



Leadership and teacher learning in urban and rural schools in China: Meeting the dual challenges of equity and effectiveness



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ABSTRACT

Despite a rapid rise in national income levels, the distribution of wealth remains unevenly distributed between residents of rural and urban areas both in mainland China and other developing nations. These inequities carry over to the education system where researchers have documented differences not only in resource allocation but also in the academic performance of students in urban and rural schools. Most research into the causes of China's urban-rural achievement gap has focused on fiscal resources. In contrast, the current study examined differences in school organization processes associated with learning-centered leadership and teacher learning. These foci were selected due to their documented importance in supporting sustainable school improvement. We employed multi-group confirmatory factor analysis and structural equation modeling to analyze survey data collected from 492 urban teachers and 423 rural teachers in 31 Chinese schools located in three different provinces. The results affirmed a similar model of leadership and teacher learning in urban and rural schools. Specifically, school leadership exerted significant direct and indirect effects on teacher learning. It was, however, notable that the strength of all variable measures were significantly higher in the urban schools. The findings imply a potential benefit to be gained from providing training focused on 'learning-centered leadership for principals and middle level leaders in rural schools, as well as expanding access to quality professional development opportunities for rural teachers.

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In developing nations throughout East Asia the economic growth of recent decades has fueled a rise in the standard of living. Nonetheless, despite a substantial rise in mean national income, the distribution of wealth and national resources remains unevenly distributed between residents of rural and urban areas (Carnoy, 2003; Chiu and Khoo, 2005; Psacharopoulos and Patrinos, 2004; Young, 1998). Concerns over these inequities has assumed greater urgency as unfulfilled expectations have fueled varying degrees of unrest and disorder in countries from Thailand and Malaysia to mainland China (Jimenez et al., 2012; Othman and Muijs, 2013; Ye, 2010). This trend of unequal access to opportunity is also evident in the education sector (Qian and Smyth, 2008; Sayed, 2010; Stelmach, 2011; Ye, 2010; Young, 1998) where a

growing “achievement gap” has been documented in the performance of students from urban and rural backgrounds (Liu, 2009; Othman and Muijs, 2013; Wu and Zhang 2010; Zhao et al., 2012; Zhang and Pang, 2016).

In China, for example, a senior government official highlighted this problem.¹

China's economy and its citizens' incomes have grown steadily during 30 years of reform: the absolute GDP increased on average 9.8% and the per capita GDP 8.6% each year between 1979 and 2007... However, the urban-rural gap, one of China's major problems in economic and social development, has worsened. The gap in terms of the urban-rural income ratio has widened dramatically and is also manifested in the

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¹ Ye Xingqing was Director-General of the Department for Rural Economy, Research Office of the State Council, People's Republic of China at the time of publication of this quote.

provision of infrastructure, compulsory education, health care and social insurance (Ye, 2010).

In light of this broad trend, policymakers have adopted a range of education interventions starting in preschool and continuing through to secondary and tertiary education (Hu et al., 2014; Jimenez et al., 2012; Levin and Lockheed, 2012; OECD, 2005; Sayed, 2010; Stelmach, 2011; Wang and Zhao, 2011). These policies have aimed at increasing the allocation of resources to rural schools in the hope of positively impacting student learning outcomes (Levin and Lockheed, 2012; Othman and Muijs, 2013; Young, 1998). However, to achieve success in increasing the achievement of rural students, system leaders must not only provide adequate fiscal resources, but also enhance the quality of human resources (OECD, 2005; Othman and Muijs, 2013; Zhao et al., 2012).

The current study explored differences in the provision of school-level leadership and teacher professional learning as key human resources in urban and rural schools in mainland China (Vanblaere and Devos, 2016). We selected teacher professional learning as a focus in this study for two reasons. First, prior research has found that capacity development of teachers underpins sustainable school improvement (Heck and Hallinger, 2010, 2014; Little, 2012; Louis, 2007; Vescio et al., 2008). Second, the recent McKinsey report on world class education systems singled out the professional learning of teachers in Shanghai schools as an important factor in explaining the school system's success (see OECD, 2005, 2014; Paine, 2013).

Principal leadership was selected as a second focus in this study because of its role in fostering school improvement in general, and teacher learning in particular (Barth, 1990; Hallinger and Heck, 1998; Li et al., 2016a,b; Saphier et al., 2006; Vanblaere and Devos, 2016). More specifically, we examined how principals employed 'learning-centered leadership' to motivate and support teacher learning (see Frost, 2006; Hallinger et al., 2014; Hallinger and Lu, 2014; Knapp et al., 2010; Vanblaere and Devos, 2016). Our conceptual model also included two teacher attitudes – teacher trust and teacher agency – as mediators of the effects of learning-centered leadership on teacher learning (Liu et al., 2016; Hallinger and Lu, 2014; Li et al., 2016a,b; Ross and Gray, 2006; Vanblaere and Devos, 2016).

Thus, the broad purpose of this study was to examine the extent and nature of differences in processes associated with principal leadership and teacher learning in urban and rural schools in China. The research questions addressed in this study were as follows.

1. What is the relationship of learning-centered leadership, teacher trust, and teacher agency with teacher professional learning in urban and rural schools in mainland China.
2. Are there differences in the levels of learning-centered leadership, teacher trust, agency and professional learning that describe principals and teachers urban and rural schools in mainland China?

Employing a quantitative survey methodology, this research represents the first study that has sought to explore the dynamics of school leadership and teacher learning across urban and rural contexts in mainland China. In light of the urgency accorded to finding solutions aimed at reducing the urban/rural achievement gap, this research has potential implications for policy and practice in China. More broadly, the study contributes to growing global and regional literatures concerned with contextualizing school leadership effects on both student and teacher learning (Hallinger and Heck, 1998; Li et al., 2016a,b; Teddlie et al., 2000; Wang, 2016; Zhang and Pang, 2016).

1. Conceptual framework

The conceptual framework for this study was guided by prior models used in studies of leadership effects on student (Hallinger and Heck, 1998; Leithwood et al., 2010) and teacher learning (Hallinger and Lu, 2014; Li et al., 2016a, 2016b; Printy, 2008; Smylie and Hart, 1999; Thoonen et al., 2011). In this body of research, leadership is usually conceptualized as an influence process that is 'mediated' by internal features of the school organization and 'moderated' by exogenous features of the school (Hallinger and Heck, 1998). Thus, research conducted within this genre seeks to understand the nature of relationships among the school environment, leadership, mediating variables and dependent variables that reflect valued school processes and outcomes.

In the current study, we chose a conceptualization of school leadership that we termed 'learning-centered leadership'. Our definition of learning-centered leadership integrated dimensions drawn from related models of instructional and transformational leadership (Hallinger and Murphy, 1985; Leithwood et al., 2010; Printy, 2008; Printy et al., 2009; Saphier et al., 2006). It proposes that school leaders influence teacher and student learning through practices that involve vision enactment, learning support, program management, and modeling.

The outcome of interest in this study was the professional learning of teachers. As noted above, our interest in leadership and teacher learning derived from the documented impact of teacher learning on sustainable school improvement (Barth, 1990; in de Wal et al., 2014; Kwakman, 2003; Louis, 2007; Timperly, 2011) and the role which leadership plays in fostering teacher learning (Frost, 2006; Hallinger and Lu, 2014; Newmann and Youngs, 2002; Robinson et al., 2008; Vanblaere and Devos, 2016). We conceptualized teacher learning as a process of workplace capacity development (Darling-Hammond and Richardson, 2009). This perspective emphasizes the school as a learning environment for teachers, highlights the role of cultural norms of collaboration and collegiality (Little, 2012; Louis, 2007; Rosenholtz, 1989; Wang, 2016; Zhang and Pang, 2016), and identifies a broader range of activities through which teachers engage with the changing knowledge base in teaching and learning (Hargreaves, 1994; Saphier et al., 2006; Timperly, 2011; Youngs and King, 2002).

Our conceptual model further proposes two mediators of leadership effects on teacher learning: teacher agency and teacher trust. Teacher agency refers to the motivation, initiative and ownership that teachers exercise in relation to their workplace learning and professional development (Emirbayer and Mische, 1998; Kwakman, 2003). Teacher agency has garnered increasing interest among scholars in the face of evidence of failures of policy-driven efforts to improve schools. Our interest in teacher agency as a mediating variable in this study suggests the belief that successful leadership for teacher learning is not described by efforts to get teachers to 'attend' workshops organized by the principal. Rather it is grounded in leadership that both motivates and empowers teachers to assume greater ownership for their professional learning, both individually and collectively (Barth, 1990; Saphier et al., 2006; Wang, 2016; Zhang and Pang, 2016).

We propose a second mediator of the relationship between leadership and teacher learning, teacher trust. Trust has also been conceptualized as a condition that enables the efforts of school leaders to gain faculty cooperation for efforts to foster teacher professional learning (Li et al., 2016a,b; Thomsen et al., 2015; Tschannen-Moran, 2009). Indeed, Li et al. (2016a,b) found that trust acted as a positive mediator of school leadership effects on teacher professional learning in Hong Kong (see also Hallinger and Lu, 2014).

Our model further conceptualized the community location of schools (i.e., urban/rural) as a moderator of the relationship

between leadership and teacher learning. Prior research has identified differences in access to resources across urban and rural schools as a factor in determining school effectiveness. [Othman and Muijs \(2013\)](#) summarized this research as follows.

An extant literature has focused on school location in developing countries and has found lower academic achievement in rural schools ([Mohd Burhan, 2005](#); [Webster and Fisher, 2000](#); [Young, 1998](#)). This may be related to a lack of educational resources such as facilities, instructional materials, teacher quality, and teacher supply in those schools, which affects teacher effectiveness . . . Most literature on urban-rural schools in developing countries seems to concentrate on physical resource differences, but research on school quality and effectiveness shows that this is not the only pertinent factor. Therefore, there is a need for more research on urban-rural differences in other school quality factors.

As suggested above, these observations have been ([Hannum, 1999](#)) and continue to be highly salient with respect to the provision of education in China ([Hu et al., 2014](#); [Liu, 2009](#); [Qian and Smyth, 2008](#); [Wang, 2016](#); [Wang and Zhao, 2009](#); [Zhao et al., 2012](#), [Zhang and Pang, 2016](#)). A gap in educational inputs and outcomes among urban and rural students in China has been identified as a national problem with wide-ranging effects ([Ye, 2010](#)). Moreover, we suggest that the 'school process variables' of interest in this study are highly salient in China for other reasons.

For example, teachers' successful engagement in professional learning has been highlighted as a hallmark feature of successful schooling in China ([Ding, 2010](#); [OECD, 2014](#); [Paine, 2013](#); [Zhang and Pang, 2016](#)). More specifically, workplace learning practices embedded in Chinese schools such as the Master Apprentice Bond and Teacher Research Groups have been widely implemented to support the ongoing capacity development of Chinese teachers and their schools ([OECD, 2014](#); [Paine, 2013](#); [Qian and Walker, 2013](#)). It remains, however, an open question as to whether these practices are implemented with similar levels of engagement in urban and rural settings ([Wang, 2016](#); [Zhang and Pang, 2016](#)).

The current study sought to shed light on some of these issues by examining the impact of school location on the relationship between leadership and teacher learning. The full model employed in our study is shown in Figure one below. As suggested above, the key variables are learning-centered leadership and teacher professional learning. Teacher agency and trust are included as mediators and school location as a moderator.

In a previous study, the authors determined that this model accurately described the means by which the effects of learning-centered leadership effects 'flowed through' influence the professional learning of teachers ([Liu et al., 2016](#)). However, given the serious gap in educational outcomes noted above, we wondered first whether the same processes associated with leadership and teacher learning would describe urban and rural schools in China. These goals shaped our approach to the method employed in this report.

2. Method

This study employed a cross-sectional survey design to examine the proposed relationships between principal leadership and teacher learning in urban and rural schools in mainland China. In this section, we describe our variables and measures, procedures for collecting data, and analytical strategy.

2.1. Variables and measures

We began with English language forms of three instruments (see [Appendix A](#)) designed to measure the four main constructs.

These had been developed using items from scales largely developed in Western societies. We followed a sequence of translation and content validation procedures aimed at ensuring accuracy of translation, succinctness of expression, ease of understanding, and cultural suitability. Subsequently, the scales were analyzed during the course of the study to ensure their reliability and validity.

We used the 'back translation method' ([Brislin, 1970](#)) to guide translation procedures. During this process, four professors specializing in teacher education and four experienced educators (teachers and leaders) were invited to assist in development of the Chinese language version of the survey. First, the English language scales were translated into Chinese. Then the resulting Chinese language version was translated back into English by different bilingual scholars. We then compared differences between the versions. We deleted some items, revised others to ensure clarity, and adjusted variable labels to reflect the priorities and perspectives of this study. In the end, 91 items distributed over four main scales were retained (see [Appendix A](#)).

In order to develop a measure of learning-centered leadership, we borrowed and/or adapted items from scales developed to measure instructional leadership, transformational leadership, and distributed leadership by various international scholars ([Goldring et al., 2009](#); [Hallinger and Murphy, 1985](#); [Leithwood et al., 2010](#); [Walker and Qian, 2011](#); [Yu et al., 2002](#)). The resulting variable consisted of four subscales (Builds a Learning Vision Provides Learning Support, Manages the Learning Program, Modeling (see [Appendix A](#)) as well as a second-order construct labeled Learning-Centered Leadership.

As indicated above there were three scales measuring teacher attitudes. Our measure of teacher agency drew on items from scales developed by [Shen \(2015\)](#) and [Peng et al. \(2006\)](#). This resulted in four subscales (Learning Effectiveness, Teaching Effectiveness, Optimism, and Constructive Engagement (see [Appendix A](#))) as well as a second-order construct labeled Teacher Agency. In measuring Teacher Trust, we drew on items from scales developed by [Tschannen-Moran \(2009\)](#) and [McAllister \(1995\)](#). Our measure consisted of three subscales (Calculative Trust, Relational Trust, and Faith Trust (see [Appendix A](#))) as well as a second-order construct labeled Teacher Trust.

To determine the nature of engagement of teachers in professional learning, we employed 25 items drawn from several previously developed scales (i.e., [Evers et al., 2015](#); [in de Wal et al., 2014](#); [Kwakman, 2003](#); [Schechter and Qadach, 2012](#)). This variable was operationalized in terms of four subscales (Collaboration, Reflection, Experimentation, and Reaching Out to the Knowledge Base (see [Appendix A](#))) as well as a second-order construct labeled Teacher Professional Learning. For the purposes of this report, our analyses only include the four main construct measures for Learning-Centered Leadership, Teacher Agency, Teacher Trust, and Teacher Professional Learning.

2.2. Sample and data collection

The study was conducted in three provinces in mainland China. Schools located in Shanghai were grouped together as urban schools. Schools from Ningxia and Haining were grouped as rural schools.

After obtaining appropriate permission, the surveys were distributed in faculty meetings at 31 schools between May and October 2015. The 915 valid questionnaires analyzed in this report consist of surveys obtained from 492 urban teachers and 423 rural teachers. Comparison of teachers comprising the two groups of schools reveals differences on several salient characteristics.

As expected based on the literature (e.g., [Othman and Muijs, 2013](#); [Peng et al., 2006](#); [Stelmach, 2011](#); [Wang and Zhao, 2011](#); [Ye,](#)

Table 1
Characteristics of the teacher sample and population.

| Teacher Characteristics | Study Sample | | China Population | |
|--------------------------------------|--------------|-------|------------------|--------|
| | Urban | Rural | Urban | Rural |
| Teacher Gender ^a | | | | |
| Female | 69.9% | 49.9% | 67.49% | 55.12% |
| Male | 30.1% | 50.1% | 32.15% | 44.88% |
| Teaching Experience ^b | | | | |
| <6 years | 23.6% | 41.1% | 22.68% | 34.30% |
| 7–15 years | 30.7% | 35.5% | 41.89% | 39.40% |
| >16 years | 45.7% | 23.4% | 35.43% | 26.3% |
| Highest Education Level ^c | | | | |
| High School diploma | 1% | 14.9% | 2.1% | 4.9% |
| Bachelor degree | 81.3% | 84.2% | 94.5% | 94.2% |
| Graduate degree | 17.7% | 0.9% | 3.4% | 0.9% |
| Professional Rank ^d | | | | |
| Senior | 30.3% | 28.0% | 39.92% | 33.9% |
| 1st Grade | 42.5% | 28.8% | 35.97% | 38.02% |
| 2nd/3rd Grade | 19.9% | 32.4% | 16.16% | 21.11% |
| No-ranking | 7.3% | 11.5% | 7.95% | 6.97% |

^a Xie (2013).
^b Wu and Qi (2012).
^c Xie (2013).
^d Xie (2013).

2010), teachers in the rural schools held a lower level of educational qualification than those in the urban schools. More specifically, the urban cohort appeared more highly qualified, as measured by higher levels of educational attainment and professional rank (see Table 1). The most notable differences were that the rural cohort was comprised of a lower percentage of high professional rank teachers (i.e., senior and 1st Grade teachers) and a larger percentage of teachers with only a high school degree.

2.3. Analytical strategy

Our primary goals were to investigate if and how leadership and teacher learning varied across the sample of teachers in urban and rural schools. The first step in our analytical strategy entailed establishing the reliability and validity of the 15 subscales and four second order constructs (see Appendix A). We used confirmatory factor analysis (CFA) and Cronbach’s alpha test of internal consistency, first for the full sample and then for each of the two subgroups (Vandenberg and Lance, 2000). Comparative fit index (CFI), standardized root mean square residual (SRMR), root mean square error of approximation (RMSEA), and χ^2 were used to assess model fit. Fit was deemed acceptable with CFI > 0.90, SRMR < 0.08, and RMSEA < 0.06 (Browne and Cudeck, 1993; Hu and Bentler, 1999). We set 0.80 as the standard for Cronbach’s alpha (Nunnally and Bernstein, 1994).

In the next step we examined the conceptual model (see Fig. 1), which proposed that principal leadership would have both direct effects and indirect effects (i.e., through teacher trust and agency) on the professional learning of teachers. In ‘mediation analysis’, scholars employ a sequence of tests to examine the paths that connect the variables which comprise the model. Recent scholarship has turned to the bootstrapping method recommended by Preacher and Hayes (2008) in order to assess these relationships. This approach provides a robust method of assessing the size of the effect, obtaining confidence intervals for variable paths, and establishing significance levels (Preacher and Hayes, 2008).

Following the mediation analysis, we wished to determine whether school location – urban/rural – was a significant ‘moderator’ of these relationships. However, before addressing this question, it was necessary to establish the measurement invariance or equivalence of measured constructs across the urban

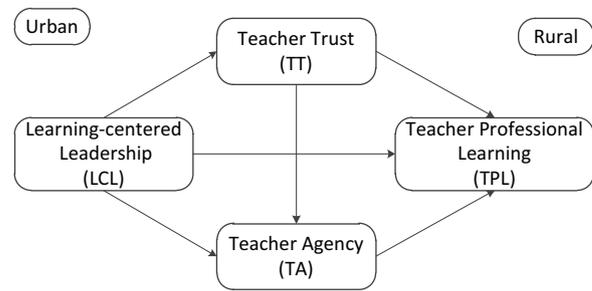


Fig. 1. Hypothesized model of leadership and teacher learning in rural schools.

and rural groups (Byrne and Stewart, 2006; Chen et al., 2005). We employed multi-group confirmatory factor analysis to test the measurement invariance of our four main constructs using three increasingly stringent tests (Chen et al., 2005; Meredith, 1993).

Configural invariance was used first to test the equivalency of the basic model structure between the two groups. After determining that the data satisfied configural invariance, we tested metric and scalar invariance (Byrne and Stewart, 2006; Vandenberg and Lance, 2000). Differences between the urban and rural school models was tested by assessing the fit indices of the data to the models for the two groups. Cheung and Rensvold (1999) concluded that when examining CFI ($\Delta CFI = CFI_{constr} - CFI_{unconstr.}$) changes of less than 0.1 indicate a lack of measurement invariance and comparisons cannot be made reliably across the groups. With this in mind, we used this as our standard for assessing measurement invariance.

After establishing measurement invariance, we used structural equation modeling (SEM) to generate models of leadership and teacher learning in the urban and rural schools. Here we sought to understand whether the paths within the two models were similar or different.

After examining the nature of the leadership and teacher learning processes across the urban and rural schools, we turned to the second research question. Here our goal was to understand if there were differences in the strength or level of the variables across the two settings. We referred back to the mean scores awarded by teachers in the urban and rural schools, and used *t*-tests to determine the statistical significance of differences in the constructs. Finally, we tested the configural invariance and path coefficient invariance of the leadership and teacher learning model across groups to gain further insight into the nature of these differences.

3. Results

The results are presented in two main sections. First we examine the measurement model to confirm the viability of our approach to measuring the variables of interest. Then we present the substantive results with respect to the research questions.

3.1. Measurement model

We began the analysis by testing the internal consistency of the scales. Alpha coefficients exceeded the standard of 0.80 for the full sample as well as the urban and rural subgroups (see Table 2). We then used CFA to test the proposed structure of the four second-order constructs. The data in Table 3 suggest a satisfactory fit for both urban and rural teachers on multiple indicators of χ^2 , CFI, SRMR, and RMSEA. These results meant that the second-order structure could be employed as the baseline model for subsequent invariance analyses.

Table 2
Descriptive statistics and internal consistency of constructs by school location.

| Constructs/Statistics | Urban School (492) | | | Rural School(423) | | | Total | T-test |
|-------------------------------|--------------------|-------|-------|-------------------|-------|-------|-------|---------|
| | Mean | SD | α | Mean | SD | α | | |
| Learning-Centered Leadership | 4.160 | 0.628 | 0.970 | 3.908 | 0.606 | 0.958 | 0.966 | 6.15*** |
| Builds a learning vision | 4.199 | 0.655 | 0.901 | 3.855 | 0.694 | 0.884 | 0.899 | 7.71*** |
| Provides learning support | 4.282 | 0.536 | 0.909 | 3.963 | 0.640 | 0.878 | 0.905 | 8.07*** |
| Manages learning program | 4.102 | 0.687 | 0.904 | 2.898 | 0.652 | 0.870 | 0.891 | 4.59*** |
| Modeling | 4.174 | 0.727 | 0.887 | 3.934 | 0.692 | 0.832 | 0.893 | 6.15*** |
| Teacher Trust | 4.386 | 0.555 | 0.962 | 4.100 | 0.619 | 0.951 | 0.959 | 7.71*** |
| Calculative trust | 4.386 | 0.555 | 0.907 | 4.100 | 0.619 | 0.903 | 0.910 | 6.15*** |
| Relational trust | 4.430 | 0.576 | 0.898 | 4.134 | 0.716 | 0.882 | 0.895 | 7.71*** |
| Faith Trust | 4.326 | 0.592 | 0.924 | 4.047 | 0.661 | 0.894 | 0.913 | 6.15*** |
| Teacher Agency | 4.124 | 0.556 | 0.953 | 3.940 | 0.589 | 0.954 | 0.955 | 7.71*** |
| Learning effectiveness | 4.247 | 0.609 | 0.867 | 4.054 | 0.620 | 0.859 | 0.866 | 6.15*** |
| Teaching effectiveness | 4.063 | 0.610 | 0.888 | 3.861 | 0.663 | 0.918 | 0.892 | 7.71*** |
| Optimism | 4.209 | 0.578 | 0.796 | 3.969 | 0.632 | 0.805 | 0.808 | 6.15*** |
| Constructive engagement | 4.001 | 0.694 | 0.904 | 3.896 | 0.714 | 0.905 | 0.905 | 7.71*** |
| Teacher professional learning | 4.217 | 0.516 | 0.946 | 3.886 | 0.569 | 0.944 | 0.949 | 6.15*** |
| Collaboration | 4.230 | 0.647 | 0.837 | 3.768 | 0.728 | 0.829 | 0.849 | 7.71*** |
| Reflection | 4.249 | 0.539 | 0.872 | 3.925 | 0.623 | 0.883 | 0.886 | 6.15*** |
| Experimentation | 4.123 | 0.640 | 0.881 | 3.838 | 0.661 | 0.835 | 0.865 | 7.71*** |
| Reach out to knowledge base | 4.237 | 0.566 | 0.828 | 3.967 | 0.613 | 0.831 | 0.838 | 6.15*** |

*** All the significance of items are <0.000.

Table 3
Model fit for the main variables in urban and rural schools.

| Subsample | χ ² | df | CFI | GFI | SRMR | RMSEA |
|--------------------------------------|----------------|-----|-------|-------|--------|-------|
| Learning-Centered Leadership | | | | | | |
| Urban Schools | 731.798 | 271 | 0.925 | 0.887 | 0.0467 | 0.059 |
| Rural Schools | 671.234 | 271 | 0.920 | 0.870 | 0.0552 | 0.059 |
| Teacher Trust | | | | | | |
| Urban Schools | 368.189 | 116 | 0.962 | 0.917 | 0.0298 | 0.067 |
| Rural Schools | 305.116 | 116 | 0.960 | 0.920 | 0.0369 | 0.062 |
| Teacher Agency | | | | | | |
| Urban Schools | 859.635 | 248 | 0.914 | 0.866 | 0.0499 | 0.071 |
| Rural Schools | 574.398 | 248 | 0.945 | 0.895 | 0.0463 | 0.056 |
| Teacher Professional Learning | | | | | | |
| Urban Schools | 731.798 | 271 | 0.925 | 0.887 | 0.0467 | 0.059 |
| Rural Schools | 671.234 | 271 | 0.920 | 0.870 | 0.0552 | 0.059 |

Note: Urban schools n = 492, Rural schools n = 423.

Next, we performed multi-group confirmatory factor analysis in order to test the measurement invariance of the four variables across the urban and rural schools (Dimitrov, 2010; Ferrer et al., 2008). Data presented in Table 4 affirm the measurement invariance of the four constructs on the three standards tested in this study: configural, metric, scalar invariance. Configural invariance serves as the baseline against which all remaining models are compared to determine evidence of invariance.

Change in the CFI values of learning-centered leadership was 0.009 for metric invariance and -0.001 for scalar invariance. Change in the CFI values of teacher trust was 0.005 for metric invariance and 0 for scalar invariance. Change in the CFI values of teacher agency was 0.003 for metric invariance and -0.003 for scalar invariance. Change in the CFI values of teacher professional learning was 0.008 for metric invariance and -0.003 for scalar invariance. This means that the nested models for the four main variables ranged from negligible to minimal on configural invariance (see Table 4). The indices used for measuring metric and scalar invariance further revealed satisfactory fit even after constraining parameters and factor loading across the two groups. Consistent with Cheung and Rensvold (2002), we concluded that there were no meaningful discrepancies in model fit for the four variables between the urban and rural schools.

3.2. Nature of leadership and teacher learning in China

In the next stage of data analysis we developed a general structural equation model of leadership and learning as presented earlier in Fig. 1. A 95th percentile confidence interval for each path was obtained by finding bootstrap estimates of the mediated paths for the 2.5th and 97.5th percentiles of the distribution for the 2000 samples (see Hayes, 2009). Then, using the bias adjustment described by MacKinnon (2008), we constructed a bias corrected confidence interval for each of the variable paths.

As shown in Table 5, the partial mediation models for the pooled sample, urban sample, and rural sample all met the standard for ‘acceptable fit’ to the data. The standardized parameter estimates shown in Figs. 2 and 3 provide effect sizes associated with the partial mediation model for principals and teachers in the urban and rural schools. These support the conclusion that Learning-Centered Leadership has a significant moderate effect on Teacher Trust ($\beta = 0.69$, $p < 0.001$ for urban schools; $\beta = 0.77$, $p < 0.001$ for rural schools), on Teacher Agency ($\beta = 0.35$, $p < 0.001$ for urban schools; $\beta = 0.43$, $p < 0.001$ for rural schools) and Teacher Professional Learning ($\beta = 0.32$, $p < 0.001$ for urban schools; $\beta = 0.53$, $p < 0.001$ for rural schools).

In order to verify Teacher Trust and Teacher Agency as mediators of Learning-Centered Leadership on Teacher Learning obtained in the SEM analysis, we obtained 2000 bootstrapped estimates of the variable paths for both rural and urban schools. A 95th percentile confidence interval for each path was obtained by finding bootstrap estimates of the mediated paths for the 2.5th and 97.5th percentiles of the distribution for the 2000 samples (see Hayes, 2009). Then, using the bias adjustment described by MacKinnon (2008), we constructed a bias corrected confidence interval for each of the variable paths (see Table 6).

As shown in Table 6, the bootstrap estimates offer additional evidence affirming the role of Teacher Agency as a mediator of leadership in both urban and rural settings. However, once again, the results with respect to Teacher Trust were somewhat weaker. This analysis, however, also highlights an interesting joint mediating effect of Teacher Trust and Teacher Agency on Learning-Centered Leadership in both urban and rural schools.

We note that the inclusion of these mediating variables in the urban/rural model reduced the direct effect of Learning-Centered Leadership on Teacher Professional Learning, but not to zero (i.e.,

Table 4
Tests for invariance of variables by urban/rural location: Goodness-of- Fit Statistics.

| Models | χ^2 | df | CFI | SRMR | RMSEA (90%CI) | Compare Model | Δ CFI |
|--------------------------------------|----------|-----|-------|-------|---------------------|---------------|--------------|
| Learning-Centered Leadership | | | | | | | |
| 1. Configural invariance | 1125.477 | 567 | 0.950 | 0.063 | 0.046 (0.042–0.050) | | |
| 2. Metric invariance | 1024.994 | 563 | 0.959 | 0.042 | 0.042 (0.038–0.046) | 2 vs 1 | 0.009 |
| 3. Scalar invariance | 1163.222 | 588 | 0.949 | 0.063 | 0.046 (0.042–0.050) | 3 vs 1 | -0.001 |
| Teacher Trust | | | | | | | |
| 1. Configural invariance | 467.012 | 249 | 0.969 | 0.074 | 0.044 (0.038–0.050) | | |
| 2. Metric invariance | 433.065 | 246 | 0.974 | 0.040 | 0.041 (0.034–0.047) | 2 vs 1 | 0.005 |
| 3. Scalar invariance | 487.462 | 263 | 0.969 | 0.079 | 0.043 (0.037–0.049) | 3 vs 1 | 0 |
| Teacher Agency | | | | | | | |
| 1. Configural invariance | 1122.769 | 520 | 0.937 | 0.059 | 0.050 (0.046–0.054) | | |
| 2. Metric invariance | 1087.079 | 516 | 0.940 | 0.054 | 0.049 (0.045–0.053) | 2 vs 1 | 0.003 |
| 3. Scalar invariance | 1168.007 | 540 | 0.934 | 0.065 | 0.050 (0.046–0.054) | 3 vs 1 | -0.003 |
| Teacher Professional Learning | | | | | | | |
| 1. Configural invariance | 1239.542 | 567 | 0.924 | 0.085 | 0.051 (0.047–0.055) | | |
| 2. Metric invariance | 1162.236 | 563 | 0.932 | 0.058 | 0.048 (0.044–0.052) | 2 vs 1 | 0.008 |
| 3. Scalar invariance | 1290.339 | 588 | 0.921 | 0.081 | 0.051 (0.047–0.055) | 3 vs 1 | -0.003 |

Note: df = ° of freedom; CFI = comparative fit index; - ; SRMR = standardized root mean squared residual; RMSEA = root mean squared error of approximation; 90% CI = 90% confidence interval.

Table 5
Goodness-of-fit statistics for invariance of variable relationships by urban/rural schools.

| Models | χ^2 | df | CFI | SRMR | RMSEA (90% CI) | Compare Model | Δ CFI |
|-----------------------------|----------|------|-------|-------|---------------------|---------------|--------------|
| Pooled sample model | 8653.659 | 3983 | 0.918 | 0.040 | 0.036 (0.035–0.037) | | |
| Urban sample | 7965.838 | 3983 | 0.879 | 0.049 | 0.045 (0.044–0.047) | | |
| Rural sample | 6593.488 | 3983 | 0.894 | 0.046 | 0.039 (0.038–0.041) | | |
| Configural invariance | 12770.86 | 8057 | 0.902 | 0.074 | 0.036 (0.035–0.037) | | |
| Path coefficient invariance | 12798.29 | 8064 | 0.902 | 0.072 | 0.036 (0.035–0.037) | 2 vs 1 | 0 |

Note: df = ° of freedom; CFI = Comparative Fit Index; SRMR = Standardized Root Mean Squared Residual; RMSEA = Robust Root Mean Squared Error of Approximation; 90% CI = 90% Confidence Interval.

from 0.773*** to 0.320*** for urban schools; 0.894*** to 0.532*** for rural schools). The total effect of Learning-Centered Leadership on Teacher Professional Learning was 0.773 for urban schools and was 0.894 for rural schools. This sequence of analyses affirms the conclusion that effects of learning-centered leadership on teacher professional learning are partially mediated by teacher trust and agency in the urban and rural schools sampled in our study.

Next, we examined whether there were differences in the ‘strength’ of the leadership and teacher learning process variables between the rural and urban schools in our study. Application of the independent samples *t*-test indicated that the mean values on the four main variables (see Table 2) and all 15 subscales (not tabled) were consistently and significantly lower (~10%) for the rural schools ($p < 0.001$).

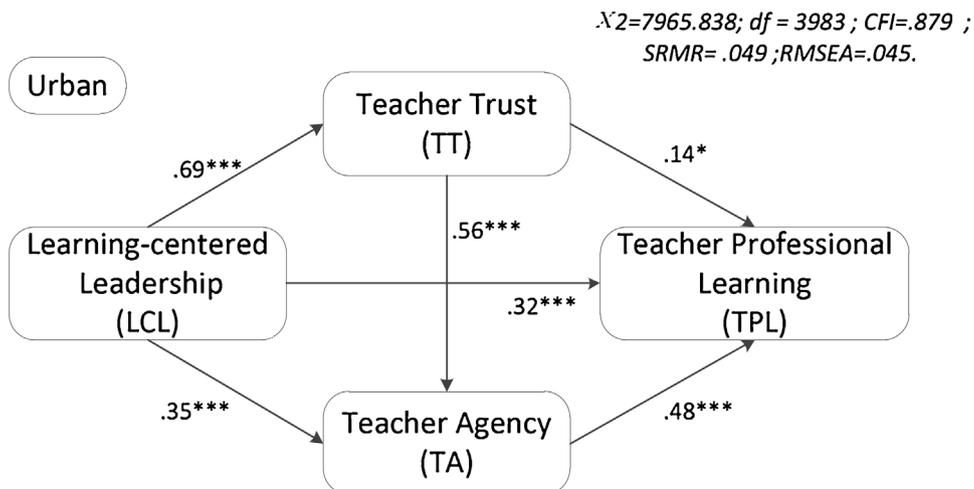


Fig. 2. SEM model of leadership and teacher learning in urban schools.

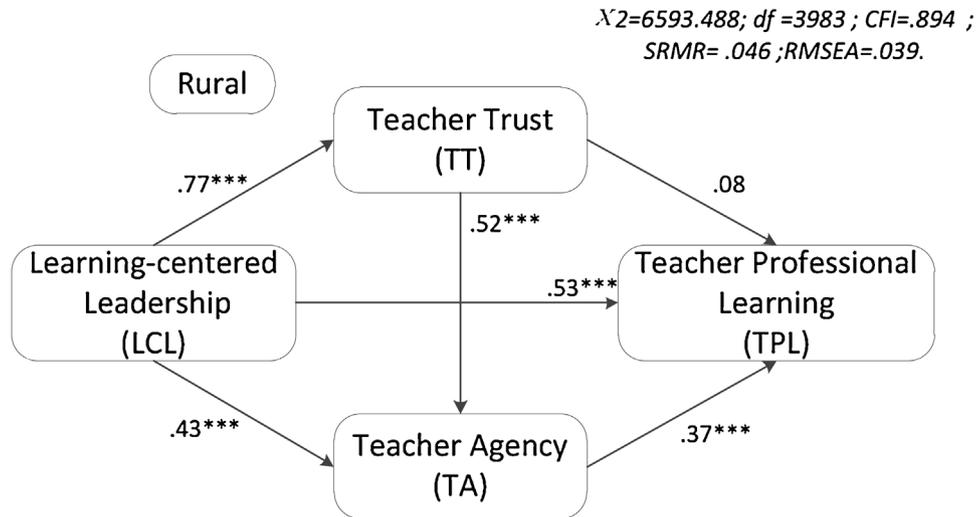


Fig. 3. SEM model of leadership and teacher learning in rural schools.

Finally, we examined the equivalence of structural models. In reviewing the results in Table 5, the configural model in which no equality constraints were imposed, represented a good fit to the data. This model served as the baseline. Then, when the path coefficients were constrained to be invariant across the groups, we still found an excellent fit to the model ($\chi^2 = 12798.29; df = 8064; CFI = 0.902; RMSEA = 0.036; SRMR = 0.072$), with a resulting ΔCFI value of 0 (see Table 5). We can conclude that the model exhibits invariance of path coefficients across the urban/rural schools (Cheung and Rensvold, 2002). These findings imply that although the leadership-teacher learning process model seems to operate in a similar fashion across the urban and rural schools, the strength of these processes appears ‘weaker’ in the rural settings.

4. Discussion

This study addressed a policy issue located in mainland China that also has implications for other developing societies: inequities in educational inputs and outcomes for students in urban and rural schools (Chiu and Khoo, 2005; Levin and Lockheed, 2012; Othman and Muijs, 2013; Teddlie et al., 2000; Ye, 2010; Zhao et al., 2012). Our study focused on principal leadership and the professional learning of teachers, school-level factors associated with sustainable school improvement (Barth, 1990; Hallinger and Heck, 1998; Li et al., 2016a,b; Printy, 2008; Robinson et al., 2008; Saphier et al., 2006; Smylie and Hart, 1999; Thoonen et al., 2011; Vanblaere and Devos, 2016). Simply stated, our study sought to assess the nature and extent of differences in school leadership and teacher learning

Table 6

Bootstrapping results for the standardized direct, indirect, and total effects of learning-centered leadership on teacher professional learning through teacher trust and teacher agency (N = 1259).

| | Point Estimate | Product of Coefficients | | 95% Bootstrap CI | | Two-tailed Sig (P) |
|--|----------------|-------------------------|--------|------------------|-------|--------------------|
| | | SE | Z | Lower | Upper | |
| Standardized Total Effects | | | | | | |
| LCL-TPL (Urban) | 0.773 | 0.031 | 24.786 | 0.712 | 0.835 | *** (0.000) |
| LCL-TPL (Rural) | 0.894 | 0.018 | 50.333 | 0.859 | 0.928 | *** (0.000) |
| Standardized Total indirect Effects | | | | | | |
| LCL-TPL (Urban) | 0.453 | 0.047 | 9.604 | 0.361 | 0.531 | *** (0.000) |
| LCL-TPL (Rural) | 0.362 | 0.063 | 5.781 | 0.239 | 0.485 | *** (0.000) |
| Indirect Effects of LCL → TA → TPL | | | | | | |
| LCL-TPL (Urban) | 0.166 | 0.036 | 4.568 | 0.095 | 0.237 | *** (0.000) |
| LCL-TPL (Rural) | 0.158 | 0.042 | 3.710 | 0.074 | 0.241 | *** (0.000) |
| Indirect Effects of LCL → TT → TPL | | | | | | |
| LCL-TPL (Urban) | 0.101 | 0.051 | 1.970 | 0.001 | 0.201 | * (0.049) |
| LCL-TPL (Rural) | 0.058 | 0.050 | 1.141 | -0.041 | 0.156 | -(0.254) |
| Indirect Effects of LCL → TT → TA → TPL | | | | | | |
| LCL-TPL (Urban) | 0.187 | 0.039 | 4.838 | 0.111 | 0.262 | *** (0.000) |
| LCL-TPL (Rural) | 0.147 | 0.041 | 3.604 | 0.067 | 0.227 | *** (0.000) |
| Standardized Direct effects | | | | | | |
| LCL-TPL (Urban) | 0.320 | 0.061 | 5.285 | 0.201 | 0.439 | *** (0.000) |
| LCL-TPL (Rural) | 0.532 | 0.071 | 7.484 | 0.392 | 0.671 | *** (0.000) |

Note: 2000 bootstrapped samples. CI = confidence-interval; LCL = Learning-centered Leadership; TT = Teacher Trust; TA = Teacher Agency; TPL = Teacher Professional Learning. Standardized indirect effects. 95% CI does not include zero.

*** = P < 0.001.

in urban and rural schools in mainland China. In this closing section we highlight limitations of the study, summarize and interpret the main findings, and discuss several implications.

4.1. Limitations

The key limitations of this study revolve around the sample of teachers and schools. The first limitation concerns the breadth of the urban and rural school samples. Our sample included schools from only three provinces. Given the vastness of China, we cannot claim that results from these particular areas are representative of all urban and rural schools.

The second limitation concerns the size of our school sample. The sample of 31 schools limited the kinds of statistical analyses that we could conduct at the school level. To address this limitation, our analyses focused on 'teachers' rather than 'schools' grouped into urban and rural clusters. While this was defensible given the types of comparisons that we made, a larger sample of schools would have enabled us to conduct additional analyses designed to assess if there were differences in 'school effects' within and across the two types of schools.

4.2. Summary and interpretation

The main findings of the study can be summarized as follows. First, our data support the conclusion that learning-centered leadership makes a difference for teacher learning. More specifically, we identified a moderate direct effect on teacher professional learning, as well small to moderate indirect effects through teacher agency and teacher trust. This confirmation of a 'partially mediated' effect of leadership on teacher learning is consistent with findings reported in other societies (e.g., Hallinger et al., 2014; Hallinger and Lu, 2014; Li et al., 2016a,b; Printy, 2008; Thoonen et al., 2011; Vanblaere and Devos, 2016). Moreover, our study further elaborates on the variety of practices by which principals motivate and support teachers, shape workplace environments that build teacher ownership, and enhance teacher development (Barth, 1990; Frost, 2006; Hallinger and Lu, 2014; Robinson et al., 2008; Saphier et al., 2006; Thoonen et al., 2011; Vanblaere and Devos, 2016).

Second, when the data were broken down into samples of urban and rural teachers, we found no significant differences in the relationships that described these processes associated with principal leadership and teacher learning. This means that the processes through which leaders achieved a positive effect on teacher workplace learning appeared quite similar in urban and rural schools. Notably, however, all four of the main variables as well as their composite practices were significantly weaker in the rural schools.

Taken together these findings offer preliminary evidence that the previously reported gap in opportunities to learn among urban and rural students in mainland China is mirrored in the learning of their teachers. We earlier noted that our sample of rural teachers tended to be both younger and lower in educational attainment than the urban teachers. Our results further suggest that rural teachers are located in schools in which they are likely to be less engaged in learning on-the-job. If this finding is confirmed through additional research, it could mean that gaps in the capacity and effectiveness of urban and rural schools may grow over time, not only as a result of differences in structural inputs (e.g., teacher qualifications) but also as a result of school-level developmental processes.

Our findings related to teacher trust and agency contribute to an ongoing global effort to develop a richer understanding of the 'paths' through which leaders achieve effects in schools (Hallinger and Heck 1998; Heck and Hallinger, 2014; Leithwood et al., 2010;

Robinson et al., 2008; Slegers et al., 2014; Thoonen et al., 2011). Indeed, the location of this study in China adds further significance to this result. Leadership in China is often characterized as hierarchical and paternalistic (Bush et al., 1998; Chen et al., 2014; Tang et al., 2014; Walker and Qian, 2015). Yet our findings suggest that principals do find it worthwhile to take efforts towards building trust and agency among teachers in the context of fostering a learning culture in the school. Here teacher agency refers to the motivation and initiative of teachers to take ownership for their professional development, an attitude that can underpin successful school improvement (Hallinger and Lu, 2014; Hargreaves, 1994; Little, 2012; Louis, 2007; Timperly, 2011; Thoonen et al., 2011; Vanblaere and Devos, 2016). Thus, this finding adds a layer of useful complexity to our understanding of how Chinese leaders 'get results' (Tang et al., 2014; Walker et al., 2012; Walker and Qian, 2015).

4.3. Implications

While our broad findings are consistent with other recently reported research, their extension to urban and rural schools represents an underexplored domain (see also Othman and Muijs, 2013; Wang, 2016; Zhang and Pang, 2016). This approach responds to an increasingly important line of inquiry in educational leadership and management that emphasizes the role that 'context' plays in shaping the enactment of leadership in schools (Belchetz and Leithwood, 2007; Bush et al., 1998; Hallinger and Leithwood, 1996). This initial effort to compare the nature and effects of leadership in urban and rural schools in China may offer encouragement to other scholars interested leadership and learning in rural education (Wang, 2016; Zhang and Pang, 2016).

In addition to the technical recommendations for future research made earlier, we would like to offer several additional thoughts about future research. First, qualitative and mixed methods study will prove of immense value in 'fleshing out' the outlines revealed through quantitative analysis (see Liu and Hallinger, *In press*). Interviews with teachers and principals as well as full-fledged case studies are called for in order to advance and deepen our understanding of these complex, dynamic relational processes. This will enable us to better understand the nature of practices and relationships in schools where principals encourage teachers to take greater ownership for their learning and where teacher learning becomes 'rooted' in the culture of the school (see Barth, 1990; Saphier et al., 2006).

Second, we see value in linking changes associated with leadership and teacher learning with improvement in student achievement. However, we note that the data requirements for doing this type of research are more demanding than meets the eye. The research design must be capable of linking changes in the learning of students with changes in the learning of their specific teachers, a technical requirement that is often difficult to achieve (see Hallinger and Heck, 2011; Heck and Hallinger, 2014). This may be achieved by using a longitudinal design in which the researcher employs a data set with identifiers at the individual student and teacher levels (see Hallinger and Heck, 2011; Heck and Hallinger, 2014). An alternative means of addressing this issue could be through an experimental intervention aimed at fostering the development of learning-centered leadership and teacher learning among rural principals and teachers (see Maag Merki and Holmeier, 2014).

With respect to policy and practice, our findings require broader replication with a larger sample of schools from more diverse locations in China. Yet, our findings already suggest the 'potential efficacy' of more focused investments in two types of human resources. First, they indicate potential for investment in developing the capacity for 'learning-centered leadership' among

rural China's school principals. We noted that the rural teachers perceived their principals as offering 'weaker leadership' in this domain than was the case in the urban schools. Although we have noted recent efforts to focus on instructional leadership in China, it may be that the practices associated with this type of 'non-traditional leadership' have been slower to gain a foothold in China's rural schools (Walker et al., 2012; Walker and Qian, 2015).

A second implication concerns resources for teacher development. While more focused learning-centered leadership from the rural principals could lead to more active teacher engagement in learning, it may also be the case that teachers in rural communities have less access to quality learning resources. Thus, the success of efforts by principals and middle level leaders to foster teacher learning in China's rural communities may also require creative strategies aimed at expanding learning opportunities for rural teachers. In closing, we believe that the findings from this study should be viewed as potentially encouraging as they further affirm and clarify an important set of relationships that underlie efforts to enable sustainable improvement in schools.

Appendix A. Survey Items

*Learning-Centered leadership*²

Builds a Learning Vision

1. Sets a clear vision for teacher learning in the school.
2. Communicates a learning vision with teachers.
3. Demonstrates high expectations for teachers.
4. Provides useful assistance to teachers in working towards the learning vision.
5. Encourages teachers to develop individual professional goals consistent with school goals.
6. Helps to clarify the reasons for implementing the learning vision to teachers.

Provides Learning Support

1. Provides resources (time, money and training opportunities) to support my professional learning.
2. Facilitates opportunities (demonstration lesson and training project) for staff to learn from each other.
3. Shows respect for teachers who pursue their goals for professional learning.
4. Rewards teachers who engage in ongoing teacher professional learning.
5. Aligns resource allocation to the priority of teacher professional learning.
6. Encourages ongoing teacher professional learning to implement new ideas and practices.
7. Supports an open and supportive environment for staff to communicate.
8. Makes teachers feel appreciated for the contributions of their professional learning to school improvement.

Manages the Learning Program

1. Participates and guides teachers in formal or informal professional learning.
2. Designs a systematic evaluation system to assess the impact of teacher professional learning Diversifies the learning forms to arouse teachers' interest.
3. Promotes professional learning content to fit teachers' needs.

4. Emphasizes the purpose of professional learning for teaching improvement.
5. Makes regular visits to ensure systematic monitoring of teacher professional learning.

Modeling

1. Displays energy and enthusiasm for learning.
2. Demonstrates a willingness to share personal learning achievements with teachers.
3. Shows outstanding performance in professional learning.
4. Focuses on the latest ideas in teaching.
5. Has own unique opinions about teaching and learning.

*Teacher Agency*³

Learning Effectiveness

1. Only if I try hard enough, will I continue to improve my teaching as time goes by.
2. Even if I am in a bad mood, I can still actively engage in professional learning.
3. In a busy period, I continue to keep learning on the job.
4. am convinced that I can develop creative ways to cope with system constraints (such as funding shortage and other administrative problems) and continue to engage in professional learning.
5. know that I can carry out professional learning projects, even when I am opposed by skeptical colleagues.
6. am convinced that I can learn more effectively with the help of colleagues compared with learning by myself.

Teaching Effectiveness

1. If a student in my class becomes disruptive and noisy, I know techniques to redirect him/her quickly.
2. I am confident that I can find effective teaching methods to develop my students.
3. I am convinced that I can teach a new course successfully.
4. When I try really hard, I am able to reach even the most difficult students.
5. I know that I can maintain a positive relationship with parents, even when tensions arise.
6. If one of my students can't do a class assignment, I am able to accurately assess whether the assignment was at the correct level of difficulty.
7. When a student gets a better grade than he/she usually gets, it is usually because I found better ways of teaching that student.

Optimism

1. I am optimistic about my future.
2. In uncertain times, I usually expect the best.
3. Overall, I expect more good things to happen to me than bad.
4. Overall, I maintain a positive relationship with my colleagues.
5. Overall, I communicate well with my colleagues.

Constructive Engagement

1. I set clear learning goals for myself.

² Items adapted from Leithwood et al. (2010); Leithwood and Jantzi (2006); Robinson et al. (2008); Walker and Qian (2011); Yu et al. (2002).

³ Items adapted from Peng et al. (2006); Schwarzer and Hallum (2008); Shen (2015); Woolfolk and Hoy, (1990); Scheier et al. (1994); Zhang (2009).

2. In order to realize a learning goal, I willingly confront difficulties.
3. I make a study plan in detail to reach a learning goal.
4. I make full use of resources available to improve my teaching.
5. I try out new ideas when I am doing a routine task.
6. I try my best to expand my professional influence in the process of school change.

*Teacher Professional Learning*⁴

Collaboration

1. I work together with colleagues to modify subject matter for students.
2. I work together with colleagues to share teaching experiences.
3. I work together with colleagues to discuss ways to improve the curriculum and instruction.
4. I participate in meetings with colleagues to decide how the school evaluates student achievement and the curriculum.
5. I participate meetings with colleagues to discuss students' learning.

Reflection

1. I modify instructional methods on the basis of feedback from colleagues.
2. I maintain previous reports about learning and teaching for learning purposes.
3. I reflect individually after observing colleagues' lesson to improve my teaching.
4. I update my instructional files according to the situation to improve my teaching.
5. I record my learning experience in professional learning projects.
6. I adapt my teaching methods in response to pupils' reactions.
7. I reflect on my own teaching practice.
8. I analyze the reasons of failures or successes in my teaching.
9. I collect more information to analyze and verify pupils feedback.

Experimentation

1. I experiment with new teaching ideas.
2. I try out new teaching methods in my lesson.
3. I apply new methods to solve teaching problems.
4. I test alternative teaching materials in class to stimulate students' interest.
5. I try out new applications of ICT in my lessons.

Reach Out to the Knowledge Base

1. I collect learning feedback from students.
2. I search online information resources for way to develop my teaching.
3. I observe other teachers' lessons to learn.
4. I read educational/subject matter pedagogical literature to obtain the new ideas.
5. I ask for help from colleagues.
6. I maintain professional learning linkages with other schools.

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⁴ Items adapted from in de Wal et al., (2014); Schechter and Qadach (2014); Evers et al. (2015).

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