devote themselves to develop the students and communities, administrators are trustworthiness and proficiency of school management, and parents and communities participated in students' development. The management factors, i.e., unique of educational policy, but different approaches to practice, decentralization of educational authorities into schools based on good governance (Office of the Basic Education Commission (OBEC), Thailand, 2009).

Ultimately, this study launched the constructing composite indicator of professional learning communities for Thai educational context. There needed to conform to the intended user, In addition, the development of a model for building professional learning communities should be made based on multilevel of data. This model can be divided into two levels, i.e., individual/ within school level, and unit/among schools level. This multilevel factor model are accepted the conformity with the nature of educational variables. Hence, the model for building professional learning communities in this study is differentiated from the traditional model that is a single level (Allua, Stapleton & Beretvas, 2008; Sun & Willson, 2008).

### Objective

The objective of this study was to develop a model for building professional learning communities (PLCs) in schools.

### Method

The population of this study consisted of 32,186 public primary schools in Thailand, academic year 2009 – 2010. Samples were 185 public primary schools that consisted of 1,826 teachers. They randomized by using two-stage random sampling.

The instrument of this study was a questionnaire that developed from educational researchers, i.e., Bryk, Camburn & Louis (1999), Silins, Mulford & Zarins (2002), Mulford (2006), Andrews & Lewis (2007), and Bolam et al. (2008). This questionnaire consisted of five key performance indicators (KPIs) of professional learning communities (PLCs), i.e., (1) shared norms and values, (2) collective focus on student learning, (3) collaboration, (4) deprivatized practice, and (5) reflective dialogue. As for each indicators contained five sub-indicators. The five-point Likert's scale was employed in this questionnaire to survey the level or magnitude of teacher performance in their professional learning communities. The reliability coefficient or Cronbach's alpha of each key performance indicators (KPIs) in this questionnaire was equal to 0.946, 0.951, 0.921, 0.941, and 0.929, respectively. In addition, the Cronbach's alpha of total indicators (KPIs) in this questionnaire was equal to 0.983.

The data collection of this study divided into two steps, i.e., the first step was documentary research for developing factors and indicators of PLCs, and the second step was survey research for developing factors and indicators of PLCs with the empirical data, its response rate was 82.18%.

The data analysis of this study employed descriptive statistics and second-order multilevel confirmatory factor analysis (second-order MCFA). These statistical analyses were conducted using the Mplus program version 5.21 (Muthen & Muthen, 2009).

The criterion for judgment of construct validity or model fit of professional learning communities data set were as follows: (1) the comparative fit index (CFI) > 0.92, and the Tucker Lewis Index (TLI) > 0.92, (2) the root mean square error of approximation (RMSEA) < 0.07, (3) the standard root mean residual (SRMR) for individual level and unit level  $\leq$  0.08, and (4) the intra-class correlation (ICC) > 0.03 (Hair et al., 2006; Muthen & Muthen, 2009).

## Result

The results of second-order multilevel confirmatory factor analysis (second-order MCFA) of professional learning communities (PLCs) factor shown in table 1 and figure 1 (see table 1 and figure 1 in appendix). These results revealed that the PLCs' model consisted of 25 indicators (or 25 observed variables). The intra-class correlation (ICC) values of these indicators were more than 0.03. These values indicated that the data set of this study was suitable for using the method of multilevel confirmatory factor analysis.

The sub-factor 1: shared norms and values (PLC1) consisted of five indicators. The intercepts/ average group means of these indicators were in the range of 3.991 – 4.210. These meant that teachers performed their work based on this sub-factor at high level. The beta weights ( $\beta$ ) of these indicators at individual level were in the range of 0.740 – 0.871, and its at unit level were in the range of 0.959 – 0.992. These meant that the indicators of this sub-factor had beta weights at high through very high level. As for unit level, the indicator which had the highest beta weight was the indicator: meet the companies for self development and self professional progress from the professional networks or related associations (PLC13) ( $\beta=0.992$ ), subsequently, its was the indicator: devote or offer enough time for participating in planning and developing the school (PLC11) ( $\beta=0.977$ ).

Regarding the shared norms and values sub-factor (PLC1) which was a latent variable, its coefficients of determination ( $R^2$ ) at individual level were in the range of 0.548 – 0.758, and at unit level were in the range of 0.920 – 0.983. There revealed that the five indicators could explain the variance of shared norms and values sub-factor with the percentage ranging from 54.8% to 75.8% at individual level, and its ranging from 92.0% to 98.3% at unit level. These meant that the indicators of this sub-factor had coefficients of determination at medium through very high level. Moreover, the five indicators could explain the variance of shared norms and values sub-factor at unit level better than that at individual level.

The sub-factor 2: collective focus on student learning (PLC2) consisted of five indicators. The intercepts/ average group means of these indicators were in the range of 3.196 – 4.023. These meant that teachers performed their work based on this sub-factor at medium through high level. The beta weights ( $\beta$ ) of these indicators at individual level were in the range of 0.751 – 0.803, and its at unit level were in the range of 0.966 – 0.974. These meant that the indicators of this sub-factor had beta weights at high through very high level. As for unit level, the indicator which had the highest beta weight was the indicator: conduct the classroom action research or academic research with colleagues, experts and researchers among other officials for solving the students' problems and/ or the qualities of educational provision (PLC23) ( $\beta=0.974$ ), subsequently, its was the indicator: build the information/database and/ or collect the data for monitoring the students' progress (PLC21) ( $\beta=0.972$ ).

Regarding the collective focus on student learning sub-factor (PLC2) which was a latent variable, its coefficients of determination ( $R^2$ ) at individual level were in the range of 0.564 – 0.644, and at unit level were in the range of 0.933 – 0.948. There revealed that the five indicators could explain the variance of collective focus on student learning sub-factor with the percentage ranging from 56.4% to 64.4% at individual level, and its ranging from 93.3% to 94.8% at unit level. These meant that the indicators of this sub-factor had coefficients of determination at medium through very high level. Moreover, the five indicators could explain the variance of collective focus on student learning sub-factor at unit level better than that at individual level.

The sub-factor 3: collaboration (PLC3) consisted of five indicators. The intercepts/ average group means of these indicators were in the range of 2.876 – 4.015. These meant that teachers performed their work based on this sub-factor at medium through high level. The beta weights ( $\beta$ ) of these indicators at individual level were in the range of 0.749 – 0.821, and its at unit level were in the range of 0.897 – 0.956. These meant that the indicators of this sub-factor had beta weights at high through very high level. As for unit level, the indicator which had the highest beta weight was the indicator: collaborate with colleagues to solve the problems-addressed of school (PLC32) ( $\beta=0.956$ ), subsequently, its was the indicator: collaborate with colleagues to learn and to review the assigned tasks and instructions (PLC31) ( $\beta=0.948$ ).

Regarding the collaboration sub-factor (PLC3) which was a latent variable, its coefficients of determination ( $R^2$ ) at individual level were in the range of 0.561 – 0.674, and at unit level were in the range of 0.805 – 0.913. There revealed that the five indicators could explain the variance of collaboration sub-factor with the percentage ranging from 56.1% to 67.4% at individual level, and its ranging from 80.5% to 91.3% at unit level. These meant that the indicators of this sub-factor had coefficients of determination at medium through very high level. Moreover, the five indicators could explain the variance of collaboration sub-factor at unit level better than that at individual level.

The sub-factor 4: deprivatized practice (PLC4) consisted of five indicators. The intercepts/ average group means of these indicators were in the range of 2.892 – 3.858. These meant that teachers performed their work based on this sub-factor at medium through high level. The beta weights ( $\beta$ ) of these indicators at individual level were in the range of 0.806 – 0.850, and its at unit level were in the range of 0.939 – 0.973. These meant that the indicators of this sub-factor had beta weights at very high level. As for unit level, the indicator which had the highest beta weight was the indicator: attend the training or coaching in assigned tasks and learning activities from teamwork (PLC41) ( $\beta=0.973$ ), subsequently, its was the indicator: share or interchange the materials, books and a new instruction approaches among colleagues/ teamwork (PLC42) ( $\beta=0.948$ ).

Regarding the deprivatized practice sub-factor (PLC4) which was a latent variable, its coefficients of determination ( $R^2$ ) at individual level were in the range of 0.650 – 0.723, and at unit level were in the range of 0.882 – 0.947. There revealed that the five indicators could explain the variance of deprivatized practice sub-factor with the percentage ranging from 65.0% to 72.3% at individual level, and its ranging from 88.2% to 94.7% at unit level. These meant that the indicators of this sub-factor had coefficients of determination at medium through very high level. Moreover, the five indicators could explain the variance of deprivatized practice sub-factor at unit level better than that at individual level.

The sub-factor 5: reflective dialogue (PLC5) consisted of five indicators. The intercepts/ average group means of these indicators were in the range of 3.490 – 4.300. These meant that teachers performed their work based on this sub-factor at medium through high level. The beta weights ( $\beta$ ) of these indicators at individual level were in the range of 0.742 – 0.850, and its at unit level were in the range of 0.926 – 0.973. These meant that the indicators of this sub-factor had beta weights at high through very high level. As for unit level, the indicator which had the highest beta weight was the indicator: express the equality and opportunity to engage in professional development at both inside and outside schools (PLC53) ( $\beta=0.973$ ), subsequently, its was the indicator: express the efficiency of materials and teaching techniques in school (PLC51) ( $\beta=0.942$ ).

Regarding the reflective dialogue sub-factor (PLC5) which was a latent variable, its coefficients of determination ( $R^2$ ) at individual level were in the range of 0.551 – 0.722, and at unit level were in the range of 0.858 – 0.947. There revealed that the five indicators could

explain the variance of reflective dialogue sub-factor with the percentage ranging from 55.1% to 72.2% at individual level, and its ranging from 85.8% to 94.7% at unit level. These meant that the indicators of this sub-factor had coefficients of determination at medium through very high level. Moreover, the five indicators could explain the variance of reflective dialogue sub-factor at unit level better than that at individual level.

As for the professional learning communities factor (PLCs) which was a latent variable consisted of five sub-factors which were a latent variables too. The beta weights ( $\beta$ ) of these sub-factors at individual level were in the range of 0.958 – 0.991, and its at unit level were in the range of 0.949 – 0.985. These meant that the sub-factors of this factor had beta weights at very high level. As for unit level, the sub-factors which had the highest beta weight was sub-factor 4: deprivatized practice ( $\beta=0.985$ ), subsequently, its was sub-factor 5: reflective dialogue ( $\beta=0.983$ ), and its was sub-factor 2: collective focus on student learning ( $\beta=0.979$ ), respectively.

Regarding the professional learning communities factor (PLCs) which was a latent variable, its coefficients of determination ( $R^2$ ) at individual level were in the range of 0.918 – 0.982, and at unit level were in the range of 0.901 – 0.970. There revealed that the five sub-factors could explain the variance of professional learning communities factor with the percentage ranging from 91.8% to 98.2% or the average of its percentage was 94.1% at individual level, and its ranging from 90.1% to 97.0% or the average of its percentage was 94.7% at unit level. These meant that the sub-factors of this factor had coefficients of determination at very high level. Moreover, the five sub-factors could explain the variance of professional learning communities factor at unit level better than that at individual level.

The overall of a model for building professional learning communities revealed that it had construct validity. The indices of its were as follows: (1) the chi-square value ( $\chi^2$ ) was equal to 631.319, the degrees of freedom value (df) was 439, the ratio of the chi-square value and the degrees of freedom value was equal to 1.438, (2) the comparative fit index (CFI) was equal to 0.995 which more than 0.92, and the Tucker Lewis Index (TLI) was equal to 0.993 which more than 0.92, (3) the root mean square error of approximation (RMSEA) was equal to 0.015 which less than 0.07, and (3) the standard root mean residual (SRMR) at individual level was equal to 0.014, and its at unit level was equal to 0.022 which not more than 0.08, respectively. These statistical values indicated that the model fitted well with the empirical data set.

## Conclusion

The model for building professional learning communities in schools could separate into two levels, i.e., individual level, and unit level. These levels consisted of five sub-factors, namely, (1) shared norms and values, (2) collective focus on student learning, (3) collaboration, (4) deprivatized practice, and (5) reflective dialogue. These sub-factors consisted of five indicators. Moreover, this model fitted well with the empirical data set ( $\chi^2= 631.319$ ,  $df = 439$ ,  $\chi^2/df = 1.438$ ,  $CFI = 0.995$ ,  $TLI = 0.993$ ,  $RMSEA = 0.015$ ,  $SRMR_W = 0.014$ ,  $SRMR_B = 0.022$ , respectively).

## Discussion

The professional learning communities factor (PLCs) or PLCs' model consisted of five sub-factors, namely, (1) shared norms and values, (2) collective focus on student learning, (3) collaboration, (4) deprivatized practice, and (5) reflective dialogue. These sub-factors were different weights. At the first-order of PLCs' model, the weights of sub-factors at unit level were higher than that at individual level. Furthermore, at the second-order of PLCs' model, the weights

of sub-factors at unit level tended to higher than that at individual level too. Thus, there would be concluded that the natural performance of the mutual teachers in schools affected to the natural performance of individual teachers. In the other word, PLCs' model could be divided into two levels, i.e., individual (within school) level, and unit (among schools) level. These findings indicated that the multilevel confirmatory factor analysis model of PLCs was compliance with the nature of educational data. In addition, This PLCs' model differentiated from the classical PLCs' model which was single level (Allua, Stapleton & Beretvas, 2008; Sun & Willson, 2008; Lubke & Muthén, 2007). Consequently, the key information of PLCs in this study will be able to contribute to the educational practitioners for making the decision on building schools toward the sustainable professional learning communities.

The PLCs' model had construct validity or its fitted well with the data set of this study, and the weights of sub-factors and indicators had the statistical significant, and its weights were at high through very high level too. There could be concluded that the PLCs' model of this study was robustness. This finding enhanced the building of PLCs theoretical framework to be more clarity.

However, the finding of this study differentiated from the finding research of Bryk, Camburn, & Louis (1999). The finding research of them revealed that the indicators of PLCs' model had factor loading not less than 0.77, except the deprivatized practice indicator which was 0.42. As for factor loading of the deprivatized practice indicator in this study found that in the second-order of factor analysis its was 0.972 at individual level, and its was 0.985 at unit level. Its factor loading was very high level. Hence, the different findings between these studies maybe come from using the method of factor analysis. Bryk, Camburn, & Louis (1999) used the traditional factor analysis with a single level for data analysis. This method has been limited to separate the variance and covariance of variables into any levels. Thus, PLCs' model of them could not reveal the factor loading of variables or indicators with distinctness.

### **Suggestion**

1. According to building the professional learning communities (PLCs) model by using multilevel confirmatory factor analysis in this study was high appropriateness. The intended researchers or another one can see the nested structure of PLCs. Thus, the procedure of modeling the PLCs in this study is a good practice as case study for investigating the appropriated indicators in building teachers' capacity or professional learning communities of teachers in the other context. The intended researchers should be defined the nested structure of variables with more sophisticate and carefully. There should be based on the opinions' experts and the statistical structures of data set (Nardo et al., 2005). As for the statistical structures of data set, many researchers used the multivariate analysis for grouping the variables into the factor or composite indicator. However, this methodology choice should be avoided for using when the sample of the study is small group or the ratio of the number of variables and the number of samples are not conform with the ratio of 1 : 10 – 20 (Hair et al., 2006).

2. The future research should be employed the input or context variables into this PLCs' model as PLCs structural equation model (SEM). This way could convey the key information to build and to develop the professional learning communities for more efficiency. Ultimately, its could be enhanced the knowledge of indicators' development. In addition, its could be supported the data for research synthesis on teachers' capacity or professional learning communities of teachers in schools.

3. The future research should be conducted the pilot study based on factors and indicators of this study for building professional learning communities. These will be provided the strategies which practical significance for driving the sustainable professional learning communities in schools. Then, there will be extended the best practice to other schools throughout educational networks.

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## Reference

- Allua, S., Stapleton, L. M., & Beretvas, S. N. (2008). *Testing latent mean differences between observed and unobserved groups using multilevel factor mixture models*[online]. Available from <http://www.sagepub.com> [2008, December 15]
- Andrews, D., & Lewis, M. (2007). *Transforming practice from within: The power of the professional learning community*[Online]. Available from <http://www.sagepub.com> [2007, July 11]
- Bolam, R., McMahon, A., Stoll, L., Thomas, S., Wallace, M., Greenwood, A., Hawkey, K., Ingram, M., Atkinson, A., & Smith, M. (2008). *Creating and sustaining effective professional learning communities*[Online]. Available from <http://www.sagepub.com> [2008, August 8]
- Borko, H. (2004). Professional development and teacher learning: mapping the terrain. *Educational Researcher*[Online]. Available from <http://www.sagepub.com> [2007, July 11]
- Bryk, A., Camburn, E., & Louis, K. S. (1999). Professional community in Chicago elementary schools: Facilitating factors and organizational consequences. *Educational Administration Quarterly*[Online]. Available from <http://www.sagepub.com> [2007, July 11]
- Bulkley, K. E., & Hicks, J. (2005). Managing community: Professional community in charter schools operated by Educational Management Organizations. *Educational Administration Quarterly*[Online]. Available from <http://www.sagepub.com> [2007, July 11]
- Forde, C., McMahon, M., McPhee, A., & Patrick, F. (2006). *Professional development, reflection and enquiry*. London: Paul Chapman Publishing.
- Giles, C., & Hargreaves, A. (2006). The sustainability of innovative schools as learning organizations and professional learning communities during standardized reform. *Educational Administration Quarterly*[Online]. Available from <http://www.sagepub.com> [2007, August 8]
- Hair, J. F. Jr., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate data analysis*. (6<sup>th</sup> ed.). New Jersey: Pearson practice hall.
- King, M. B., & Newmann, F. M. (2001). Building school capacity through professional development: Conceptual and empirical considerations. *International Journal of Educational Management*[Online]. Available from <http://www.sagepub.com> [2007, July 11]
- Mitchell, C., & Sackney, L. (2000). *Profound improvement: Building capacity for a learning community*[Online]. Available from <http://www.sagepub.com> [2007, July 11]
- Mulford, B. (2006). Leading change for student achievement[Online]. *Journal of Education Change*[Online]. Available from <http://www.sagepub.com> [2007, August 8]
- Muthen, L. K. & Muthen, B. O. (2009). *Mplus user' guide*. (5<sup>th</sup> ed.). Los Angeles, C.A.: Muthen & Muthen.
- Nardo, M., Saisana, M., Saltelli, A., & Tarantola, S. (2005). *Handbook on constructing composite indicators: Methodology and user guide*[Online]. Available from <http://europa.eu.net> [2007, August 8]
- Office of the Basic Education Commission (OBEC), Thailand. (2009). *Standard of national education*[Online]. Available from <http://www.obec.go.th> [2009, February 20]



- Silins, H. C., Mulford, W. R., & Zarins, S. (2002). Organizational learning and school change. *Educational Administration Quarterly*[Online]. Available from <http://www.sagepub.com> [2007, August 8]
- Sun, J., & Willson, V. L. (2008). *Assessing general and specific attitudes in human learning behavior: An activity perspective and a multilevel modeling approach*[Online]. Available from <http://www.sagepub.com> [2008, May 15]
- Toole, J. C., & Louis, K. S. (2002). *The role of professional learning communities in international education*[Online]. Available from <http://www.sagepub.com> [2007, July 11]
- Wiley, S. D. (2001). Contextual effect on student achievement: school leadership and professional community. *Journal of Education Change*[Online]. Available from <http://www.sagepub.com> [2007, July 11]



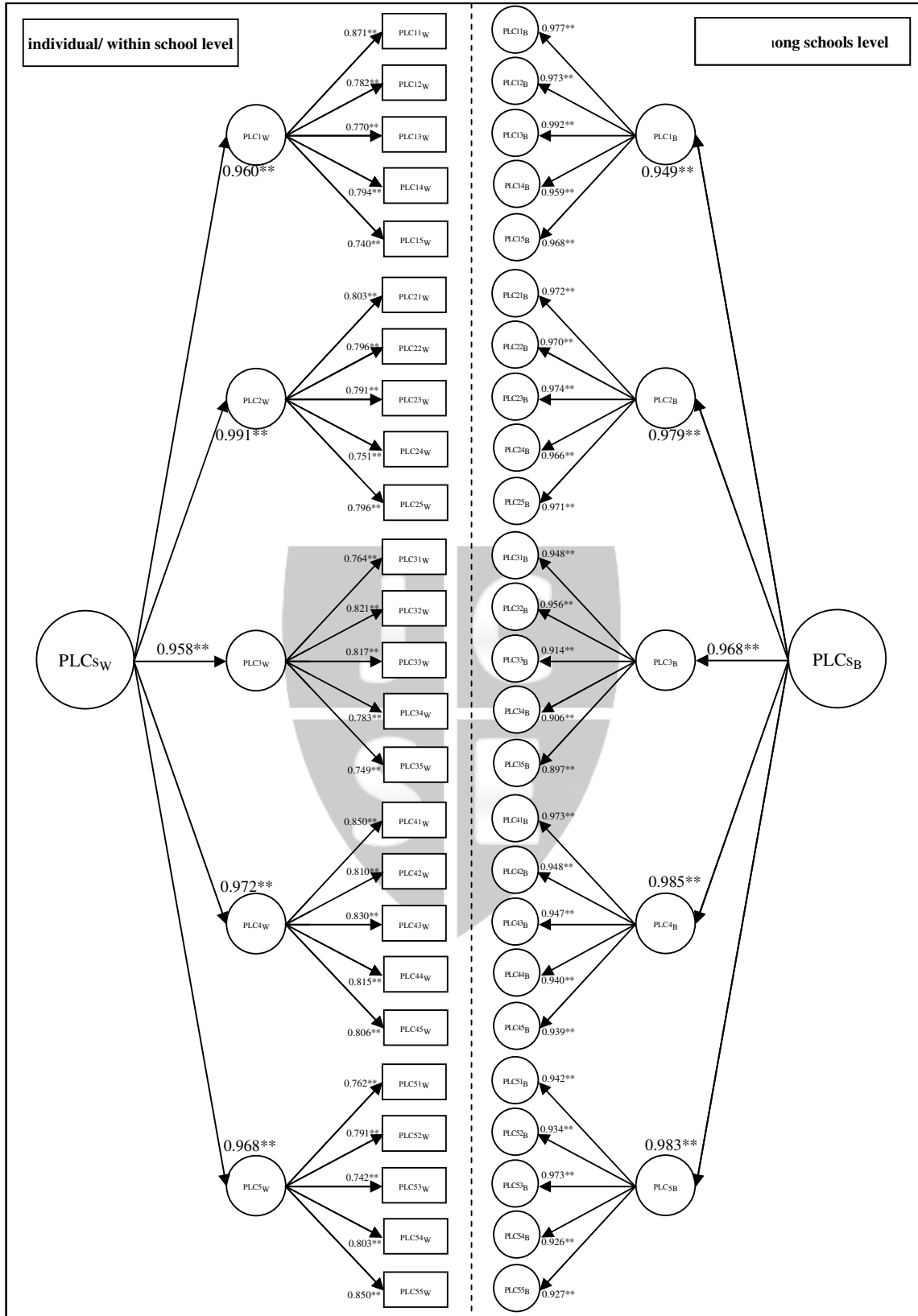
Appendix

**Table 1** The results of second-order multilevel confirmatory factor analysis (second-order MCFA) of professional learning communities

| factors/<br>sub-factors/<br>indicators  | individual/ within school level |       |         |                | unit/ among schools level |       |         |                | intra-class<br>correlation (ICC) | intercepts/<br>average group<br>means |
|---|---------------------------------|-------|---------|----------------|---------------------------|-------|---------|----------------|----------------------------------|---------------------------------------|
|   | $\beta$                         | SE    | Z       | R <sup>2</sup> | $\beta$                   | SE    | Z       | R <sup>2</sup> |                                  |                                       |
| <b>First-order</b>  |                                 |       |         |                |                           |       |         |                |                                  |                                       |
| <b>PLC1</b>   |                                 |       |         |                |                           |       |         |                |                                  |                                       |
| PLC11   | 0.871                           | 0.007 | 130.592 | 0.758          | 0.977                     | 0.005 | 179.514 | 0.954          | 0.503                            | 4.049                                 |
| PLC12   | 0.782                           | 0.011 | 73.468  | 0.611          | 0.973                     | 0.007 | 146.637 | 0.946          | 0.546                            | 3.991                                 |
| PLC13   | 0.770                           | 0.010 | 78.164  | 0.592          | 0.992                     | 0.004 | 242.950 | 0.983          | 0.501                            | 4.069                                 |
| PLC14   | 0.794                           | 0.012 | 68.932  | 0.631          | 0.959                     | 0.008 | 115.954 | 0.920          | 0.538                            | 4.078                                 |
| PLC15   | 0.740                           | 0.012 | 61.598  | 0.548          | 0.968                     | 0.009 | 105.732 | 0.938          | 0.435                            | 4.210                                 |
| <b>PLC2</b>   |                                 |       |         |                |                           |       |         |                |                                  |                                       |
| PLC21   | 0.803                           | 0.010 | 78.762  | 0.644          | 0.972                     | 0.006 | 158.182 | 0.945          | 0.704                            | 3.196                                 |
| PLC22   | 0.796                           | 0.010 | 79.195  | 0.634          | 0.970                     | 0.006 | 157.823 | 0.941          | 0.535                            | 3.912                                 |
| PLC23   | 0.791                           | 0.010 | 75.539  | 0.626          | 0.974                     | 0.006 | 156.211 | 0.948          | 0.610                            | 3.606                                 |
| PLC24   | 0.751                           | 0.011 | 65.828  | 0.564          | 0.966                     | 0.007 | 136.044 | 0.933          | 0.616                            | 4.023                                 |
| PLC25   | 0.796                           | 0.010 | 79.995  | 0.634          | 0.971                     | 0.006 | 155.444 | 0.944          | 0.566                            | 3.939                                 |
| <b>PLC3</b>   |                                 |       |         |                |                           |       |         |                |                                  |                                       |
| PLC31   | 0.764                           | 0.011 | 72.416  | 0.584          | 0.948                     | 0.013 | 72.017  | 0.898          | 0.364                            | 3.748                                 |
| PLC32   | 0.821                           | 0.008 | 105.376 | 0.674          | 0.956                     | 0.010 | 91.248  | 0.913          | 0.340                            | 4.015                                 |
| PLC33   | 0.817                           | 0.009 | 90.794  | 0.667          | 0.914                     | 0.016 | 56.318  | 0.835          | 0.307                            | 3.763                                 |
| PLC34   | 0.783                           | 0.012 | 66.181  | 0.613          | 0.906                     | 0.017 | 52.194  | 0.820          | 0.353                            | 3.886                                 |
| PLC35   | 0.749                           | 0.011 | 66.909  | 0.561          | 0.897                     | 0.020 | 44.038  | 0.805          | 0.458                            | 2.876                                 |
| <b>PLC4</b>   |                                 |       |         |                |                           |       |         |                |                                  |                                       |
| PLC41   | 0.850                           | 0.008 | 106.650 | 0.723          | 0.973                     | 0.009 | 111.535 | 0.947          | 0.363                            | 3.851                                 |
| PLC42   | 0.810                           | 0.010 | 79.229  | 0.656          | 0.948                     | 0.010 | 95.649  | 0.899          | 0.440                            | 3.633                                 |
| PLC43   | 0.830                           | 0.009 | 96.082  | 0.689          | 0.947                     | 0.011 | 87.643  | 0.897          | 0.401                            | 3.858                                 |
| PLC44   | 0.815                           | 0.010 | 82.620  | 0.664          | 0.940                     | 0.011 | 83.401  | 0.884          | 0.445                            | 3.532                                 |
| PLC45   | 0.806                           | 0.011 | 74.078  | 0.650          | 0.939                     | 0.010 | 94.300  | 0.882          | 0.522                            | 2.892                                 |
| <b>PLC5</b>   |                                 |       |         |                |                           |       |         |                |                                  |                                       |
| PLC51   | 0.762                           | 0.012 | 64.932  | 0.580          | 0.942                     | 0.011 | 87.254  | 0.887          | 0.492                            | 3.593                                 |
| PLC52   | 0.791                           | 0.010 | 83.035  | 0.626          | 0.934                     | 0.016 | 57.025  | 0.872          | 0.365                            | 3.989                                 |
| PLC53   | 0.742                           | 0.012 | 61.576  | 0.551          | 0.973                     | 0.011 | 88.776  | 0.947          | 0.446                            | 4.300                                 |
| PLC54   | 0.803                           | 0.010 | 83.201  | 0.644          | 0.926                     | 0.015 | 60.075  | 0.858          | 0.373                            | 4.201                                 |
| PLC55   | 0.850                           | 0.008 | 101.750 | 0.722          | 0.927                     | 0.011 | 84.426  | 0.860          | 0.522                            | 3.490                                 |
| <b>Second-order</b>   |                                 |       |         |                |                           |       |         |                |                                  |                                       |
| <b>PLCs</b>   |                                 |       |         |                |                           |       |         |                |                                  |                                       |
| PLC1  | 0.960                           | 0.005 | 178.611 | 0.922          | 0.949                     | 0.011 | 88.229  | 0.901          |                                  |                                       |
| PLC2  | 0.991                           | 0.005 | 200.419 | 0.982          | 0.979                     | 0.005 | 184.822 | 0.959          |                                  |                                       |
| PLC3  | 0.958                           | 0.006 | 170.135 | 0.918          | 0.968                     | 0.008 | 119.994 | 0.938          |                                  |                                       |
| PLC4  | 0.972                           | 0.004 | 260.556 | 0.945          | 0.985                     | 0.005 | 181.595 | 0.970          |                                  |                                       |
| PLC5  | 0.968                           | 0.005 | 199.620 | 0.937          | 0.983                     | 0.005 | 186.574 | 0.966          |                                  |                                       |
| $\chi^2 = 631.319$ $df = 439$ $\chi^2/df = 1.438$ CFI = 0.995 TLI = 0.993 RMSEA = 0.015 SRMR <sub>w</sub> = 0.014 SRMR <sub>B</sub> = 0.022<br>Number of clusters = 185 Average cluster size = 9.87 |                                 |       |         |                |                           |       |         |                |                                  |                                       |

**Legend:**

- PLC1 = Shared norms and values.
- PLC11 = Devote or offer enough time for participating in planning and developing the school.
- PLC12 = Study and review the self learning process for contributing the learning of students.
- PLC13 = Meet the companies for self development and self professional progress from the professional networks or related associations.
- PLC14 = Actively acquire the notions, media, techniques and approaches related to instruction from colleagues and other schools.
- PLC15 = Understand the self role and self function, and connect that to another one onto the mutual role and function of school with systemically.
- PLC2 = Collective focus on student learning.
- PLC21 = Build the information/database and/or collect the data for monitoring the students' progress.
- PLC22 = Monitor students' learning and develop the academic progress of individual students.
- PLC23 = Conduct the classroom action research or academic research with colleagues, experts and researchers among other officials for solving the students' problems and/or the qualities of educational provision.
- PLC24 = Conduct the classroom action research or academic research by oneself for solving the students' problems and/or the qualities of educational provision.
- PLC25 = Disseminate the education research or classroom action research to colleagues at both inside and outside schools.
- PLC3 = Collaboration.
- PLC31 = Collaborate with colleagues to learn and to review the assigned tasks and instructions.
- PLC32 = Collaborate with colleagues to solve the problems-addressed of school.
- PLC33 = Collaborate with colleagues to develop and to empower the evaluation capacities for transferring that to the students.
- PLC34 = Collaborate with colleagues to reflective dialogue about the strategies or notions of professional performance for acquiring the best practice.
- PLC35 = Collaborate with colleagues to provide a full responsibility for enhancing the practical efficiency of school.
- PLC4 = Deprivatized practice.
- PLC41 = Attend the training or coaching in assigned tasks and learning activities from teamwork.
- PLC42 = Share or interchange the materials, books and a new instruction approaches among colleagues/ teamwork.
- PLC43 = Share or interchange the information about the results of students' learning development with colleagues/ teamwork to convey its to continuous development of students' learning.
- PLC44 = Improve and change the instruction according to an approach of colleagues who are the best or good practice.
- PLC45 = Systemically collect the results of performance to make a database for self development and educational quality assurance.
- PLC5 = Reflective dialogue.
- PLC51 = Express the efficiency of materials and teaching techniques in school.
- PLC52 = Express the sufficiency and reaching in learning sources at both inside and outside schools.
- PLC53 = Express the equality and opportunity to engage in professional development at both inside and outside schools.
- PLC54 = Express the decision and leadership of head and/ or personnel who participated in decision making at all levels of school.
- PLC55 = Express the driving mechanics and developments of instructions or learning activities within school.
- PLCs = Professional learning communities.



\*\* statistical significant at .01 level

**Figure 1** The model for building professional learning communities in schools