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REGULAR ARTICLE

Measuring Teacher Leadership in Different Domains of Practice: Development and Validation of the Teacher Leadership Scale

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Abstract Echoing research interests in recent concepts and models of teacher leadership, the focus of existing scales needs to be updated, and their quality needs to be improved. This study summarizes common ground of influential definitions, models, and frameworks for teacher leadership, proposes a six-factor model (association, professional learning, assessment, instruction, community, and policy leadership), and develops the corresponding scale. The data from 534 teachers (97% from public schools) support the model, confirm psychometric quality of the scale, and reveal characteristics of teacher leadership in four cities in China. The scale is used in future studies as a measurement instrument and in practice to assess teacher leadership development.

Keywords Teacher leadership · Professional development · Measurement instrument

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Introduction

Leadership plays a critical role in contributing to school improvement and student success, and as Leithwood et al. (2004, p. 3) noted, leadership is second only to classroom instruction among all school-related factors. In recent years, teachers leadership has gained increasing attention as an important aspect of school leadership (e.g., Margolis and Deuel 2009; Wenner and Campbell 2017; York-Barr and Duke 2004). Researchers and educators believe that promoting teacher leadership can enhance teaching practices that lead to increased student achievement and improved decision making at the school level or higher, and create a dynamic teaching profession (Martin and Coleman 2011; Muijs and Harris 2003, 2006; Teacher Leadership Exploratory Consortium 2012; Wenner and Campbell 2017).

However, in this relatively new field, there is a striking lack of knowledge related to fundamental questions: the exact meaning of the concept of teacher leadership, the leaderships it encompasses, and the educational practices in which it is revealed. Although teacher leadership already has influential definitions, models or frameworks (e.g., Center for Strengthening the Teaching Profession 2018; Center for Teaching Quality et al. 2014; Jackson et al. 2010; Wenner and Campbell 2017; York-Barr and Duke 2004), they are not well examined by rigorous empirical research.

Although there have been a few studies to measure teacher leadership, some of them do not catch hold of common ground in this concept (Adams and Gamage 2008; Cheng 2009; Galland 2008; Smylie and Denny 1990; Tsai 2017) and some do not show enough evidence of the quality of measurement instruments (Adams and Gamage

2008; Cheng 2009; Galland 2008; Hanuscin et al. 2012; Leithwood and Jantzi 1999; Smylie and Denny 1990).

Therefore, the purpose of this study is to summarize the common ground of influential definitions, models, and frameworks for teacher leadership; propose a measurable teacher leadership model; and develop and validate a corresponding scale. The results are expected to create a valid and reliable teacher leadership scale and provide empirical evidence for the concepts and theoretical models of teacher leadership.

Literature Review

Definition of Teacher Leadership

A number of definitions of teacher leadership have been proposed in the literature. A summary of typical conceptions is presented here. Moller and Katzenmeyer (1996) suggest that teacher leadership is concerned with teachers contributing to student learning or school reform that happened within or beyond the classroom, helping other colleagues improve their professional practice, and identifying with and contributing to a community of leaders Silva et al. (2000) suggest that a teacher should be valued as a leader with leadership if he/she has a positive impact on students' learning, improvement of teaching, and school development. Harris (2003) considers that "teacher leadership essentially refers to the exercise of leadership by teachers, regardless of position and designation." York-Barr and Duke (2004) consider that teacher leadership refers to teachers using their teaching and learning expertise to improve the instruction and culture in schools to enhance student learning. Taylor et al. (2011) also suggest that teacher leadership is "based on the work of classroom teachers that is neither supervisory nor hierarchical but rather is focused on individual and school growth and development."

Although the definitions of teacher leadership vary widely, a consensus of the conceptualizations of the term has somehow been reached, which constitutes the working definition of teacher leadership in this study. Teacher leadership derives from the expertise of teachers instead of the appointed positions; the responsibilities of teacher leadership are not limited to the classroom, but also extend to their leading roles played outside the classroom, especially their responsibility for the colleagues, schools, and communities (Harris 2003; Hunzicker 2012; Moller and Katzenmeyer 1996). This concept first acknowledges that the teacher leaders continue to undertake the complex teaching tasks in the classroom (Mangin and Stoelinga 2008; Margolis 2012). In the meantime, they are regarded as collaborators, serving as a role model for other teachers in guiding the specific teaching practices and supporting professional learning in schools (Margolis 2012; Margolis and Doring 2012; Moller and Katzenmeyer 1996; Muijs and Harris 2006), and they be involved in policy and decision making at some level (Carpenter and Sherretz 2012). They also play a leading role in working towards the improvement and change of the whole school organization and the community in which they are located (Gigante and Firestone 2008; Silva et al. 2000; Taylor et al. 2011; York-Barr and Duke 2004). The ultimate goal of teacher leadership is to improve student learning and success (Taylor et al. 2011; Hanuscin et al. 2012; Hunzicker 2012; Silva et al. 2000).

Dimensions of Teacher Leadership

What dimensions does teacher leadership include or which domains of educational practices reveal teacher leadership? These kinds of question have been discussed in detail in existing studies. This study analyzed and compared the classifications of some important research reviews, models, and standards.

There are six general dimensions in which teacher leadership is revealed. The first dimension is *association leadership* which means that teacher leaders perform the following tasks: create and guide effective interactions and collective action; build an environment of trust, respect, and collegiality; develop and support collaborative teams in the school (Center for Strengthening the Teaching Profession 2018; Center for Teaching Quality et al. 2014; Jackson et al. 2010; Wang and Hong 2019; Wenner and Campbell 2017). The second dimension is *professional learning leadership.* Several authors opine that to be a teacher leader, one should engage in the following: model and encourage professional learning; promote and design job-embedded, integrated and differentiated professional learning based on teacher needs; and facilitate the use of research as an important component of ongoing learning and development (Center for Strengthening the Teaching Profession 2018; Jackson et al. 2010; Teacher Leadership Exploratory Consortium 2012; Wang and Hong 2019; Wenner and Campbell 2017; York-Barr and Duke 2004). *Assessment leadership* is the third dimension, which encompasses informing and facilitating colleagues' selection, design, use, and interpretation of multiple assessments and other related data to make informed decisions (Jackson et al. 2010; Teacher Leadership Exploratory Consortium 2012; York-Barr and Duke 2004).

Additionally, some studies proposed the concept of *instruction leadership* (Center for Strengthening the Teaching Profession 2018; Jackson et al. 2010; Teacher Leadership Exploratory Consortium 2012; York-Barr and Duke 2004; Ye and Zhu 2018). The dimension asserts that

teacher leaders should demonstrate excellence in instructional contexts, share effective teaching with colleagues, and advance the instructional skills of colleagues by providing quality feedback and supporting reflective practice based on student needs. The fifth dimension, c*ommunity leadership* notes that teacher leaders collaborate effectively with families and communities, promote the quality of colleagues' interaction with families and communities to improve educational systems and expand opportunities for student learning (Center for Teaching Quality et al. 2014; Jackson et al. 2010; Teacher Leadership Exploratory Consortium 2012; Wenner and Campbell 2017; York-Barr and Duke 2004; Ye and Zhu 2018). *Policy leadership* is the last dimension, which highlights that teacher leaders help colleagues to understand educational policies, participate in policy-making at some level, and advocate for the development of students and teachers, and for educational improvement (Center for Strengthening the Teaching Profession 2018; Center for Teaching Quality et al. 2014; Hu and Gu 2012; Jackson et al. 2010; Teacher Leadership Exploratory Consortium 2012; Wenner and Campbell 2017; York-Barr and Duke 2004).

Based on these six dimensions above, this study attempts to build a teacher leadership model and develop the corresponding measurement instrument.

Measures of Teacher Leadership

Although the term teacher leadership is increasingly popular in the literature, there are only a few instruments to measure teacher leadership. Studies by Smylie and Denny (1990) and by Adams and Gamage (2008) focused on teacher leaders with formal positions. Both studies asked teacher leaders to state leadership activities in which they engaged and then integrated their responses into questionnaires. The Teacher Leadership School Survey, developed by Katzenmeyer and Moller (2001, pp. 190–196), has been employed in some studies (e.g., Aliakbari and Sadeghi 2014). The questionnaire considered an informant's school as a unit and assessed the teacher leadership of the whole school. The questionnaire measured teacher leadership from seven factors: developmental focus, recognition, autonomy, collegiality, participation, open communication, and positive environment. Leithwood and Jantzi (1999) designed three similar items about the effects of teacher leadership, one for each of three distinct leadership sources: individual teachers with formal leadership roles, individual teachers providing informal leadership, and groups of teachers.

The instruments developed by Galland (2008), Cheung (2009), and Hanuscin et al. (2012) measured teacher leadership from different task areas. Galland (2008) assessed the impact of teacher leadership on instruction and student achievement, and Cheung (2009) focused on the domains of curriculum and instruction, teacher mentoring, and school administration. Hanuscin et al. (2012) included formal and informal leadership activities within the seven dimensions summarized by York-Barr and Duke (2004). Tsai (2017) did not design a scale from the perspective of different leadership activities, but rather extended the framework of the charismatic, ideological, and pragmatic leadership model (Bedell-Avers et al. 2009) to teacher leadership.

In terms of the quality of measurement instruments, most of the above studies above do not report enough information on reliability and validity, especially the results of exploratory factor analysis and confirmatory factor analysis (Adams and Gamage 2008; Cheng 2009; Galland 2008; Hanuscin et al. 2012; Leithwood and Jantzi 1999; Smylie and Denny 1990).

Consistent with the research interests in the recent concepts and models of teacher leadership, the focus of existing instruments needs to be updated and their quality needs to be improved. Therefore, this study attempts to measure leadership of individual teachers with or without formal leadership positions and includes important domains of teacher leadership practices. Moreover, the data analysis results demonstrate the quality of the instrument.

Method

Instrument Development

As stated in the literature review section, several salient domains of teacher leadership were identified: association leadership, professional learning leadership, assessment leadership, instruction leadership, community leadership, and policy leadership. The description and elaboration towards each domain in these important literatures (Center for Strengthening the Teaching Profession 2018; Center for Teaching Quality et al. 2014; Hu and Gu 2012; Jackson et al. 2010; Teacher Leadership Exploratory Consortium 2012; Wang and Hong 2019; Wenner and Campbell 2017; Ye and Zhu 2018; York-Barr and Duke 2004) were decomposed into several detailed activities or behaviors. For example, the explanation for professional development dimension proposed by York-Barr and Duke (2004) was decomposed into four behaviors: mentor other teachers, lead workshops, engage in peer coaching, and model and encourage professional growth. All the detailed behaviors were analyzed and compared: same or similar behaviors were merged into one item, and behaviors inconsistent with our definition were deleted. Finally, we got a pool of potential scale items for each domain. As the most of items originated from studies written in English, two of the

authors, who are influent in both Chinese and English, first translated them into Chinese, and then conducted back-translation to ensure the translation quality.

In terms of response format, a four-point scale (nearly always not, sometimes, often, and nearly always) was adopted to measure the frequency of teacher behaviors.

The following step was to interview the local practitioners to assess whether the content and formulation of the instrument were applicable to local educational settings and language habits. The interviewees included eight elementary and secondary teachers, a teacher–researcher, and a public official in the division of education management. The interviewees and the study sample were from the same four cities. Three interviewees worked in Shanghai, three in Hangzhou, two in Jiaxing, and two in Wenzhou. Each of them had ten years or above teaching experience and was well acquainted with the local conditions. According to their feedback, necessary revisions were made before the scale was administered to the study sample.

Participants

A total of 534K-12 teachers from Shanghai city, Hangzhou city, Jiaxing city, and Wenzhou city in China participated in our study. A snowball convenience sampling method was used to recruit participants through authors' social network. All teachers were informed that their participation was voluntary and the confidentiality of their response was assured. Participants were chosen from a variety of grade levels (K-12) and a wide range of content areas. The overwhelming majority (97%) of participants were from public schools, and none of participants were from international schools or foreign language schools whose official language was not Chinese. Full democratic characteristics are specified in Table 1.

Data Analyses

Using the random sample function in SPSS version 22, all participants were randomly assigned into two groups to create a development sample (n=268) and a validation sample (n=266). The development sample was employed to examine the structure of the teacher leadership questionnaire by exploratory factor analysis (EFA). The extraction method for EFA was the principal axis factoring, and the missing values were replaced with means. Since it was assumed that different factors of teacher leadership could be correlated, an oblique rotation method was utilized. The Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity were applied to assess the adequacy of the sample to yield reliable and discrete factors.

Based on the EFA results and the constructs established through the literature review, the validation sample was used to test the hypothesized model via confirmatory factor analysis (CFA). The parameter estimation method used was the maximum likelihood parameter estimation with standard errors and a mean-adjusted chi-square test statistic (MLM), which are robust to non-normality. Goodness of fit was evaluated using the following statistics: chi-square statistic (χ^2/df), comparative fit index (CFI), Tucker–Lewis index (TLI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA). According to the criteria described by Schreiber et al. (2006), Tabachnick and Fidell (2007), and Kline (2010), an excellent model fit requires χ^2/df to be less than two, CFI and TLI greater than 0.95, SRMR less than 0.08, and RMSEA less than 0.06; an acceptable model fit requires χ^2/df to be less than three, CFI and TLI greater than 0.90, SRMR less than 0.11, and RMSEA less than 0.08.

Cronbach's alpha was applied to examine the internal consistency for the entire teacher leadership scale and each subscale, with a criterion of>0.70 (Comrey and Lee 1992).

SPSS version 22 was used to perform descriptive statistics, correlation analysis and EFA, and to compute Cronbach's alpha. The CFA was conducted in Mplus version 6.

Results

Exploratory Factor Analysis

To determine the suitability of the development sample for conducting EFA, the KMO measure of sampling adequacy and the Bartlett's test of sphericity were performed. The KMO value equaled 0.96, which indicated that the sampling adequacy was "marvelous" (Hutcheson and Sofroniou 1999). The Bartlett's test of sphericity was significant (χ^2=12,152.20, df=780, p<0.01). Both of these two tests demonstrated that EFA was appropriate.

Given eigenvalues, the scree plot, and conceptual interpretability, a six-factor solution was determined. For item elimination, an item had to have a loading above 0.40 on one factor (Ford et al. 1986), and an item's loading on one factor had to be 0.20 larger than its loading on any other factor (Vangrieken et al. 2017). These criteria resulted in a 34-item teacher leadership scale as shown in Table 2. The six-factor solution accounted for 74% of the variance and was theoretically meaningful. The six factors were named after association leadership, profession learning leadership, assessment leadership, instruction leadership, community leadership, and policy leadership, respectively.

Table 1 Sample characteristics (N=534)

Demographics and professional experiences	Number (%)
Gender	
Female	331 (62%)
Male	203 (38%)
Grade level taught	
Kindergarten	4 (0.7%)
Elementary school	236 (44%)
Middle school	209 (39%)
General high school	63 (12%)
Vocational high school	20 (4%)
Subject taught	
Chinese language	143 (27%)
Mathematics	99 (19%)
English language	81 (15%)
Natural science	83 (15%)
Social science	84 (16%)
Others	137 (26%)
Highest diploma/degree attained	
High school	1 (0.2%)
Junior college	10 (2%)
Bachelors	472 (88%)
Masters	50 (9%)
Professional title	
N/A	39 (7%)
Third-grade teacher	10 (2%)
Second-grade teacher	141 (26%)
First-grade teacher	276 (52%)
Senior teacher	67 (13%)
Senior professor	1 (0.2%)
Years of teaching experience (mean=14.63)	
1–10 years	213 (40%)
11–20 years	183 (34%)
21–30 years	98 (18%)
Above 30 years	38 (7%)
Leader of teaching-research group	61 (11%)
Leader of a grade	39 (7%)
Leader of lesson-preparing group	92 (17%)
School types: public/private	
Public school	517 (97%)
Private school	17 (3%)
School types: rural/urban	
Rural school	188 (35%)
Urban school	346 (65%)
City	
Shanghai	268 (50%)
Hangzhou	89 (17%)
Wenzhou	79 (15%)
Jiaxing	98 (18%)

* A teacher probably instructs several subjects at school

Confirmatory Factor Analysis

CFA with maximum likelihood parameter estimation was performed for the validation sample to test the factor structure identified in EFA. The six-factor model demonstrated an acceptable fit to the data (χ^2/df=2.36, CFI=0.91, TLI=0.90, SRMR=0.046, RMSEA=0.072).

Some adjustments were made to improve the model fit. Model modification indices were assessed (Norwegian Social Science Data Services 2013). Item 4 and item 28 were excluded as they loaded on multiple factors. The specification of correlated measurement error was added to items 9 and 10, items 9 and 11, items 10 and 11, items 15 and 16, items 23 and 26, and items 39 and 40.

The revised model fits well with the data (χ^2/df=1.77, CFI=0.95, TLI=0.95, SRMR=0.037, RMSEA=0.055). The difference between the Bayesian Information Criterion (BIC) of the original model and the BIC of the revised model was much larger than 10, which showed extremely strong support for the revised model (Raftery 1995). Moreover, this present model did not compromise the integrity of the scale conceptually. As shown in Table 3, the retained model included 32 observational variables on six latent variables. The scale consisted of four to seven items per factor, balancing statistical strength with parsimony (Costello and Osborne 2005). The amended scale can be found in Appendix.

Internal Consistency

The internal consistency and reliability analysis of the six-factor scale with 32 items was assessed via Cronbach's alpha. The values of Cronbach's alpha for each subscale are 0.91 (association leadership), 0.96 (professional learning leadership), 0.90 (assessment leadership), 0.96 (instruction leadership), 0.94 (community leadership), and 0.92 (policy leadership), respectively. The results are considered to be sufficient. The overall reliability of all 32 items is equal to 0.98, which is also located at an appropriate level (Comrey and Lee 1992).

Characteristics of Teacher Leadership in China

The means, standardized deviations, and correlation matrix of factors for the whole sample are reported in Table 4. The mean of association leadership is the highest, the mean of assessment leadership is the second highest, and the other four are relatively low.

Table 2 Factor loadings from exploratory factor analysis

Item	Factor 1: professional learning leadership	Factor 2: association leadership	Factor 3: instruction leadership	Factor 4: policy leadership	Factor 5: community leadership	Factor 6: assessment leadership
1		0.61				
2		0.62				
3		0.82				
4		0.79				
5		0.70				
6		0.60				
7		0.60				
9	0.70					
10	0.65					
11	0.70					
12	0.63					
13	0.47					
14	0.63					
15	0.61					
16						0.53
19						0.71
20						0.67
21						0.58
22			0.52			
23			0.68			
24			0.62			
25			0.64			
26			0.64			
27			0.59			
28					0.42	
29			0.47			
30					0.63	
31					0.66	
32					0.65	
33					0.68	
36				0.60		
38				0.62		
39				0.65		
40				0.65		
Total variance explained	14%	12%	12%	12%	12%	11%

Conclusion and Discussion

Responding to the recent call for the development of teacher leadership measures (Wenner and Campbell 2017), the present study distilled a six-factor teacher leadership model and developed the corresponding scale from the extant theories and models. The six factors of the model are association leadership, professional learning leadership, assessment leadership, instruction leadership, community leadership, and policy leadership. They catch hold of common ground of influential models and frameworks for teacher leadership (Center for Strengthening the Teaching Profession 2018; Center for Teaching Quality et al. 2014; Jackson et al. 2010; Teacher Leadership Exploratory Consortium 2012; Wenner and Campbell 2017; York-Barr and Duke 2004).

The data from Chinese teachers are used to explore the reliability and validation of the scale and examine the six-factor model. Our findings indicate that the scale represents a valid and reliable research-based measure of teacher

leadership. This scale shows a high level of construct validity, as demonstrated by a strong theoretical grounding in the previously mentioned research literature (Center for Strengthening the Teaching Profession 2018; Center for Teaching Quality et al. 2014; Jackson et al. 2010; Teacher Leadership Exploratory Consortium 2012; Wenner and Campbell 2017; York-Barr and Duke 2004) and strong patterns within the data set. EFA and CFA yielded an interpretable six-factor solution, namely that items developed to measure the same construct were grouped together into an interpretable factor solution. Internal consistency was high for each of the six factors and for the entire instrument, which indicated that each subscale and the whole scale are reliable.

Features of Teacher Leadership and Their Cause of Formation in China

The vast majority of existing studies on teacher leadership have focused on Western contexts (Wenner and Campbell 2017; York-Barr and Duke 2004). The theoretical and empirical meaning of teacher leadership in Asian settings, especially China, has largely been ignored. Although the concept of teacher leadership does not attract much attention in China, it does not mean that teacher leadership does not exist in China. In fact, in Chinese schools, it is very common to see that teacher serves as leaders in professional learning communities, such as directors of disciplines, backbone teachers, and senior teachers serving as mentors for younger teachers. They all play the leading

Table 3 Standardized model results from confirmatory factor analysis

Factor	Item	Factor loading	Standard error	Residual variance
Association leadership	1	0.80	0.03	0.35
	2	0.78	0.02	0.37
	3	0.77	0.03	0.41
	5	0.77	0.03	0.40
	6	0.85	0.02	0.27
	7	0.87	0.02	0.24
Professional learning leadership	9	0.84	0.02	0.30
	10	0.83	0.02	0.31
	11	0.84	0.02	0.30
	12	0.89	0.01	0.21
	13	0.90	0.02	0.19
	14	0.86	0.02	0.25
	15	0.86	0.02	0.27
Assessment leadership	16	0.88	0.02	0.22
	19	0.89	0.01	0.21
	20	0.89	0.02	0.21
	21	0.70	0.03	0.51
Instruction leadership	22	0.87	0.02	0.25
	23	0.86	0.02	0.26
	24	0.87	0.02	0.25
	25	0.92	0.01	0.16
	26	0.91	0.01	0.18
	27	0.92	0.01	0.15
	29	0.83	0.02	0.32
Community leadership	30	0.84	0.02	0.30
	31	0.89	0.02	0.22
	32	0.91	0.01	0.17
	33	0.92	0.01	0.15
Policy leadership	36	0.86	0.02	0.25
	38	0.91	0.01	0.18
	39	0.85	0.02	0.28
	40	0.84	0.02	0.29

Table 4 Correlation matrix, means, and standard deviations of factors

Factor	1	2	3	4	5	6
Association leadership						
Professional learning leadership	0.68**					
Assessment leadership	0.69**	0.81**				
Instruction leadership	0.61**	0.80**	0.76**			
Community leadership	0.60**	0.76**	0.73**	0.83**		
Policy leadership	0.54**	0.75**	0.70**	.83**	0.83**	
Mean	3.32	2.87	3.13	2.85	2.81	2.71
SD	0.61	0.85	0.71	0.80	0.87	0.89

**$p<0.01$

roles in schools, and dedicate themselves to teaching and influencing their colleges gradually. Previous studies have found that while these teacher leaders play a similar role in Western contexts, those in the Chinese context exhibit their own unique characteristics that are influenced by the Chinese cultural and educational systems (Zeng et al. 2014). Therefore, investigating teacher leadership practice in the Chinese context can enrich knowledge in the field and provide an enlightening comparison for other countries.

This study finds that K-12 teachers in China have strong association leadership. Generally, the frequency of their association leadership behavior is more than "usual." Compared to Western countries, the contemporary China prefers to emphasize collectivism culture, in which collective interest is considered more important than personal interest (Tan 2013, p. 210). Therefore, it is easily understood that school leaders and school climate are also used to stress the importance of team goals and collaborative activities (Sargent and Hannum 2009). These cultural and institutional factors may have a strong influence on teachers' daily behavior (Zhang and Pang 2016). Future quantitative studies may include these variables and examine the associations.

The participants in the present study also showed up relatively strong assessment leadership. The examination culture prevails throughout Chinese history (Brown and Wang 2016; Pong and Chow 2002). The lower and middle classes consider high-stakes examinations to be one of the most important opportunities to promote upward mobility, and the advantaged classes consider them as an important way to maintain class status. Under this kind of social context, the most important assessment standard for teachers' working performance is often to see how well their students perform on various tests (Chen and Lu 2010; Lee et al. 2011; Yan 2015). Our study further confirms that Chinese teachers are used to assisting and supporting their colleagues in terms of assessment and evaluation.

It is the results-oriented culture and system that can explain why professional learning leadership and instructional leadership are lower than assessment leadership in the present study. Although professional learning may increase teachers' professional ability and instructional improvement may increase students achievement, teachers have to adjust their time and effort distribution to the whole culture and system that pays much more attention to examination results than educational process. Additionally, previous studies pointed out (Chen and Lu 2010; Wang and Hong 2019) that backbone teachers tended to demonstrate strong leadership in professional learning and instruction improvement. However, only 13% of participants in the present study is senior teacher, and the percentages of being leaders of teaching-research group, lesson-preparing group, and grade group are 11%, 17%, and 7%, respectively. The low percent of backbone teachers can be another underlying reason.

The top-down educational administration system in mainland China (Hu and Gu 2012; Lu and Chen 2007) may account for the relatively low policy leadership identified by this study. Among this system, governments at all levels and school principals are leaders of teachers, whereas teachers are used to play the role of followers. The present study also found that participants' community leadership was low, which is consistent with previous study (Gao and Zhu 2016). Although Chinese teachers admit the importance of family education, the cooperation between communities and teachers usually are arbitrary, passive, and marginal.

Limitations

The questionnaire employed in this study shows the potential to be a useful instrument in measuring teacher leadership, but some limitations need to be taken into account when using the questionnaire and interpreting the results. First, the questionnaire was administrated in Chinese, so future research needs to validate the scale in other languages to establish the degree of validity and reliability of the instrument across linguistic borders. In the present

study, the definition, dimensions, and items of teacher leadership were influenced by literature in English, so the current scale has the potential to be applicable to non-Chinese contexts. However, as a social concept, teacher leadership is likely to be influenced by cultural characteristics and the local educational landscape, so it will be necessary to evaluate the structure and functioning of the instrument in different countries. The scale is possibly more applicable in Asian countries and regions that share similar culture and thinking patterns with China.

Second, this study adopts a convenience sample method. The participants are from Shanghai City and three prefecture-level cities (Hangzhou, Wenzhou, and Jiaxing) in Zhejiang Province. China has four municipalities (e.g., Shanghai City) and 293 prefecture-level cities with a wide range of economic and social differences (Ministry of Civil Affairs of the Peoples' Republic of China 2019), however, the Gross Domestic Product (GDP) of all four cities included in this study is ranked within top 15% (Twenty-One Data News Laboratory 2019). Hence, future research may sample from different cities or use a nationally representative sample to validate the instrument and examine whether the development of teacher leadership is the same across the country.

Contributions

The present study offers new contributions to the field of teacher leadership. The debate regarding which dimensions teacher leadership includes always existed in previous theoretical and qualitative studies (e.g., Center for Strengthening the Teaching Profession 2018; Center for Teaching Quality et al. 2014; Jackson et al. 2010; Teacher Leadership Exploratory Consortium 2012; Wenner and Campbell 2017; York-Barr and Duke 2004). The present study analyzed and compared the relevant discussions in previous studies, summarized their common ground, and proposed a six-factor teacher leadership model. The six factors are association leadership, professional learning leadership, assessment leadership, instruction leadership, community leadership, and policy leadership. Moreover, the analysis of the data from Chinese teachers supports the six-factor model. Our finding can provide empirical evidence for the question of which dimensions are included in teacher leadership.

The majority of the existing teacher leadership research is qualitative-based (Wenner and Campbell 2017; York-Barr and Duke 2004), so this field needs more quantitative studies. Furthermore, among the existing quantitative studies, the measurement instruments of teacher leadership (Adams and Gamage 2008; Cheng 2009; Galland 2008; Hanuscin et al. 2012; Leithwood and Jantzi 1999; Smylie and Denny 1990; Tsai 2017) need improvement. Consequently, the present study developed a measurement instrument underpinned by important theories and models of teacher leadership, aiming to make abstract concepts of teacher leadership more concrete, operable, and measurable. Moreover, our evidence suggests that the instrument is valid and reliable. Validated teacher leadership instrument affords educators and researchers a diagnostic tool that can be used to assess the status quo and uncover problems. This kind of evidence is particularly important for teachers' professional development and school improvement. In addition, quantitative research builds on high-quality measurement instruments. The instrument developed and validated in this study can motivate more high-quality quantitative studies in the field of teacher leadership.

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Appendix

Amended 32-item teacher leadership scale

Association leadership.

1. I demonstrate effective communication skills when working with colleagues.
2. I help to resolve conflicts between colleagues.
3. I assist in cultivating good colleague relations.
5. I help other colleagues to treasure merits of every colleague.
6. I motivate team members to work from their strengths.
7. I promote the realization of shared goals.

Professional learning leadership

9. I assist colleagues in applying research findings of external experts.
10. I help colleagues to combine day-to-day educational practices with academic theories.
11. I support colleagues in conducting cooperative studies with the higher education or other research organizations.
12. I identify the diverse learning needs of colleagues and promote varied professional learning.
13. I help my school to implement activities related to teachers' professional development.
14. I communicate with school administrators to ask for more professional learning time of teachers.
15. I communicate with school administrators to ask for more training opportunities of teachers' professional development.

Assessment leadership

16. I work with colleagues to assess the quality and effects of professional learning.
19. I support colleagues in collecting student performance data.
20. I help colleagues to improve instructional practices by analyzing student achievement.
21. I communicate with families about their children's learning and assessment.

Instruction leadership

22. I create learning groups to improve colleagues' instruction.
23. I model classroom teaching practices for colleagues.
24. I observe colleagues' classroom teaching and provide suggestions for them.
25. I facilitate colleagues' reflection on their instructional practices.
26. I lead colleagues to pay attention to differentiated backgrounds and needs of students.
27. I assist colleagues in designing appropriate teaching strategies for varied students.
29. I discuss how to improve instruction with team members.

Community leadership

30. I have positive interactions with families and community members.
31. I ask families and community members to offer help for student development.
32. I model and teach communication and collaboration skills with families for colleagues.
33. I facilitate colleagues' positive interactions with families and the community.

Policy leadership

36. I appeal for more financial, human and other resources used to support teacher development.
38. I seek recognition and support for the profession in contexts outside of the classroom.
39. I participate in policy-making concerned with teachers' job in the school.
40. I facilitate colleagues' participation in policy-making in the school.

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