Contextual influence on formal and informal teacher leadership

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ARTICLE INFO

ABSTRACT

Using the 2013 Teaching and Learning International Survey data, this research employed descriptive analysis and multiple logistic regression with the complex survey data analysis approach (resampling with Balanced Repeated Replicate weights), in order to reveal the variations in overall informal and formal teacher leadership, and for different leadership dimensions, respectively, as well as the contextual influence on teacher leadership. The results suggest that there exist significant variations between general informal and formal teacher leadership, and for each of the leadership dimensions internationally. In sum, Eastern and Nordic Europe have a greater extent of teacher leadership, compared to Asia, Latin America, and Latin Europe. There was less prevalent teacher leadership in hiring, setting teacher salary, and budget allocation in general. Formal teacher leaders often make school decisions for disciplinary policy, teacher evaluation, data analysis, and parental communication, while informal teacher leaders frequently decide on instructional content. Female, experienced, and well-educated teachers often make decisions even without positions; schools with increased minority students tend to have a greater extent of teacher leadership, while schools with disproportional poverty students have decreased teacher leadership. Using large-scale and international data, this study has provided nuanced evidence in teacher leadership with the intersection of leadership functions, positions, and contexts.

Introduction

While it is generally acknowledged that it is beneficial for schools to engage teacher leaders (Muijs & Harris 2006; Sebastian & Huang, 2017), the current evidence is limited both for the conceptualization and empirical rigour of teacher leadership. First, the concept of teacher leadership itself is ambiguous. "It is evident from the international literature that there are overlapping and competing definitions of the term teacher leadership" (Harris 2003, 315). The standpoint was reiterated in two meta-analyses of teacher leadership research (Wenner & Campbell 2017; York-Barr & Duke 2004), which found the term of "teacher leader" has been used interchangeably for both position holders as formal teacher leaders, e.g., the department head and coach, etc.; and non-position holders as informal teacher leaders, e.g., teachers lead for specific occasions but do not hold any formal positions; or both. Moreover, there are also conceptual confusions regarding what is teacher leadership? Specifically, there is limited evidence for what teacher leaders lead for with a few exceptions. For instance, Ingersoll, Sirinides, and Dougherty (2018) specified teacher leaders were often responsible for devising teaching techniques and selecting student assessment practices. While their study moved a significant step forward with large-scale data and quantitative evidence, it still used a relatively generic concept of teacher leadership, which emphasized the dynamic interactions between teacher leaders and tasks, yet failed to distinguish in-

formal teacher leaders from formal teacher leaders for their roles. The second limitation is that most teacher leadership research has provided small-scale or case by case evidence, which is problematic to be generalized (Wenner & Campbell 2017; York-Barr & Duke 2004). With all the limitations in the literature, this research is interested, through a task-oriented and operational lens, in the distinction between informal and formal teacher leadership for various school leadership responsibilities across national boundaries, critical to understanding teacher leadership with the nuances for both informal and formal teacher leadership in a broader context.

Literature review

Research supports that school leadership is only second to classroom teaching in terms of the effect on student learning outcomes (Leithwood, Day, Sammons, Harris, & Hopkins et al. 2006), and the effect size of school leadership on student performance is approximately 0.25 (Marzano, Waters, & McNulty 2005). In addition, research evidence is logically persuasive that the effects of school leadership on student learning is indirect, through influential and direct impacts on instruction, teacher attributes, school condition, and process, etc. (Leithwood, Sun, & Schumacker 2019). While the early model and framework of school leadership highlighted the roles of school principals in pursuing schools' instructional effectiveness (Hallinger & Mur-

phy 1985; Weber 1996), more recent literature advocates that principals need to share leadership in order to improve organizational capacity for improved learning (Goddard, Goddard Kim, & Miller, 2015; Marks & Printy 2003).

Who are teacher leaders?

The concept of teacher leadership argues it is legitimate that teachers join principals to lead for school success (Muijs & Harris 2006; Crowther, Ferguson, & Hann 2009). Since the composition of teacher leaders and the role they play vary in socially and academically diverse contexts, there is no convinced definition for teacher leadership in the literature (Wenner & Campbell 2017; York-Barr & Duke 2004; Harris 2003). Teacher leaders could be position holders like the department chair, or full-time classroom teachers without a formal position while assuming leadership responsibilities under certain circumstances (Hunzicker 2018; Margolis 2012). A meta-review by Wenner and Campbell (2017) provided a definition that partially reflects the imperfection for the concept. They defined teacher leaders as "teachers who maintain K-12 classroom-based teaching responsibilities, while also taking on leadership responsibilities outside of the classroom" (p. 140). From this definition, it is apparent that teacher leaders lead while teaching, but it is ambiguous for whether and which leadership responsibilities teacher leaders are responsible for with and without positions, and the variations in diverse settings. The new evidence needs to move from only task-oriented or position-focused teacher leadership to integrate both in a way examining the dynamic interactions between teacher leaders (with or without positions) and tasks, with a consideration of contextual variations. Such evidence will help understand teacher leadership more systematically because "leadership can be separated from person, role and status" (Harris 2003, 318).

What is teacher leadership?

Moving beyond the question of who are teacher leaders, the interests also center around what do teacher leaders lead. To another word, what is teacher leadership? Drawing from key literature, York-Barr and Duke (2004) specified the Dimensions of Practice for teacher leaders, which include coordination, school or district curriculum work, developing colleagues, participation in school change/ improvement, parent and community involvement, contributions to the profession, and pre-service teacher education. Hairon and Goh (2015) highlighted three teacher leadership dimensions as: (1) building collegial and collaborative culture, (2) promoting teacher development and learning, and (3) enabling change in teachers' teaching practices. Leithwood and his colleagues (2007) provided the qualitative evidence in a study for distributed leadership that teachers are frequently involved in developing people, managing instruction, and designing organizations to coordinate collaborations. Katzenmeyer and Moller (2009) assigned teacher leadership with three main facets: (1) leadership of students or other teachers including the role as coach, mentor, curriculum specialist and leading professional development, etc.; (2) leadership of operational tasks for school operation and organizational tasks, through roles as department head or the member of task forces; (3) leadership through decision making or partnership. Day and Harris (2002) suggested four discrete but discernible teacher leadership dimensions. The first dimension translates the school improvement into individual classrooms, which the authors argue to be the central responsibility for a teacher leader. A second dimension focuses on participative leadership, where all teachers are held accountable for the change with a strong sense of ownership. The third teacher leadership dimension specifies that teacher leaders are imperative sources of expertise and information, and teachers often inform the decision making directly or indirectly. The last and most important teacher leadership dimension is to foster positive school climate and establish good relationships among teachers through which collaborative learning could take place. Other researchers have also identified dimensions of the teacher leadership role, such as peer classroom observation or establishment collaborative culture (Little 1995; Lieberman & Miller 2011).

Summarizing these essential teacher leadership dimensions in the literature, it is apparent that teacher leaders often lead with tasks that are closely aligned with their expertise for instructional improvement and collective teacher professional learning, which are vital steps for schools to achieve success (Muijs & Harris 2006; Wenner & Campbell 2017). Teacher leaders are, in the first place, expert teachers, who spend time in classrooms but take on various leadership roles under different circumstances (Lieberman & Miller 2011; Ingersoll et al., 2018). However, the evidence is very limited regarding whether and to what extent teacher leaders lead for an even broader scope of leadership responsibilities like hiring, budgeting, managing student affairs, and engaging parents in different settings; and whether and to what extent teacher leaders with or without positions lead for different leadership roles.

Contextual influences on school leadership

Schools are organizational clusters where people work collectively to fulfil common goals (Bolman & Deal 2017), and researchers argue that school leadership is manifested through reflecting both external and internal values so once size does not fit all (Bush 2018). Therefore, it is essential to take contexts into consideration, in order to fully understand school leadership operation and effects (Porter & McLaughlin 2006; Lee & Hallinger 2012). Empirically, researchers found principal time use and allocation (Lee and Hallinger 2012), distributed leadership in terms of who is responsible for making schools decisions (Liu 2020), instructional leadership and professional learning community (Moos, Johansson, & Day 2011; Day 2011), teacher leadership and the interaction with principal leadership (Printy & Liu 2020) could vary significantly in different national contexts. The operationalization of context, through many years of research, has been layered. First and foremost, the societal value, regulation, and convention profoundly impact how leadership is perceived and practiced. The famous GLOBE study (House, Hanges, Javidan, Dorfman, & Gupta, 2004) defined cultural dimensions in order to illustrate preferred leadership and practices aligned with societal values in ten different cultural clusters. In addition, educational policy exerts fundamental impact on how school leadership is defined, structured, and practiced (Day 2011; Printy & Liu 2020). Meanwhile, school contexts, including who the school serves could also substantially outline school leadership (Stipek 2012; Porter & McLaughlin 2006). The operationalization of the national context, using large scale international data, include the gross national income (GNI) per capita GINI index, etc. (Luschei & Jeong 2018). Though such operationalization is not ideal, it helps differentiate educational system at the national levels.

Conceptual framework and research questions

The literature review suggests that teacher leadership has gained momentum while educational leadership research emphasis shifts from an individual leader to collective capacity of a group of leaders, however, the concept and the operationalization of teacher leadership are still underdeveloped due to complexity in measuring teacher leadership practices. The operational dimensions of teacher leadership, summarized by York-Barr and Duke (2004) a decade ago still has not gained much empirical evidence (Wenner & Campbell 2017). Such limitation in teacher leadership research calls for more empirical evidence to advance teacher leadership theory and practices.

First of all, this research is particularly interested in the extent to which informal and formal teacher leaders are responsible for different leadership dimensions, respectively, in an international context. Formal teacher leaders, defined in the literature, are those teachers who hold formal positions as members of a school's management team. Informal teachers are explicitly defined for non-position holders whose

primary role remains within the classroom. School leadership dimensions or responsibilities are broad in this study by summarizing those dimensions identified by previous research (Day & Harris 2002; Hairon & Goh 2015; Katzenmeyer & Moller 2009; Little 1995), which includes hiring and salary decision, budget allocation, student disciplinary policy, student admission, managing instruction, developing people, student performance data analysis, and parental communication. In addition, the research is interested in understanding teacher leadership in different situations, and reveal whether teacher characteristics and other contextual variables are deterministic for teacher leadership. As called by Wenner and Campbell (2017) in the most recent meta-review of teacher leadership, there needs large-scale and cross-case quantitative research evidence to operationalize teacher leadership. Specifically, this research tried to answer:

1. What is the extent of informal and formal teacher leadership in general in different countries?
2. What is the extent of informal and formal teacher leadership for each leadership responsibility in different countries?
3. What is the extent to which formal and informal teacher leadership are related to the country, school, and teacher-level factors?

Data and methods

Data source

In this study, the researcher used the data from the 2013 Teaching and Learning International Survey (TALIS 2013), administered by the Organization for Economic Cooperation and Development (OECD). The TALIS 2013 study employed two different questionnaires for the school leader and teachers at four grade levels, respectively, including elementary, lower secondary, secondary, and the schools that also participated in 2012 PISA (Program for International Student Assessment) study. This research used the lower secondary level survey data collected from both the school leader and teachers, given this level had all countries participated. There are 34 countries/regions in total from the 2013 TALIS lower secondary level, while the data from Iceland and Cyprus are not publicly available, thus, the final dataset has 104,358 teachers nested in 6045 schools within 32 countries. Please refer to Appendix A for the total number of schools in each country, and the sample size for schools and teachers, respectively.

As a large-scale and multi-country study, the research team employed a two-stage stratified sampling method, which first selected 200 schools within each country, then randomly selected 20 teachers within the sampled school (OECD 2014). Since the selection probability varies for each sample unit due to the stratified sampling approach, the TALIS research team calculated weights included in the dataset to compensate for unequal selection probability and varied response rates. Since this study used both surveys, the final weights included in both the leader and teacher datasets were applied for the analysis.

Variables and coding

Teacher leadership

In the school leader survey, there are questions reported by school leaders with binary responses (yes/no) indicating whether a specific group were responsible for each of the school leadership responsibilities.

As listed in Table 1, for the question 18 and 28 in the 2013 TALIS leader survey, each item has five sets of corresponding answers indicating whether a particular group holds the leadership responsibility (yes/no). The choices included principals, formal teacher leaders, informal teacher leaders, governing board, and external authority. This research only selected the two groups of teacher leaders given the interest of the study. The 17 survey items were organized in nine leadership dimensions based on the literature review. While it should be very interesting to compare different perspectives between teachers and principals

for teacher leadership, it is unfortunate that the teacher survey did not include the same items. In addition, the school principal maneuvers a school's leadership mechanism, so the principal should be able to report teacher leadership in a holistic manner.

Other variables

In addition to the teacher leadership variables, this study also included several country and school contextual and teacher characteristics variables. Country contextual variables include gross national income (GNI) per capita measured in 2012 U.S. dollars, and 2012 GINI index. The GINI index measures income inequity for a country ranging from 0 to 1. The number closer to 1 represents larger income inequality. The data were retrieved from word bank database. School variables include public school (yes vs no), size (number of students enrolled), and the proportion of minority and low socio-economic students (1 = none, 2 = 1%~10%, 3 = 11%~30%, 4 = 31%~60%, 5 = more than 60%), all school-level variables were included in the TALIS principal survey. Teacher characteristics include teachers' gender as female (yes 1/no 0), experience and educational level. The descriptive statistics for all variables used in the model are included in Appendix B with the sample available for each item.

Data analysis

Complex survey data analysis

This section explains the procedure for data analysis. Using a two-stage stratified sampling method, the 2013 TALIS collected the complex survey data with unequal selection probability and a nested structure, which leads to increased Type I error (Raudenbush & Bryk 2002) if analyzing the data assuming a random sampling approach was applied. The primary methods are either design-based or model-based approach to analyze complex survey data (Hahs-Vaughn, McWayne, Bulotsky-Shearer, Wen, & Faria, 2011). The basic idea behind the design-based method, like resampling using replicated weights, is that, in random sampling, the variability between repeated samples (which defines the sampling variance) can be simulated by repeatedly taking random and unbiased sub-samples (or 'replicates') from the achieved sample, and then measuring the variability using the sub-samples. Survey weights are incorporated into the analysis to ensure that each sampled school and teacher are weighed appropriately to represent the population. A replication method using Balanced Repeated Replicate (BRR) weights was suggested by the TALIS research team to estimate parameter, which took account of unequal selection probability and varied response rates. This method is well documented in the complex survey data analysis literature (Wolter 2007).

Analytical approach used for each research question

For the first research question regarding overall informal and formal teacher leadership across participating countries, this study constructed two latent variables to measure informal and formal teacher leadership using Mplus 7 software. All items listed in Table 1 were utilized for the interested groups, respectively. The latent variables were estimated by specifying "country" and "school" as two-stage clusters, and variables as categorical because all the items are dichotomous variables (Muthén 1984). School-level weights were applied because the items were retrieved from the school leader survey. The construct incorporated covariance between items if they have a great extent of correlation as suggested through model tests.

While above latent variables could provide the overall extent of both informal and formal teacher leadership, it does not depict the nuances for the interactions between teacher leaders and specific tasks. Therefore, for the second research question, the researcher also estimated the population mean for each of the leadership responsibility led by either informal or formal teacher leaders. The population mean was estimated using the design-based approach by specifying the two-stage stratified sampling procedure (schools sampled within the county and teachers

Table 1
Questions used for teacher leadership variables.

Regarding this school, who has a significant responsibility for the following tasks? (principal, management team, teachers, governing board, external authority)		
Leadership Dimensions	Item	Description
Hiring	TC2G18A	Appointing or hiring teachers
	TC2G18B	Dismissing or suspending teachers from employment
Salary setting	TC2G18C	Establishing teachers' starting salaries, including setting pay-scales
	TC2G18D	Determining teachers' salary increases
Budgeting Allocation	TC2G18E	Deciding on budget allocations within the school
Disciplinary Policy	TC2G18F	Establishing student disciplinary policies and procedures
Admission	TC2G18H	Approving students for admission
Managing Instruction	TC2G18G	Establishing student assessment policies
	TC2G18I	Choosing which learning materials are used
	TC2G18J	Determining course content, including curricula
	TC2G18K	Deciding which courses are offered
Teacher Evaluation and	TC2G28A	Direct observation of teaching
Development	TC2G28B	Managing student surveys about teaching
	TC2G28C	Assessments of teachers' knowledge
	TC2G28E	Discussion of teachers' self-assessments of their work
Performance Data Analysis	TC2G28D	Analysis of students' test scores
Parental engagement	TC2G28F	Discussion about feedback received by parents or guardians

Note: TC2G28A5-F5 and TC2G18A3- TC2G18A3 were used for informal teacher leaders
TC2G28A3-F3 and TC2G18A2- TC2G18A2 were used for formal teacher leaders

sampled within the school), and adding 100 Balanced Repeated Replicate (BRR) weights.

For the third research question regarding what teacher, school and country factors might be related to the extent to which informal and formal teacher leaders are responsible for leading, multiple logistic regression was applied. The outcome variables are all binary variables, multiple logistic regression, therefore, is appropriate where a set of explanatory variables are related to a binary dependent variable (Menard 2018).

The equation for the multiple logistic regression is detailed as following. The logistic formulas indicate with the probability that $Y = 1$, which is referred to as $\hat{p}$. The probability that $Y = 0$ is $1 - \hat{p}$. The ln symbol refers to a natural logarithm, and $\beta_0 + \beta_1 C + \beta_2 S + \beta_3 T$ is the equation for the regression, where C refers to GNI and GINI index at the country level, S for public school (yes/no), size, and student composition at the school level, and T stands for teacher gender, experience, and educational background at the teacher level. In addition, the design-based approach was used to adjust standard errors by using complex survey data setting and resampling with 100 balanced repeated replicate weights when fitting the models.

$$\ln\left(\frac{\hat{p}}{1-\hat{p}}\right) = \beta_0 + \beta_1 C + \beta_2 S + \beta_3 T$$

Findings

This section reports the statistical findings in order to answer each of the three research questions.

Overall Informal and Formal Teacher Leadership

Table 2 has the descriptive statistics of the latent variables estimated regarding the overall informal and formal teacher leadership for the 32 countries, respectively.

The model fit for informal teacher leadership has CFI as 0.962, TLI as 0.940, and RMSEA as 0.004. And for formal teacher leadership construct, the model fit indices are CFI at 0.983, TLI at 0.974, and RMSEA at 0.004. These indices demonstrated a satisfactory model fitted to the data, as the threshold conventionally accepted in the literature is for CFI and TLI larger than 0.90 and RMSEA smaller than 0.08 (Hu & Bentler 1999).

The latent variables are standardized. When organizing all the countries in a two-way quadrant as shown in Fig. 1, which has zero as the midpoint for both formal and informal teacher leadership, it is

more obvious to observe that among the 32 countries/regions, 14 countries/regions, including Latvia, Netherlands, England, Slovak Republic, Singapore, Czech Republic, Estonia, Australia, Israel, Denmark, Bulgaria, Norway, Alberta (Canada), have both informal and formal teacher leadership above average; Nine countries/regions have above-average informal teacher leadership, and these countries/regions are Italy, Flanders (Belgium), Korea, Romania, Croatia, Poland, Serbia, Sweden, and Finland. Two countries (Chile and Brazil) have high extent of formal teacher leadership only. Lastly, eight countries have below-average score for both formal and informal teacher leadership, which includes the United States, Malaysia, Japan, Spain, Portugal, Mexico, France, and Abu Dhabi (United Arab Emirates).

Informal and formal teacher leadership for each leadership task

The second research question was answered by specifying the extent of informal and formal teacher leadership in each leadership dimension. The results of the simulated population mean in Table 3 revealed that formal teacher leaders, across all the countries, are more likely held accountable for school leadership responsibilities than informal teacher leaders. They are often the decision makers for developing disciplinary policy, establishing student assessment policies, choosing learning materials, observing teaching, discussing evaluations with teachers, analyzing student performance data, and communicating with parents. Meanwhile, informal teacher leaders could take responsibilities for choosing learning materials, determining course content, analyzing student performance data, and communicating with parents.

While the summative statistics are fairly interesting, the researcher is additionally interested in teacher leadership specifications in different countries. As shown in Appendix D and E, there are significant variations in informal and formal teacher leadership for each leadership dimension across the 32 countries. It is more consistent that informal teacher leaders are less responsible for hiring and dismissing teachers, deciding teacher salary and increase, and budget allocation, though there are outliers that Denmark and Netherlands often have both formal and informal teachers involved for hiring new teachers. In addition, there is less consistency in other teacher leadership dimensions across countries. The researcher actually anticipated an emerged pattern of teacher leadership in certain countries/regions potentially based on student performance, economic standings, or cultural preference of leadership etc., but such homogeneousness was not observed obviously through the descriptive statistics.

Table 2
Informal teacher leadership and formal teacher leadership.

Informal Teacher Leadership				Formal Teacher Leadership			
Country	mean	SD	SE	Country	mean	SD	SE
Estonia	0.977	0.702	0.013	Latvia	1.082	0.801	0.018
Latvia	0.799	0.942	0.021	Netherlands	0.997	0.829	0.020
Denmark	0.741	0.673	0.018	England (UK)	0.954	0.548	0.011
Italy	0.683	0.616	0.011	Singapore	0.899	0.585	0.011
Czech Republic	0.679	0.749	0.013	Slovak Republic	0.881	0.798	0.014
England (UK)	0.639	0.768	0.016	Czech Republic	0.835	0.796	0.014
Slovak Republic	0.616	0.830	0.014	Estonia	0.810	0.895	0.016
Serbia	0.565	0.644	0.011	Australia	0.730	0.638	0.015
Poland	0.512	0.672	0.011	Israel	0.574	0.569	0.010
Netherlands	0.495	0.603	0.014	Denmark	0.556	0.738	0.020
Norway	0.424	0.775	0.017	Chile	0.398	1.053	0.028
Finland	0.413	0.703	0.013	Bulgaria	0.281	0.475	0.009
Bulgaria	0.349	0.820	0.015	Norway	0.206	0.800	0.017
Sweden	0.317	0.573	0.010	Alberta (Canada)	0.070	0.786	0.019
Croatia	0.302	0.662	0.011	Brazil	0.058	0.699	0.006
Romania	0.267	0.789	0.014	Italy	-0.010	0.741	0.013
Australia	0.173	0.902	0.021	Abu Dhabi (Unite	-0.010	0.951	0.022
Korea	0.166	0.886	0.017	United States	-0.045	0.823	0.020
Alberta (Canada)	0.152	0.739	0.018	Malaysia	-0.128	0.592	0.011
Singapore	0.099	0.838	0.016	Flanders (Belgium)	-0.136	0.767	0.014
Israel	0.059	0.851	0.015	Japan	-0.178	0.699	0.012
Flanders (Belgium)	0.051	0.562	0.011	Korea	-0.185	0.887	0.017
Spain	-0.043	0.538	0.009	Spain	-0.232	0.713	0.012
Portugal	-0.063	0.665	0.011	Poland	-0.260	0.906	0.015
United States	-0.073	0.886	0.022	Portugal	-0.265	0.705	0.012
France	-0.093	0.615	0.012	Serbia	-0.340	0.814	0.013
Brazil	-0.169	0.781	0.007	Croatia	-0.349	0.775	0.013
Chile	-0.183	0.897	0.024	Romania	-0.351	0.641	0.011
Malaysia	-0.249	0.646	0.012	Mexico	-0.352	0.777	0.014
Japan	-0.312	0.700	0.012	France	-0.469	0.726	0.014
Mexico	-0.388	0.681	0.012	Sweden	-0.575	0.925	0.017
Abu Dhabi	-0.425	0.775	0.018	Finland	-0.647	0.745	0.014
Total	0.194	0.823	0.003	Total	0.095	0.894	0.003
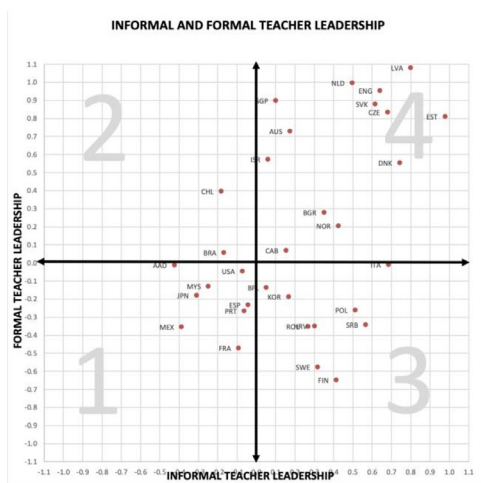
Chile, Brazil	Latvia, Netherlands, England, Slovak Republic, Singapore, Czech Republic, Estonia, Australia, Israel, Denmark, Bulgaria, Norway, Alberta (Canada)
United States, Malaysia, Japan, Spain, Portugal, Mexico, France, Abu Dhabi (United Arab Emirates)	Italy, Flanders (Belgium), Korea, Romania, Croatia, Poland, Serbia, Sweden, Finland

Fig. 1. Informal and formal teacher leadership for the 32 countries.

Factors associated with teacher leadership

The observable variations of both informal and formal teacher leadership across leadership dimensions and countries make it rational to run multiple logistic regressions using each leadership task, rather than a composite of teacher leadership as the dependent variable.

Tables 4 and 5 have the multiple logistic regression results. For informal teacher leadership models, female and experienced teachers are more likely responsible for school leadership responsibilities in general. Compare to teachers with less than ISCED5B degrees, teachers with higher degrees are also more likely responsible for leading. Though

larger schools might include teachers without positions for professional development, they are unlikely invited to lead for setting salary, making disciplinary policy, student admission, or even choosing learning materials. A thought-provoking finding is that schools with more minority students tend to have increased level of informal teacher leadership, while schools with a large proportion of poverty students have decreased informal teacher leadership. Schools as public, and country's GNI and GINI index do not demonstrate a consistently predictable effect on informal teacher leadership.

For formal teacher leadership, there is less consistency for teacher gender and experiences as predictors, while teachers' educational level

Table 3
Summary of teacher leadership for each of the leadership dimensions and tasks.

Leadership	Item	Item Description	Informal Teacher Leadership		Formal Teacher Leadership			
			M	BRR SE	M	BRR SE	n	N
Hiring	TC2G18A	Appointing or hiring teachers	0.08	0.01	0.25	0.01	98197	3541120
	TC2G18B	Dismissing or suspending teachers	0.01	0.01	0.12	0.01	97808	3529541
Salary-setting	TC2G18C	Establishing teachers' starting salaries scales	0.02	0.01	0.10	0.01	97391	3512270
	TC2G18D	Determining teachers' salary increases	0.03	0.01	0.10	0.01	97152	3506406
Budgeting Allocation	TC2G18E	Deciding on budget allocations within the school	0.07	0.01	0.35	0.01	97300	3510115
Disciplinary Policy	TC2G18F	Establishing student disciplinary policies and procedures	0.32	0.01	0.54	0.01	97920	3537401
Admission	TC2G18H	Approving students for admission	0.09	0.01	0.27	0.01	97729	3524678
Managing Instruction	TC2G18G	Establishing student assessment policies	0.34	0.01	0.45	0.01	96283	3448043
	TC2G18I	Choosing which learning materials are used	0.65	0.01	0.51	0.01	97846	3535766
	TC2G18J	Determining course content and curricula	0.39	0.01	0.35	0.01	97418	3519995
	TC2G18K	Deciding which courses are offered	0.29	0.01	0.42	0.01	97449	3521097
Teacher Evaluation and Development	TC2G28A	Direct observation of teaching	0.21	0.01	0.53	0.01	89168	3208107
	TC2G28B	Managing student surveys about teaching	0.23	0.01	0.42	0.01	88328	3185280
	TC2G28C	Assessments of teachers' knowledge	0.12	0.01	0.36	0.01	84510	3155764
	TC2G28E	Discussion of teachers' self-assessments of their work	0.18	0.01	0.45	0.01	88752	3182675
Data Analysis	TC2G28D	Analysis of students' test scores	0.44	0.01	0.70	0.01	88945	3190634
Parent Communication	TC2G28F	Discussion about feedback received by parents or guardians	0.33	0.01	0.60	0.01	89073	3205762

Note: the population mean was estimated using the complex survey data analysis approach by adding 100 BRR weights.
n is the sample size and N is the simulated population size through resampling

lower than ISCED5A is shown as a negative predictor preventing teachers from being formally appointed as leaders. Public schools have less formal teacher leadership compared to their private counterparts, while larger schools have more formal teacher leaders. Again, schools with more minority students have a greater extent of formal teacher leadership, while schools with more poverty students have a lower level of formal teacher leadership. At the country level, GNI and GINI index are both positive predictors of formal teacher leadership.

Discussion

Research supports teachers who possess expertise and skills are more likely engaged to lead (Wenner & Campbell 2017), which would promote their own growth (Hunzicker 2018; Margolis 2012). Since teachers tend to develop expertise in instruction and the related areas through classroom teaching experiences, they would be more likely invited to lead for instruction-related leadership tasks. A recent study confirmed such assumptions; using the data collected from 2011 to 2015 by the

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Table 4
Factors related to informal teacher leadership.

	TC2G18A3	TC2G18B3	TC2G18C3	TC2G18D3	TC2G18E3	TC2G18F3	TC2G18H3	TC2G18G3	TC2G18I3	TC2G18J3	TC2G18K3	TC2G28A5	TC2G28B5	TC2G28C5	TC2G28D5	TC2G28E5	TC2G28F5
TFEMALE	-0.15	0.07	0.25	0.24	-0.01	0.10***	-0.01	0.13***	0.24***	0.20***	0.21***	0.05	0.17***	-0.00	0.09***	0.00	0.12***
	(0.06)	(0.11)	(0.14)	(0.12)	(0.06)	(0.03)	(0.08)	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
TEXPERIENCE	-0.16	2.01***	1.92***	1.38***	0.18	0.05	-0.01	0.15***	0.15***	0.06	0.10**	-0.06	0.12***	-0.15**	0.02	-0.07	-0.01
	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ISCED5B	-0.52***	0.80	0.20	-0.36	0.04	0.02	0.12	0.15***	0.08**	0.14***	0.24***	-0.03	0.10**	-0.24***	0.07**	0.02	0.05
	(0.16)	(0.20)	(0.45)	(0.24)	(0.13)	(0.07)	(0.13)	(0.06)	(0.08)	(0.05)	(0.06)	(0.08)	(0.08)	(0.11)	(0.07)	(0.10)	(0.08)
ISCED5B	0.47***	0.93	2.64***	0.53	0.14	0.04	0.03	0.08*	-0.08*	0.11***	0.09**	0.07	0.21***	-0.14*	0.22***	0.04	0.06
	(0.12)	(0.20)	(0.30)	(0.19)	(0.12)	(0.07)	(0.15)	(0.06)	(0.06)	(0.05)	(0.06)	(0.07)	(0.06)	(0.09)	(0.07)	(0.09)	(0.08)
ISCED6	0.49***	0.20	-0.52	-1.52***	0.00	0.08*	-0.05	0.06***	0.01	0.01	0.01	0.11***	0.11***	-0.11**	0.01	0.12**	0.02
	(0.22)	(0.40)	(0.42)	(0.35)	(0.20)	(0.13)	(0.22)	(0.09)	(0.12)	(0.08)	(0.10)	(0.10)	(0.09)	(0.12)	(0.11)	(0.13)	(0.11)
SPUBLIC	-0.52*	-1.14	5.36***	1.32	0.34	0.19**	-2.49***	0.09	-0.29**	-0.42***	-0.11	-0.12	0.09	-0.27*	0.43***	0.08	0.43**
	(0.14)	(0.34)	(0.46)	(0.32)	(0.23)	(0.09)	(0.17)	(0.09)	(0.11)	(0.10)	(0.11)	(0.09)	(0.08)	(0.11)	(0.11)	(0.13)	(0.14)
SSIZE	0.17	-0.07	-8.05***	-4.44***	-0.40	-0.28**	-1.16***	-0.01	-0.23*	-0.13	-0.10	0.74***	-0.10	1.19***	-0.03	0.44***	0.22*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
SMINORITY	0.80*	-1.10	3.28**	3.24***	-0.16	0.23**	0.50*	0.41***	0.57***	0.29***	0.06	-0.14	-0.05	-0.31***	0.11	0.05	-0.13
	(0.08)	(0.15)	(0.17)	(0.14)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
SLOWSES	0.25	-7.05***	0.87	0.77	-0.62**	-0.29***	-1.07***	-0.60***	-0.76***	-0.72***	-0.48***	-0.12	-0.39**	-0.16	-0.33***	-0.34*	-0.52***
	(0.08)	(0.09)	(0.09)	(0.09)	(0.05)	(0.04)	(0.06)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)	(0.04)
GNI	-0.35	-2.41	-3.95***	-4.00***	0.43*	0.05	-1.53***	0.18**	-0.34***	0.11	-0.08	0.36***	0.13	0.12	-0.31***	0.01	-0.28**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
GINI	1.16***	-2.37	3.24***	2.26***	0.75***	-0.34***	-1.41***	-0.48***	0.03	0.46***	0.53***	0.02	-0.39***	-0.18	-0.16*	-0.00	-0.50***
	(0.77)	(1.84)	(1.06)	(0.85)	(0.64)	(0.46)	(0.71)	(0.45)	(0.47)	(0.40)	(0.49)	(0.44)	(0.49)	(0.66)	(0.44)	(0.53)	(0.54)
N	78491	78199	77792	77688	77930	78348	78086	78246	78250	78023	78038	72160	71432	68589	72029	71850	72130

Table 5
Factors related to formal teacher leadership.

	TC2G18A2	TC2G18B2	TC2G18C2	TC2G18D2	TC2G18E2	TC2G18F2	TC2G18H2	TC2G18G2	TC2G18I2	TC2G18J2	TC2G18K2	TC2G28A3	TC2G28B3	TC2G28C3	TC2G28D3	TC2G28E3	TC2G28F3
TFEMALE	-0.03	0.09	-0.03	0.09	0.04	-0.02	0.04	-0.00	0.03	-0.00	0.11***	-0.02	-0.05*	0.03	0.03	-0.02	0.05*
	(0.03)	(0.03)	(0.05)	(0.05)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)
TEXPERIENCE	0.01	0.19*	-0.41***	-0.40***	-0.06	0.04	-0.07	0.01	-0.02	-0.09*	-0.06	-0.04	0.01	-0.14**	0.14**	0.02	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ISCED5B	-0.12***	-0.21***	-0.34***	-0.43***	-0.04	-0.01	-0.07*	0.07**	-0.07**	0.00	0.13***	-0.14***	-0.18***	-0.08*	-0.17***	-0.26***	-0.12***
	(0.07)	(0.10)	(0.12)	(0.11)	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.07)	(0.06)	(0.07)	(0.07)	(0.09)	(0.08)	(0.07)	(0.07)
ISCED5B	0.10**	0.09	-0.14	-0.09	0.02	0.03	-0.11**	0.11***	-0.01	0.09**	0.11***	-0.03	-0.09**	-0.11**	0.02	-0.33***	-0.07*
	(0.06)	(0.08)	(0.11)	(0.10)	(0.06)	(0.07)	(0.06)	(0.07)	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)	(0.09)	(0.07)	(0.07)
ISCED6	0.09*	-0.25***	-0.14*	-0.23***	0.03	0.06*	-0.04	0.01	0.01	-0.02	0.06*	-0.07*	-0.08*	-0.06	0.06*	-0.12***	-0.05
	(0.13)	(0.14)	(0.12)	(0.13)	(0.11)	(0.12)	(0.08)	(0.09)	(0.09)	(0.09)	(0.10)	(0.13)	(0.13)	(0.16)	(0.11)	(0.13)	(0.12)
SPUBLIC	-1.07***	-1.60***	-2.52***	-2.22***	-0.42***	-0.41***	-1.36***	-0.58***	-0.43***	-0.65***	-0.66***	-0.25**	0.02	-0.36***	-0.20	0.06	-0.02
	(0.09)	(0.12)	(0.13)	(0.12)	(0.09)	(0.08)	(0.10)	(0.09)	(0.09)	(0.09)	(0.08)	(0.11)	(0.09)	(0.08)	(0.14)	(0.08)	(0.13)
SSIZE	0.70***	0.75***	-0.01	-0.15	0.27**	-0.10	0.38***	-0.01	0.09	-0.03	0.30**	1.08***	0.51***	0.88***	0.89***	0.83***	0.99***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
SMINORITY	0.22	-0.33	-1.71***	-1.16**	-0.15	0.45***	-0.01	0.21*	0.30**	0.21	0.22*	-0.04	0.11	-0.04	0.37***	-0.01	-0.01
	(0.06)	(0.10)	(0.13)	(0.12)	(0.05)	(0.04)	(0.06)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.05)	(0.04)	(0.04)
SLOWSES	0.62***	-0.33	-0.61	-0.79*	-0.01	-0.38***	0.14	-0.38***	0.08	-0.35**	-0.11	-0.03	-0.28**	0.24*	0.10	-0.09	-0.00
	(0.05)	(0.07)	(0.10)	(0.10)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.06)	(0.04)	(0.05)
GNI	-0.07	-0.75***	-0.28	-0.46**	0.30***	0.44***	0.44***	0.43***	0.31***	0.52***	0.64***	0.35***	-0.07	0.42***	0.17	0.50***	0.33***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
GINI	0.56***	-0.13	0.67*	0.47	0.66***	0.17*	0.08	0.11	0.14*	0.68***	0.83***	0.12	-0.27***	0.31***	0.45***	0.29***	0.23**
	(0.42)	(0.72)	(0.98)	(0.92)	(0.46)	(0.45)	(0.59)	(0.47)	(0.43)	(0.43)	(0.39)	(0.50)	(0.37)	(0.44)	(0.48)	(0.45)	(0.43)
N	78491	78199	77792	77688	77930	78373	78111	78246	78275	78023	78063	72135	71407	68589	72004	71825	72105

New Teacher Center from about 900,000 teachers in 25,000 public schools, and 16 states in the US, Ingersoll et al. (2018) found teacher leaders were more proactive for devising teaching techniques, selecting student grading or assessment practices, while less influential in setting the budget or selecting new teachers. However, the available research evidence did not distinguish formal and informal teacher leaders adequately for varied tasks in different contexts, and this study filled such a gap.

Through rigorous quantitative analyses, this study was able to answer three research questions. The first one tried to measure both informal and formal teacher leadership in general, then the second research question quantified teacher leadership, both formally and informally, more specifically for 17 leadership tasks across counties. The third question was interested in the associations among country and school contexts, teacher characteristics, and teacher leadership.

The results indicated that, first of all, there are enormous variations among countries for both informal and formal teacher leadership. While it is not strictly aligned, countries in Eastern and Nordic Europe tend to have a greater extent of teacher leadership, while countries in Asia, Latin America, Latin Europe likely have a lower level of both formal and informal teacher leadership. The finding resonates with the previous research that found regional variations in leadership distribution due to cultural preferences for leadership (Liu 2020). Teacher leaders need to be supported the recognized, so a culture that values participative, team-oriented, and autonomous leadership styles (House et al. 2004) would have more teacher leadership in general. The cultural norms, including institutional collectivism in Nordic Europe, in-group collectivism in East Europe, opposing power distance in Anglo, Germanic, and Nordic Europe (Chhokar, Brodbeck, & House 2013) might explain a greater extent of teacher leadership in the aforementioned regions. In addition, as researchers pointed out (Printy & Liu 2020; Lee, Hallinger, & Walker 2012; Moos et al., 2011), the educational policy at the national level could potential exert influence on how leadership is practiced; for instance, the US demonstrated to have a low extent of teacher leadership in general potentially due to the fact that American schools usually do not have a teacher management team, the decision is often made by a school board outside of the school. The future study within each country would delve deeper into cultural norms and educational policy, in order to explain the variations more meaningfully across countries.

As for each of the leadership dimensions and responsibilities, formal teacher leaders are more likely held accountable for leading than informal teacher leaders across all the countries, which is understandable given formal teacher leaders hold positions. The findings are consistent with the previous research in the US (Ingersoll et al., 2018) that teacher leaders are less influential in hiring, budgeting, setting salaries, and admission, while more powerful in instructional decisions, parental communication, teacher evaluation, professional development, and data analysis. But this study found, unlike American schools, formal teacher leaders are often responsible for making disciplinary policy as well. In addition, as not much evidence is available, this research adds nuances in the variations between formal and informal teacher leadership in the specific leadership tasks. The results revealed informal teacher leaders often make decisions for instructional materials and analyzing student performance data, while formal teacher leaders often decide on assessment policy, teacher evaluation, data analysis, and parental communication. Though the results from the 32 countries vary significantly, this research has provided preliminary and significant comparative results, which leaves much more opportunities for future study about the dynamic integrations among teacher leader roles and tasks.

For the third research question, this study found female and experienced teachers, and teachers with privileged degrees would more likely be responsible for school leadership informally. Larger schools would have more formal teacher leadership overall, but informal teacher leaders are often involved for professional development. This finding resonates with previous research evidence that teacher leaders, even without designated positions, usually play significant roles in teacher collective development (Wenner & Campbell 2017; Sebastian & Huang 2017; Murphy 2005). A very interesting finding from this study, also reveals the significant variations of informal teacher leadership in schools when student compositions are taken into account; schools with more minority students tend to have increased informal teacher leadership, while schools with a large proportion of poverty students have decreased informal teacher leadership in general. The findings resonate with the research from both the TALIS (Liu, Bellibas,& Printy 2018; Liu & Watson 2020) and the PISA study (Liu n.d.) in the associations between leadership practices and student compositions, and is worthy of future research. For formal teacher leadership, teacher's educational background is a significant predictor for teacher leaders to hold positions. Private and large schools have more formal teacher leadership, so do schools with a great share of minority students. But schools with disproportional low-income students would have less formal teacher leadership as well. In addition, country GNI and GINI index are both positively related to formal teacher leadership in the school. So affluent countries and countries that have larger income gaps would have more formal teacher leadership. Searching literature did not provide similar evidence, which calls for more research on the topic.

Conclusion

In an ever-changing school system that is amidst continuously increased accountability requirements globally, heroic or hierarchical leadership style has lost the ground to more inclusive and collaborative leadership models, which is argued to improve organizational capacity (Sebastian & Huang, 2017; Liu & Watson, 2020; Day & Harris, 2002). Teacher leadership, thus has gained interest from researchers and practitioners. However, the evidence regarding when and how teacher leaders lead with the school principal is still far from complete. Therefore, the terms and concepts are often interchangeably used in the literature while emphasizing on the same educational phenomenon, and caused much ambiguity and overlapping in the literature (Wenner & Campbell 2017; Harris 2003).

The results from this study are rather newfangled in terms of the distinguished roles formal and informal teacher leaders could play in an international context. When researchers and policymakers advocate for teacher leadership in general, there is no such a theoretical framework or evidence to guide for what school leadership responsibilities principals should invite teachers. Teachers might get involved to lead based on their expertise, experiences, or reputations arbitrarily because it is generally believed that teacher leaders could help improve school success. Given a heavy load teachers assume for daily teaching, nuanced evidence is desperately needed for what teacher leaders could contribute most to the school success when a collective leadership model is preferable, so teachers would not be burned out for all kinds of unnecessary leadership responsibilities. This study has provided preliminary and nuanced evidence in the direction emphasizing the intersectionality of teacher leaders' positions, leadership tasks, and contextual variations, while the next step is surely needed for the effect of such intersections.

Though TALIS data has included 17 different leadership tasks and ask specifically who leads for what, which is sufficient for conducting in-depth analysis for leadership structures, there are some essential leadership responsibilities missed from the data, for instance, setting the school direction and creating the school mission and vision, and building positive school culture. Researchers have identified these leadership responsibilities as fundamental to school success (Day & Harris 2002; Katzenmeyer & Moller 2009). In addition, there is much that could be done for each individual country in order to understanding teacher leadership in a much more in-depth and nuanced way.

Declaration of Competing Interest

There is no potential conflict of interests.

Appendix A. Overview of the samples in all TALIS 2013 participating countries

	Total number of ISCED 2 Schools	Total number of ISCED 2 Teachers	School Sample Size	Teacher Sample Size
Australia	2 869	84 474	154	3 080
Brazil	62 676	881 540	1 142	22 840
Bulgaria	2 189	27 998	200	4 000
Chile	6 041	58 374	200	4 000
Croatia	971	19 906	201	4 020
Cyprus	100	4 138	100	2 000
Czech Republic	2 639	30 831	200	4 000
Denmark	1 789	52 652	198	3 600
Estonia	425	8 437	200	4 000
Finland	734	unknown	152	3 040
France	7 160	217 368	250	5 000
Iceland	145	1 350	145	1 350
Israel	2 139	140 744	154	3 080
Italy	7 917	178 385	200	4 000
Japan	10 863	289 125	200	4 000
Korea	3 183	110 658	200	4 000
Latvia	750	88 775	150	3 000
Malaysia	2 138	132 578	200	4 000
Mexico	15 881	315 829	200	4 000
Netherlands	542	78 263	150	3 000
Norway	1 226	22 997	200	4 000
Poland	6 532	172 326	200	4 000
Portugal	1 318	46 088	200	4 000
Romania	5 865	70 807	200	4 000
Serbia	1 083	47 833	200	4 000
Singapore	197	10 383	197	3 940
Slovak Republic	1 642	27 271	200	4 000
Spain	7 322	241 177	200	4 000
Sweden	1 731	301 907	200	4 000
United States	68 030	815 840	200	4 000
Abu Dhabi (United Arab Emirates)	268	86 726	200	4 000
Alberta (Canada)	1 174	134 527	200	4 000
England (United Kingdom)	4 347	1 773 534	205	4 100
Flanders (Belgium)	726	19 557	200	4 000

Source: OECD TALIS Database

Appendix B. Descriptive statistics for all variables

	n	Mean	BRR Std. Err.	[95% Conf.	Interval]	max	min
TC2G18A3	98197	0.085	0.007	0.072	0.098	1	0
TC2G18B3	97808	0.006	0.001	0.005	0.007	1	0
TC2G18C3	97391	0.026	0.005	0.016	0.036	1	0
TC2G18D3	97152	0.030	0.005	0.020	0.040	1	0
TC2G18E3	97284	0.062	0.005	0.053	0.070	1	0
TC2G18F3	97895	0.319	0.011	0.297	0.340	1	0
TC2G18G3	97729	0.338	0.010	0.318	0.359	1	0
TC2G18H3	96258	0.057	0.006	0.044	0.070	1	0
TC2G18I3	97821	0.660	0.010	0.640	0.680	1	0
TC2G18J3	97418	0.404	0.011	0.383	0.426	1	0
TC2G18K3	97424	0.330	0.011	0.307	0.352	1	0
TC2G28A5	89192	0.233	0.007	0.219	0.247	1	0
TC2G28B5	88354	0.237	0.007	0.224	0.251	1	0
TC2G28C5	84510	0.131	0.008	0.116	0.147	1	0
TC2G28D5	88971	0.476	0.012	0.453	0.500	1	0
TC2G28E5	88778	0.201	0.008	0.186	0.216	1	0
TC2G28F5	89099	0.250	0.010	0.231	0.269	1	0
TC2G18A2	98197	0.247	0.010	0.228	0.266	1	0
TC2G18B2	97808	0.106	0.007	0.093	0.119	1	0
TC2G18C2	97391	0.090	0.007	0.076	0.104	1	0
TC2G18D2	97152	0.093	0.007	0.079	0.106	1	0
TC2G18E2	97300	0.348	0.010	0.328	0.368	1	0
TC2G18F2	97920	0.527	0.010	0.507	0.548	1	0
TC2G18G2	97729	0.446	0.011	0.425	0.467	1	0
TC2G18H2	96283	0.229	0.009	0.212	0.247	1	0
TC2G18I2	97846	0.475	0.012	0.451	0.498	1	0
TC2G18J2	97418	0.339	0.010	0.319	0.360	1	0
TC2G18K2	97449	0.442	0.011	0.420	0.464	1	0
TC2G28A3	89168	0.509	0.012	0.485	0.533	1	0
TC2G28B3	88328	0.404	0.011	0.383	0.425	1	0
TC2G28C3	84510	0.339	0.010	0.319	0.359	1	0
TC2G28D3	88945	0.700	0.012	0.675	0.724	1	0
TC2G28E3	88752	0.440	0.010	0.420	0.460	1	0
TC2G28F3	89073	0.580	0.012	0.557	0.604	1	0
GNI	104358	24643.690	146.007	24353.980	24933.390	57799	11421
GINI	90067	0.388	0.001	0.387	0.390	0.550	0.249
SPUBLIC	99350	0.811	0.006	0.799	0.823	1	0
SSIZE	97958	733.028	10.556	712.082	753.973	4335	1
SMINORITY	97588	2.034	0.018	1.998	2.069	5	1
SLOWSES	98037	3.135	0.025	3.085	3.184	5	1
TFEMALE	104355	0.631	0.002	0.626	0.636	1	0
TEXPERIENCE	97773	15.349	0.101	15.149	15.548	58	1
TDEGREE	102910	2.961	0.001	2.959	2.964	4	1

Note: mean was estimated using complex survey data setting through adjusting standard errors using balanced repeated replicate weights

IQ: Instructional quality; PLC: professional learning community

Appendix C. Correlational coefficient among all variables

	A3	B3	C3	D3	E3	F3	G3	H3	I3	J3	K3	A5	B5	C5	D5	E5	F5	A2	B2	C2	D2	E2	F2	G2	H2	I2	J2	K2	A3	B3	C3	D3	E3	F3	GNI	GINI	PUB	SZ	MI	SES	FE	EXP	DEG
A3	1.00																																										
B3	0.27	1.00																																									
C3	0.13	0.17	1.00																																								
D3	0.11	0.12	0.57	1.00																																							
E3	0.14	0.13	0.20	0.14	1.00																																						
F3	0.16	0.13	0.06	0.09	0.25	1.00																																					
G3	0.16	0.12	0.08	0.10	0.19	0.54	1.00																																				
H3	0.16	0.09	0.09	0.07	0.09	0.15	0.21	1.00																																			
I3	0.14	0.06	0.04	0.05	0.13	0.36	0.38	0.13	1.00																																		
J3	0.17	0.08	0.05	0.09	0.14	0.33	0.43	0.16	0.45	1.00																																	
K3	0.13	0.10	0.02	0.07	0.19	0.35	0.35	0.15	0.34	0.47	1.00																																
A5	-0.05	0.00	0.00	-0.01	-0.05	-0.02	0.00	0.00	0.02	-0.05	-0.06	1.00																															
B5	0.01	-0.01	0.01	0.00	-0.04	-0.03	-0.01	0.00	0.02	-0.01	-0.03	0.31	1.00																													
C5	-0.02	-0.01	0.01	0.00	-0.04	-0.02	0.00	0.00	0.03	-0.02	-0.04	0.40	0.38	1.00																													
D5	0.00	0.01	0.00	0.00	-0.03	-0.01	0.01	0.01	0.02	0.00	-0.02	0.33	0.38	0.43	1.00																												
E5	-0.01	-0.02	-0.02	-0.01	-0.04	-0.02	0.01	-0.01	0.01	-0.01	-0.04	0.30	0.33	0.39	0.39	1.00																											
F5	0.01	-0.01	0.00	0.00	-0.04	-0.03	-0.01	0.00	0.00	-0.01	-0.03	0.27	0.41	0.33	0.41	0.38	1.00																										
A2	0.33	0.10	0.03	0.07	0.10	0.20	0.21	0.11	0.18	0.25	0.17	-0.07	-0.01	-0.03	-0.02	-0.03	0.00	1.00																									
B2	0.21	0.18	0.05	0.08	0.11	0.19	0.18	0.12	0.12	0.20	0.17	-0.04	-0.01	-0.04	-0.01	-0.03	-0.01	0.55	1.00																								
C2	0.12	0.08	0.07	0.10	0.09	0.10	0.12	0.09	0.07	0.17	0.11	-0.04	-0.03	-0.03	0.00	-0.02	-0.01	0.30	0.37	1.00																							
D2	0.12	0.07	0.05	0.15	0.11	0.15	0.16	0.08	0.09	0.20	0.16	-0.03	-0.01	-0.02	0.00	-0.01	0.00	0.34	0.40	0.69	1.00																						
E2	0.16	0.06	0.04	0.08	0.24	0.25	0.23	0.06	0.19	0.26	0.18	-0.06	-0.01	-0.04	-0.02	-0.03	0.00	0.37	0.31	0.31	0.35	1.00																					
F2	0.15	0.06	0.06	0.08	0.12	0.30	0.26	0.09	0.23	0.25	0.14	-0.02	-0.01	-0.03	0.00	-0.02	0.00	0.32	0.23	0.15	0.19	0.44	1.00																				
G2	0.15	0.06	0.03	0.06	0.11	0.23	0.35	0.10	0.17	0.32	0.16	-0.02	-0.01	-0.02	0.01	0.00	0.01	0.34	0.25	0.21	0.25	0.39	0.62	1.00																			
H2	0.19	0.05	0.06	0.06	0.05	0.13	0.18	0.24	0.13	0.20	0.11	-0.02	0.02	0.00	0.01	0.00	0.02	0.39	0.28	0.22	0.25	0.26	0.35	0.35	1.00																		
I2	0.11	0.07	0.06	0.05	0.11	0.21	0.19	0.06	0.09	0.21	0.14	0.00	0.00	0.00	0.02	0.00	0.01	0.28	0.20	0.17	0.21	0.34	0.48	0.50	0.30	1.00																	
J2	0.13	0.06	0.05	0.05	0.12	0.21	0.22	0.11	0.11	0.41	0.21	-0.05	-0.01	-0.03	0.00	-0.02	0.01	0.33	0.25	0.24	0.29	0.36	0.45	0.55	0.32	0.56	1.00																
K2	0.16	0.07	0.05	0.06	0.12	0.20	0.23	0.11	0.19	0.31	0.26	-0.03	0.01	-0.02	0.01	-0.01	0.02	0.36	0.27	0.22	0.26	0.41	0.53	0.53	0.35	0.51	0.58	1.00															
A3	-0.06	-0.04	0.01	-0.02	0.00	-0.03	-0.03	0.00	0.04	-0.05	-0.01	0.04	0.03	0.05	0.00	0.01	0.01	-0.14	-0.12	-0.12	-0.17	-0.12	-0.12	-0.16	-0.08	-0.15	-0.18	-0.19	1.00													
B3	-0.03	-0.02	0.00	-0.02	0.01	-0.01	-0.01	-0.01	0.05	0.01	0.01	0.03	-0.02	0.05	0.00	0.02	0.02	-0.06	-0.08	-0.09	-0.10	-0.06	-0.06	-0.07	-0.04	-0.07	-0.10	-0.10	0.42	1.00												
C3	0.00	-0.03	0.00	-0.02	0.00	-0.02	-0.01	0.00	0.06	0.00	0.00	0.01	0.04	0.02	0.01	0.02	0.03	-0.06	-0.08	-0.07	-0.11	-0.07	-0.07	-0.09	-0.03	-0.11	-0.10	-0.12	0.51	0.48	1.00											
D3	-0.01	-0.02	-0.01	-0.02	0.00	-0.01	0.01	0.01	0.05	0.02	0.03	0.03	0.02	0.02	-0.05	0.00	0.01	-0.06	-0.07	-0.07	-0.10	-0.07	-0.08	-0.09	-0.04	-0.11	-0.09	-0.12	0.46	0.46	0.51	1.00										
E3	-0.01	-0.03	0.00	-0.02	-0.01	-0.01	0.00	0.00	0.06	0.00	0.01	0.04	0.04	0.05	0.00	0.00	0.02	-0.06	-0.08	-0.07	-0.10	-0.07	-0.07	-0.08	-0.04	-0.10	-0.10	-0.11	0.47	0.44	0.51	0.51	1.00									
F3	0.00	-0.02	0.00	0.00	0.00	0.00	0.02	0.00	0.07	0.03	0.02	0.04	0.05	0.03	0.03	0.02	0.02	-0.05	-0.05	-0.07	-0.03	-0.04	-0.01	-0.05	-0.04	-0.01	-0.05	-0.04	0.37	0.49	0.43	0.47	0.48	1.00								
GNI	0.04	-0.01	0.07	0.06	0.10	0.07	0.08	0.04	-0.04	0.10	0.03	-0.06	-0.04	-0.08	-0.02	-0.05	-0.02	0.00	0.02	0.05	0.05	0.07	0.13	0.11	0.07	0.08	0.15	0.14	0.05	0.00	-0.01	0.01	0.03	0.00	1.00								
GINI	0.04	0.00	0.02	0.03	0.00	-0.07	-0.07	-0.05	0.04	0.00	0.06	-0.02	0.08	0.05	0.03	0.02	0.05	0.02	-0.03	0.01	0.01	0.04	0.01	-0.04	-0.03	0.00	0.00	0.06	-0.07	-0.01	0.03	-0.04	0.00	-0.02	-0.28	1.00							
PUB	-0.10	0.02	0.01	0.00	0.05	0.06	0.01	-0.08	0.00	-0.06	0.02	0.02	-0.04	-0.01	-0.03	-0.02	-0.04	-0.19	-0.18	-0.17	-0.16	-0.09	-0.06	-0.12	-0.17	-0.05	-0.12	-0.11	0.02	0.03	-0.03	-0.01	-0.02	0.00	0.00	-0.07	1.00						
SZ	0.03	-0.02	-0.03	-0.03	-0.04	-0.11	-0.10	-0.04	-0.04	-0.09	-0.04	-0.04	0.00	-0.03	-0.04	-0.02	0.01	0.10	0.02	0.00	-0.02	0.07	0.04	0.00	0.12	0.08	0.02	0.08	-0.11	-0.07	-0.07	-0.11	-0.11	-0.06	-0.09	0.07	-0.09	1.00					
MI	0.03	-0.01	0.05	0.05	0.01	-0.05	-0.04	0.00	0.07	0.02	-0.02	0.02	0.08	0.06	0.06	0.05	0.07	0.04	-0.01	-0.03	-0.02	0.08	0.08	0.06	0.07	0.11	0.07	0.14	-0.06	-0.01	-0.05	-0.07	-0.06	-0.02	-0.10	0.16	0.00	0.19	1.00				
SES	-0.06	-0.04	0.00	0.02	-0.03	-0.07	-0.09	-0.03	-0.09	-0.17	-0.10	0.05	0.03	0.03	0.02	0.02	0.04	-0.05	-0.10	-0.14	-0.14	-0.10	-0.07	-0.08	-0.02	-0.02	-0.14	-0.06	0.00	0.00	-0.03	-0.06	-0.02	-0.02	-0.03	-0.04	0.15	0.08	0.18	1.00			
FE	0.00	0.02	0.02	0.02	0.01	0.05	0.05	0.01	0.05	0.05	0.05	0.01	-0.01	0.01	0.00	0.00	0.02	0.02	0.02	0.03	0.04	0.01	0.03	0.02	0.01	0.04	0.03	0.05	0.00	0.02	0.00	0.01	0.02	-0.05	0.06	0.01	0.01	0.00	0.01	0.00	1.00		
EXP	0.00	0.02	0.04	0.04	0.01	0.04	0.04	0.01	0.03	0.02	0.02	0.02	-0.02	-0.01	-0.01	-0.02	-0.02	0.01	0.01	0.00	0.02	0.03	-0.02	0.01	0.01	0.00	0.00	-0.02	-0.01	0.00	0.05	-0.03	-0.02	-0.02	-0.01	-0.03	0.11	-0.02	0.06	-0.05	-0.08	1.00	
DEG	0.03	0.00	0.01	0.00	0.01	0.01	-0.02	-0.05	-0.05	0.01	-0.01	-0.05	-0.04	-0.04	-0.05	-0.02	-0.03	0.01	0.00	0.02	0.02	0.01	0.01	0.00	0.00	0.02	0.04	0.00	-0.04	-0.02	-0.01	-0.04	-0.03	-0.02	0.06	0.06	0.08	0.05	-0.05	-0.01	0.03	-0.05	1.00

Note: A3-K3 are survey items of TC2G18 for informal teacher leadership; A5-F5 are survey items of TC2G28 for informal teacher leadership; A2-K2 are survey items of TC2G18 for formal teacher leadership; A3-F3 are survey items of TC2G28 for formal teacher leadership; GNI: gross national income per capita; GINI: GINI index; PUB: public schools; SZ: school size; MI: minority student proportion, SES: low socioeconomic student proportion; FE: female teachers; EXP: teacher experiences, DEG: teacher educational background

Appendix D. Informal teacher leadership for each leadership function within 32 participating countries

	M 18A	SE	M 18B	SE	M 18C	SE	M 18D	SE	M 18E	SE	M 18F	SE	M 18G	SE	M 18H	SE	M 18I	SE	M 18J	SE	M 18K	SE	M 28A	SE	M 28B	SE	M 28C	SE	M 28D	SE	M 28E	SE	M 28F	SE
All	**0.08**	**0.01**	**0.01**	0	**0.02**	0	**0.03**	0	**0.07**	0	**0.32**	0.01	**0.34**	0.01	**0.09**	0.01	**0.65**	0.01	**0.39**	0.01	**0.29**	0.01	**0.21**	0.01	**0.23**	0.01	**0.12**	0.01	**0.44**	0.01	**0.18**	0.01	**0.33**	0.01
Australia	0.14	0.02	0.00	om	0.00	om	0.00	om	0.05	0.01	0.33	0.03	0.35	0.02	0.00	0.00	0.68	0.03	0.61	0.03	0.27	0.02	0.37	0.03	0.36	0.03	0.18	0.02	0.36	0.03	0.24	0.03	0.14	0.03
Brazil	0.02	0.00	0.00	om	0.00	0.00	0.00	0.00	0.10	0.01	0.31	0.01	0.31	0.01	**0.27**	0.01	0.58	0.01	0.30	0.01	**0.08**	0.01	**0.06**	0.01	0.17	0.01	0.05	0.01	0.23	0.01	0.08	0.01	0.15	0.01
Bulgaria	0.13	0.01	0.00	0.00	0.12	0.01	0.13	0.01	0.14	0.01	0.37	0.01	0.47	0.02	**0.28**	0.02	0.81	0.02	0.41	0.02	0.20	0.02	0.25	0.02	0.32	0.02	0.07	0.01	0.34	0.02	0.28	0.02	0.38	0.02
Chile	0.01	0.00	0.06	0.01	0.02	0.01	0.02	0.01	0.04	0.01	0.39	0.02	0.33	0.02	0.12	0.01	0.51	0.02	0.31	0.02	0.17	0.02	0.15	0.02	0.09	0.02	0.08	0.02	0.32	0.02	0.18	0.02	0.25	0.02
Croatia	0.03	0.01	0.03	0.01	0.00	om	0.00	om	0.03	0.01	0.61	0.02	0.50	0.02	0.16	0.01	0.83	0.01	0.28	0.02	**0.08**	0.01	0.13	0.01	0.40	0.02	**0.00**	om	0.63	0.02	0.38	0.02	0.60	0.02
Czech Republic	0.01	0.00	0.04	0.01	0.00	om	0.00	om	0.14	0.01	**0.72**	0.02	**0.67**	0.02	0.04	0.01	0.87	0.01	0.75	0.02	0.52	0.02	0.47	0.02	0.56	0.02	0.09	0.01	0.64	0.02	0.09	0.01	0.51	0.02
Denmark	**0.44**	0.03	0.00	0.00	0.03	0.01	0.04	0.01	**0.24**	0.03	0.64	0.03	0.52	0.03	0.11	0.01	0.95	0.01	0.77	0.03	0.47	0.03	0.25	0.03	0.32	0.03	**0.04**	0.01	0.49	0.03	0.10	0.02	0.39	0.02
Estonia	0.16	0.02	0.00	om	0.00	0.00	0.06	0.01	0.06	0.01	0.78	0.01	0.85	0.01	0.20	0.02	0.91	0.01	**0.88**	0.01	0.68	0.02	0.46	0.02	0.34	0.02	0.12	0.01	0.48	0.02	0.28	0.02	0.55	0.02
Finland	0.00	0.00	0.05	0.01	0.00	om	0.02	0.01	0.13	0.01	0.42	0.02	0.42	0.02	0.00	om	0.86	0.02	0.65	0.02	0.57	0.02	**0.05**	0.01	0.29	0.02	0.01	0.00	0.48	0.03	0.10	0.01	0.31	0.02
France	0.01	0.00	0.00	om	0.00	om	0.00	om	0.02	0.01	0.33	0.02	0.51	0.02	0.01	0.00	0.79	0.02	0.16	0.01	**0.04**	0.01	**0.04**	0.01	0.01	0.00	0.30	0.02	0.03	0.01	0.03	0.01	0.19	0.01
Israel	0.11	0.01	0.00	om	0.01	0.00	0.01	0.01	0.05	0.01	0.51	0.01	0.44	0.02	0.16	0.02	0.61	0.02	0.53	0.02	0.30	0.02	0.16	0.02	0.17	0.02	0.12	0.02	0.38	0.02	0.10	0.02	0.19	0.03
Italy	0.00	0.00	0.03	0.01	0.00	om	0.00	om	0.11	0.01	0.43	0.02	0.73	0.02	0.06	0.01	0.88	0.01	**0.84**	0.02	**0.88**	0.01	0.03	0.01	0.20	0.03	**0.06**	0.02	0.43	0.04	0.22	0.03	0.32	0.03
Japan	0.01	0.01	0.00	om	0.01	0.00	0.01	0.00	0.09	0.01	0.30	0.02	0.31	0.02	0.03	0.01	0.26	0.02	0.19	0.01	0.16	0.02	0.32	0.02	0.29	0.02	0.12	0.01	0.58	0.02	0.24	0.02	0.31	0.02
Korea	0.01	0.00	0.01	0.00	0.02	0.01	0.01	0.00	0.21	0.02	0.27	0.02	0.17	0.01	0.03	0.01	0.50	0.02	0.38	0.02	0.55	0.02	**0.63**	0.02	0.54	0.02	0.45	0.02	0.67	0.02	**0.48**	0.02	0.50	0.02
Latvia	0.10	0.01	0.01	0.00	0.06	0.01	0.08	0.01	**0.24**	0.02	0.67	0.02	**0.70**	0.03	0.11	0.02	0.82	0.02	0.59	0.02	0.51	0.03	0.45	0.02	0.42	0.03	0.22	0.02	0.58	0.03	0.45	0.03	0.35	0.03
Malaysia	0.01	0.00	0.07	0.01	0.00	om	0.01	0.00	0.06	0.01	**0.14**	0.02	**0.07**	0.01	0.01	0.00	0.52	0.02	**0.06**	0.01	0.18	0.02	0.45	0.02	0.32	0.02	0.30	0.02	0.65	0.02	0.34	0.02	0.49	0.02
Mexico	0.03	0.01	0.00	om	0.00	om	0.00	om	0.03	0.01	0.29	0.02	0.19	0.02	0.07	0.01	0.52	0.02	**0.08**	0.01	0.11	0.01	0.09	0.01	0.13	0.01	0.15	0.01	0.24	0.02	0.17	0.02	0.18	0.02
Netherlands	**0.48**	0.03	0.00	om	0.00	om	0.00	om	0.26	0.03	0.53	0.03	0.19	0.02			**0.97**	0.01	0.96	0.01	0.32	0.03	0.39	0.03	0.19	0.02	0.36	0.03	0.25	0.02	**0.07**	0.02	**0.09**	0.01
Norway	0.08	0.02	0.01	0.00	0.01	0.00	0.04	0.02	0.12	0.02	0.60	0.03	0.49	0.03	0.03	0.01	0.79	0.02	0.74	0.03	0.26	0.04	0.33	0.04	0.22	0.04	0.06	0.01	0.58	0.03	0.42	0.04	0.53	0.03
Poland	0.00	0.00	0.03	0.01	0.00	om	0.00	om	0.03	0.01	0.62	0.03	0.72	0.02	0.10	0.01	0.84	0.02	0.67	0.02	0.23	0.02	0.09	0.01	0.62	0.04	0.08	0.01	0.75	0.02	0.15	0.02	0.39	0.03
Portugal	0.08	0.01	0.00	om	0.00	om	0.00	om	0.02	0.00	0.26	0.02	0.27	0.02	0.01	0.00	0.62	0.02	0.09	0.01	0.15	0.01	0.56	0.02	0.29	0.02	0.30	0.02	0.56	0.02	0.45	0.02	0.38	0.02
Serbia	0.05	0.01	0.00	om	0.00	om	0.00	om	0.05	0.01	0.55	0.02	0.54	0.02	0.10	0.01	0.90	0.01	0.47	0.02	**0.74**	0.02	0.36	0.02	0.26	0.02	0.12	0.01	0.59	0.02	0.29	0.02	0.43	0.02
Singapore	0.02	0.00	0.07	0.01	0.00	0.00	0.00	om	0.11	0.01	0.44	0.00	0.41	0.00	0.05	0.01	0.72	0.00	0.58	0.00	0.27	0.00	0.16	0.00	0.21	0.00	0.09	0.00	0.22	0.00	0.08	0.00	0.11	0.00
Slovak Republic	0.05	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.05	0.01	0.52	0.02	0.62	0.02	0.06	0.01	0.68	0.02	0.69	0.02	0.55	0.02	0.44	0.02	0.53	0.02	0.09	0.01	**0.82**	0.01	0.38	0.02	0.61	0.02
Spain	0.02	0.01	0.06	0.01	0.00	om	0.00	om	0.05	0.01	0.36	0.02	0.27	0.02	0.01	0.00	0.87	0.01	0.27	0.02	0.12	0.01	**0.03**	0.01	0.24	0.02	0.01	0.01	0.41	0.02	0.13	0.02	0.15	0.02
Sweden	0.07	0.01	0.02	0.01	0.00	om	0.01	0.00	0.05	0.01	**0.15**	0.02	0.37	0.02	0.03	0.01	0.95	0.01	0.63	0.02	0.37	0.02	0.24	0.02	0.32	0.02	0.04	0.01	0.69	0.02	0.29	0.02	0.50	0.02
United States	0.11	0.02	0.00	om	0.07	0.01	0.07	0.01	0.09	0.02	0.27	0.03	0.26	0.03	0.06	0.02	0.61	0.03	0.40	0.03	0.40	0.03	0.11	0.02	0.11	0.02	0.06	0.01	0.48	0.03	0.15	0.02	0.19	0.03
England (United Kingdom)	0.23	0.02	0.00	om	0.01	0.00	0.05	0.01	0.05	0.01	0.28	0.02	0.36	0.02	0.11	0.01	0.89	0.01	0.79	0.02	0.60	0.02	**0.66**	0.02	0.37	0.02	**0.41**	0.03	0.56	0.02	0.47	0.03	0.32	0.02
Flanders (Belgium)	0.00	0.00	0.00	om	0.00	om	0.00	om	0.03	0.01	0.28	0.02	0.47	0.02	0.22	0.02	**0.95**	0.01	0.26	0.02	0.18	0.02	0.05	0.01	0.24	0.02	0.05	0.01	0.20	0.02	0.03	0.01	0.08	0.01
Emirates)	0.04	0.01	0.00	om	0.01	0.00	0.00	0.00	0.02	0.00	0.19	0.02	0.23	0.02	0.05	0.01	0.32	0.02	0.23	0.02	0.23	0.02	0.24	0.02	0.17	0.02	0.19	0.02	0.45	0.03	0.09	0.01	0.24	0.02
Alberta (Canada)	0.03	0.01	0.02	0.01	0.01	0.00	0.00	om	0.02	0.00	0.14	0.02	0.43	0.02	0.43	0.02	0.70	0.02	0.31	0.02	0.49	0.02	0.04	0.01	0.14	0.02	0.02	0.01	0.48	0.02	0.20	0.02	0.24	0.02
Romania	0.01	0.00	0.00	om	0.00	om	0.00	om	0.01	0.00	0.50	0.02	0.35	0.02	0.07	0.01	0.73	0.02	0.32	0.02	0.43	0.02	0.32	0.02	0.45	0.02	0.12	0.01	0.58	0.02	0.29	0.02	0.50	0.02
n	97391		97808		97391		97152		97,284		97895		97729		96258		97821		97418		97424		89192		88354		84510		88971		88778		89099	
N	3,512,270		3,529,541		3,512,270		3,506,406		3,502,633		3,537,277		3,524,678		3,447,918		3,535,642		3,519,995		3,520,972		3,207,846		3,185,378		3,155,764		**3,190,733**		3,182,774		3,205,861	

Note: n is sample size, N is simulated population size

The population mean was estimated using complex survey data analysis by adding the 100 balanced repeated replicate weights

Appendix E. Formal teacher leadership for each leadership function within 32 participating countries.

	M 18A	SE	M 18B	SE	M 18C	SE	M 18D	SE	M 18E	SE	M 18F	SE	M 18J	SE	M 18H	SE	M 18I	SE	M 18J	SE	M 18K	SE	M 28A	SE	M 28B	SE	M 28C	SE	M 28D	SE	M 28E	SE	M 28F	SE
ALL	**0.25**	**0.01**	**0.12**	**0.01**	**0.1**	**0.01**	**0.1**	**0.01**	**0.35**	**0.01**	**0.54**	**0.01**	**0.45**	**0.01**	**0.27**	**0.01**	**0.51**	**0.01**	**0.35**	**0.01**	**0.42**	**0.01**	**0.53**	**0.01**	**0.42**	**0.01**	**0.36**	**0.01**	**0.7**	**0.01**	**0.45**	**0.01**	**0.6**	**0.01**
Australia	0.51	0.03	0.06	0.01	0.12	0.02	0.09	0.02	0.51	0.03	0.77	0.03	0.73	0.03	0.54	0.03	0.77	0.03	0.72	0.03	0.88	0.02	0.86	0.02	0.38	0.03	0.66	0.03	0.89	0.02	0.73	0.02	0.77	0.02
Brazil	0.21	0.01	0.15	0.01	0.10	0.01	0.10	0.01	0.33	0.01	0.59	0.01	0.48	0.01	0.45	0.01	0.69	0.01	0.42	0.01	0.29	0.01	0.64	0.01	0.54	0.02	0.47	0.02	0.76	0.01	0.54	0.01	0.68	0.01
Bulgaria	0.04	0.01	0.08	0.01	0.10	0.01	0.09	0.01	0.32	0.02	0.96	0.01	0.54	0.02	0.54	0.02	0.55	0.02	0.45	0.02	0.74	0.01	0.02	0.01	0.15	0.01	0.03	0.01	0.59	0.01	0.31	0.02	0.56	0.02
Chile	0.34	0.02	0.28	0.02	0.20	0.02	0.21	0.02	0.27	0.02	0.63	0.02	0.54	0.02	0.50	0.02	0.61	0.02	0.54	0.02	0.47	0.02	0.77	0.02	0.33	0.03	0.50	0.03	0.71	0.02	0.58	0.02	0.70	0.02
Croatia	0.08	0.01	0.07	0.01	0.01	0.00	0.01	0.00	0.19	0.02	0.52	0.02	0.37	0.02	0.27	0.02	0.39	0.02	0.20	0.02	0.09	0.01	0.42	0.02	0.54	0.02			0.43	0.02	0.47	0.02	0.54	0.02
Czech Republic	0.29	0.02	0.22	0.01	0.25	0.01	0.32	0.02	0.69	0.02	0.84	0.01	0.84	0.01	0.28	0.02	0.76	0.02	0.84	0.01	0.87	0.01	0.88	0.01	0.65	0.02	0.50	0.02	0.74	0.02	0.61	0.02	0.77	0.02
Denmark	0.67	0.03	0.35	0.03	0.13	0.02	0.08	0.01	0.71	0.03	0.80	0.03	0.73	0.03	0.52	0.03	0.54	0.03	0.45	0.03	0.64	0.03	0.59	0.03	0.48	0.03	0.39	0.03	0.63	0.03	0.43	0.03	0.61	0.03
Estonia	0.62	0.02	0.36	0.02	0.16	0.02	0.31	0.02	0.49	0.02	0.84	0.01	0.84	0.01	0.51	0.02	0.70	0.02	0.66	0.02	0.81	0.01	0.88	0.01	0.77	0.02	0.73	0.02	0.89	0.01	0.72	0.02	0.79	0.02
Finland	0.06	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.23	0.02	0.32	0.02	0.15	0.01	0.00	om	0.19	0.02	0.18	0.02	0.26	0.02	0.05	0.01	0.26	0.03	0.02	0.01	0.16	0.02	0.08	0.01	0.35	0.03
France	0.04	0.01	0.00	0.00	0.00	om	0.00	om	0.33	0.02	0.47	0.02	0.37	0.02	0.16	0.01	0.50	0.02	0.05	0.01	0.18	0.02	0.11	0.01	0.14	0.01	0.00	0.00	0.52	0.02	0.11	0.01	0.32	0.02
Israel	0.43	0.02	0.25	0.02	0.05	0.01	0.04	0.01	0.38	0.02	0.84	0.01	0.79	0.02	0.57	0.02	0.77	0.02	0.65	0.02	0.71	0.02	0.57	0.02	0.42	0.02	0.43	0.02	0.82	0.02	0.54	0.02	0.63	0.02
Italy	0.07	0.01	0.03	0.00	0.05	0.01	0.05	0.01	0.35	0.02	0.49	0.02	0.48	0.02	0.17	0.02	0.51	0.02	0.42	0.02	0.56	0.02	0.10	0.02	0.19	0.03	0.08	0.02	0.36	0.04	0.33	0.03	0.36	0.03
Japan	0.03	0.01	0.02	0.01	0.04	0.00	0.04	0.00	0.26	0.02	0.58	0.02	0.54	0.02	0.05	0.01	0.24	0.02	0.28	0.02	0.27	0.02	0.53	0.02	0.58	0.02	0.25	0.02	0.70	0.02	0.49	0.02	0.66	0.02
Korea	0.23	0.02	0.21	0.01	0.09	0.01	0.06	0.01	0.40	0.02	0.44	0.02	0.28	0.02	0.11	0.01	0.28	0.02	0.23	0.02	0.29	0.02	0.57	0.02	0.45	0.02	0.39	0.02	0.55	0.02	0.38	0.02	0.43	0.02
Latvia	0.52	0.02	0.44	0.03	0.52	0.03	0.57	0.02	0.66	0.03	0.83	0.02	0.81	0.02	0.32	0.02	0.75	0.02	0.56	0.03	0.86	0.02	0.96	0.01	0.86	0.02	0.59	0.03	0.94	0.01	0.90	0.02	0.81	0.02
Malaysia	0.02	0.01	0.01	0.00	0.00	om	0.01	0.00	0.23	0.02	0.45	0.02	0.17	0.02	0.09	0.01	0.56	0.02	0.06	0.01	0.55	0.02	0.84	0.02	0.46	0.02	0.74	0.02	0.80	0.02	0.75	0.02	0.83	0.02
Mexico	0.10	0.01	0.07	0.01	0.10	0.01	0.09	0.01	0.15	0.01	0.40	0.02	0.21	0.02	0.23	0.02	0.41	0.02	0.14	0.01	0.16	0.01	0.59	0.02	0.52	0.02	0.35	0.02	0.65	0.02	0.60	0.02	0.65	0.02
Netherlands	0.79	0.02	0.39	0.02	0.25	0.02	0.31	0.03	0.66	0.03	0.83	0.02	0.86	0.02	0.85	0.02	0.61	0.03	0.69	0.02	0.93	0.01	0.96	0.01	0.79	0.02	0.74	0.03	0.88	0.02	0.85	0.02	0.72	0.03
Norway	0.37	0.04	0.14	0.03	0.05	0.02	0.01	0.00	0.27	0.02	0.68	0.03	0.61	0.03	0.11	0.02	0.65	0.04	0.51	0.03	0.52	0.03	0.64	0.03	0.38	0.04	0.49	0.03	0.74	0.03	0.62	0.03	0.68	0.03
Poland	0.07	0.01	0.03	0.01	0.04	0.01	0.05	0.00	0.16	0.01	0.56	0.02	0.57	0.02	0.17	0.02	0.51	0.02	0.29	0.02	0.24	0.02	0.47	0.02	0.44	0.02	0.27	0.02	0.54	0.02	0.29	0.02	0.45	0.02
Portugal	0.44	0.02	0.03	0.01	0.01	0.00	0.00	0.00	0.17	0.02	0.42	0.02	0.27	0.02	0.41	0.02	0.34	0.02	0.12	0.01	0.31	0.02	0.18	0.02	0.14	0.01	0.08	0.01	0.68	0.02	0.33	0.02	0.49	0.02
Serbia	0.13	0.01	0.18	0.02	0.03	0.01	0.00	0.00	0.27	0.02	0.48	0.02	0.26	0.02	0.27	0.02	0.32	0.02	0.18	0.02	0.42	0.02	0.23	0.02	0.31	0.02	0.11	0.01	0.35	0.02	0.26	0.02	0.30	0.02
Singapore	0.24	0.00	0.15	0.00	0.06	0.00	0.12	0.00	0.74	0.00	0.91	0.00	0.89	0.00	0.46	0.00	0.92	0.00	0.83	0.00	0.84	0.00	0.97	0.00	0.62	0.00	0.95	0.00	0.97	0.00	0.91	0.00	0.84	0.00
Slovak Republic	0.43	0.02	0.37	0.02	0.24	0.02	0.31	0.02	0.48	0.02	0.77	0.02	0.80	0.02	0.26	0.02	0.76	0.02	0.77	0.02	0.79	0.02	0.93	0.01	0.62	0.02	0.59	0.02	0.78	0.02	0.65	0.02	0.69	0.02
Spain	0.16	0.01	0.15	0.01	0.04	0.01	0.05	0.01	0.32	0.02	0.59	0.02	0.28	0.02	0.16	0.01	0.36	0.02	0.12	0.01	0.25	0.02	0.24	0.02	0.30	0.03	0.11	0.01	0.78	0.02	0.58	0.02	0.67	0.02
Sweden	0.20	0.01	0.04	0.01	0.14	0.01	0.15	0.01	0.15	0.02	0.22	0.02	0.25	0.02	0.13	0.01	0.22	0.02	0.21	0.02	0.17	0.02	0.24	0.02	0.26	0.02	0.14	0.01	0.49	0.02	0.29	0.02	0.35	0.02
United States	0.27	0.03	0.11	0.02	0.09	0.02	0.09	0.02	0.38	0.03	0.40	0.03	0.32	0.03	0.16	0.03	0.46	0.03	0.32	0.03	0.44	0.03	0.41	0.03	0.31	0.03	0.29	0.03	0.69	0.03	0.29	0.03	0.52	0.03
England (United Kingdom)	0.62	0.02	0.13	0.01	0.21	0.02	0.22	0.02	0.63	0.02	0.90	0.01	0.92	0.01	0.50	0.02	0.73	0.02	0.75	0.02	0.88	0.02	0.94	0.01	0.64	0.03	0.71	0.02	0.94	0.01	0.79	0.02	0.74	0.02
Flanders (Belgium)	0.30	0.02	0.15	0.02	0.02	0.01	0.01	0.01	0.35	0.03	0.59	0.02	0.63	0.02	0.36	0.03	0.30	0.02	0.13	0.01	0.51	0.02	0.30	0.02	0.19	0.02	0.17	0.02	0.40	0.02	0.15	0.02	0.30	0.02
Emirates)	0.28	0.02	0.21	0.02	0.14	0.02	0.14	0.02	0.25	0.02	0.35	0.03	0.34	0.02	0.50	0.02	0.37	0.02	0.38	0.02	0.37	0.02	0.67	0.03	0.63	0.02	0.58	0.02	0.72	0.03	0.68	0.02	0.79	0.02
Alberta (Canada)	0.33	0.02	0.05	0.01	0.03	0.01	0.03	0.01	0.44	0.02	0.61	0.02	0.49	0.02	0.32	0.02	0.59	0.02	0.22	0.02	0.59	0.02	0.53	0.03	0.30	0.02	0.40	0.02	0.60	0.02	0.42	0.02	0.48	0.02
Romania	0.04	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.06	0.01	0.38	0.02	0.24	0.02	0.08	0.01	0.34	0.02	0.16	0.02	0.21	0.02	0.54	0.02	0.55	0.02	0.19	0.02	0.73	0.02	0.62	0.02	0.72	0.02
n	98197		97808		97391		97152		97300		97920		97729		96283		97846		97418		97449		89168		88328		84510		88945		88752		89073	
N	3541120		3529541		3512270		3506406		3510115		3537401		3524678		3448043		3535766		3519995		3521097		3208107		3185280		3155764		3190634		3182675		3205762	

Note: n is sample size, N is simulated population size

The population mean was estimated using complex survey data analysis by adding the 100 balanced repeated replicate weights

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