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Teachers' and principals' perceptions of school climate: the role of principals' leadership style in organizational quality

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Abstract
In this paper, we report on teachers' and principals' shared perceptions regarding beliefs, rules, trust, and encouragement of new initiatives. Collectively, these are aspects of leadership for learning (LFL) describing an overall shared climate in schools. We demonstrate how these perceptions on school climate differ across teachers and principals within and across countries. Moreover, we report how different perceptions of school climate are associated with leadership style. We analyze data from 37 countries that participated in the last cycle of the Teaching and Learning International Survey (TALIS) in 2018. To build the measurement model, we employ multigroup multilevel confirmatory factor analysis, whereas multivariate linear regression is used to inspect associations. Overall, principals and teachers differ in their views of school climate. In the majority of the countries, principals report stronger school climate than teachers. We further confirm these perceptual differences between teachers and principals by separately studying the relationships between teacher perceived school climate and principal perceived school climate with relevant leadership variables. In the entire sample, we find that principals' perceptions of school climate are more strongly and consistently associated with leadership in schools. This relationship is particularly stable for distributed leadership. In the entire sample, leadership styles are weakly positively correlated with teacher perceptions of school climate too; however, this association is less pronounced and less stable within individual countries. The analyses conducted within countries revealed that the distributed leadership rather than instructional leadership shapes teachers' perceptions of school climate. More discussion is presented on the need for alignment between different perceptions of school climate and leadership styles in the overall organizational quality.

Keywords Leadership for learning · School climate · Teachers' and principals' perceptions · TALIS 2018 · Multigroup Multilevel Confirmatory Factor Analysis (MG-MCFA)

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1 Introduction

Educational research emphasizes a tight connection between school leadership and school climate (Griffith, 1999; Kelley, 2005; Kozlowski & Doherty, 1989). While there is currently limited empirical evidence about the nature of this association, it seems intuitive to suggest that a favorable climate can facilitate effective leadership and vice versa. School climate defined as *a shared perception* of behaviors, work environment, and organizational life (Ashforth, 1985; Hoy, 1990; Peterson & Spencer, 1990) constitutes a crucial factor in fostering teaching and instruction, supporting teachers' and students' development, and promoting healthy relationships, which are essential for successful learning (Cohen et al., 2009; Grazia & Molinari, 2020; Thapa et al., 2013). Assessing the perspectives of teachers and principals in relation to these shared aspects of school climate is one of the key measures of effective leadership (Brezicha et al., 2020; Park & Ham, 2016). The reason is that the school climate acts as a bridge between leadership and learning in schools. Building this bridge occurs by indirectly fostering working conditions, caring about teachers' well-being, and supporting instructional practices (Burkhauser, 2017; Ladd, 2009; Sims, 2019).

Accordingly, Ogawa and Bossert (1995) conceptualize leadership as an organizational quality that travels through the networks of actors and roles that constitute an organization. Furthermore, Otero (2019) describes leadership for learning (LFL) as a system of relationships between principals, teachers, students, families, and communities. Although certain aspects of LFL can be achieved individually, for example, by principals or teachers, many of these aspects are only achievable jointly through the network of interactions between school stakeholders (MacBeath & Dempster, 2008; Pietsch et al., 2019). Such a system requires constant communication about learning that further fosters an environment of collaboration, trust, and dialog. Despite constant communication, common goals, and joint activities, the perceptions likely differ between teachers and principals due to their different roles and hierarchical positions (Bandura, 1988; Ramsey et al., 2016). Only a few articles investigate how larger perceptual differences regarding the aspects of school leadership are associated with poor teacher collaboration (Park & Ham, 2016) and lower teacher job satisfaction (Brezicha et al., 2020).

Døjbak Haakonsson et al. (2008) argue that leadership and climate should be in harmony in order to promote the organizational environment effectively. To better understand how the combined characteristics of leadership and school environment impact organizational quality, we analyze the degree to which school climate as measured from teachers' and principals' perspectives differ. Moreover, we also examine the association between different perspectives on school climate and leadership styles.

We do not discount that different perceptions of school climate can coexist in healthy learning environments too, nor are they necessarily destructive. For example, Ramsey et al. (2016) found that respondents give lower ratings to school climate dimensions that are closely related to their own behaviors because of either greater awareness or a more

critical perspective. Moreover, the organizational literature in general assumes that leaders have tendency to overestimate their performance (Atwater & Yammarino, 1992), whereas followers' ratings are more likely to be influenced by their personal experiences with leaders (D. J. Brown & Keeping, 2005). By developing a comparable measure of school climate from both teacher and principal perspectives at the level of school, we investigate these differences in perceptions of school climate.

Our findings add to the research about the conceptual linkage between climate and leadership in schools. Importantly, we establish a comparable measure of school climate between teachers and principals at the level of school. By using these measures, we demonstrate how principals and teachers differ in their perception of school climate. Lastly, we examine the association between both the teacher and principal reported school climate and school leadership as reported by principals across 37 countries. Overall, the results show a tight connection between climate and leadership in schools and their joint contribution in shaping the overall organizational quality.

2 Theoretical background

2.1 School climate

School climate refers to shared perceptions of the work environment and behaviors (Ashforth, 1985; Hoy, 1990). In the organizational literature, climate represents an internal distinguishing characteristic of an organization that influences the behaviors of its members (Woodman & King, 1978). The same line of research emphasizes that "climate is external to the individual, yet cognitively the climate is internal to the extent that it is affected by individual perceptions" (Woodman & King, 1978, p. 818). The "commonality of perceptions" and homogeneity within organizations represent a critical attribute that differentiates climate from other organizational variables (Drexler, 1977; Woodman & King, 1978).

In the education literature, students', school personnel's, and parents' experiences of school life socially, emotionally, civically, ethically, and academically represent the school climate (Thapa et al., 2013). Similarly, Grazia and Molinari (2020) describe the moral, relational, and institutional aspects of school life as school climate dimensions. Therefore, school climate represents a broadly scoped quality and character of school life. It stands as a group phenomenon that includes norms, values, and expectations that support people (Cohen et al., 2009). The commonality of perceptions (Van Vianen et al., 2011; Woodman & King, 1978) and the teacher–principal relationship (Barnett & McCormick, 2004; Price, 2012; Van Maele & Van Houtte, 2015) represent an important attribute of organizational climate. Moreover, a positive school climate is determined by the presence of trustworthy relationships between school stakeholders which is often cultivated by the principal (Kutsyuruba et al., 2016). Thus, by establishing and maintaining positive school climate and healthy working environment, the school leadership shapes teacher and student outcomes (Dutta & Sahney, 2016; Özdemir

et al., 2022; Sebastian & Allensworth, 2012). As such, positive climate also represents an indicator of leadership effectiveness.

A good school climate has multiple benefits, influencing students' affective and cognitive outcomes, such as learning and well-being (Gustafsson & Nilsen, 2016; Hoy et al., 2006; Kutsyuruba et al., 2015; Scherer & Nilsen, 2016) and also teachers' outcomes, such as beliefs, commitment, and engagement (Collie, 2012; Collie et al., 2011; Dickhäuser et al., 2021; Muijs & Reynolds, 2002). Higher self-efficacy and job satisfaction of teachers are associated with a better school climate (Aldridge & Fraser, 2016; Collie, 2012; Katsantonis, 2020). Furthermore, school climate enhances students' self-concept (Coelho et al., 2020), cognitive engagement (Yang et al., 2018), and life satisfaction (Suldo et al., 2013; Zullig et al., 2011). It is also an inevitable factor for successful learning (Cohen, 2013; Cohen et al., 2009; Sherblom et al., 2006).

From a measurement perspective, researchers recognize the multidimensionality of the school climate construct across multiple studies (Grazia & Molinari, 2020; Lenz et al., 2021; Wang & Degol, 2016; Zullig et al., 2010). In their systematic review of the literature on school climate measures, Lenz et al. (2021) identified nine studies conceptualizing school climate as a multidimensional construct. Within these nine studies, 27 subscales relate to interpersonal relationships between school stakeholders emphasizing the social character of school climate (Lenz et al., 2021). In Wang and Degol (2016), which seems to be the most popular conceptualization, school climate is distinguished into four domains (academic, community, safety, and institutional environment) that are further subdivided into 13 dimensions. The academic, community, safety, and institutional environment domains refer to the (1) academic atmosphere, leadership, professional development, and instruction, (2) interpersonal relationships between school members, (3) physical and emotional safety and order and discipline, and (4) the physical and structural organization of the school and resource availability associated with teaching and learning, respectively (Wang & Degol, 2016).

In TALIS, school climate is represented by several measures derived from sets of questions in the school questionnaire (academic pressure, parent–community involvement, student delinquency scale, lack of resources and personnel), the teacher questionnaire (classroom disciplinary climate and student–teacher relations), or both (participation of stakeholder measure) (Ainley & Carstens, 2018). In addition, both questionnaires in TALIS 2018 contain numerous identical stand-alone items (teacher–teacher trust, common teaching beliefs, climate of shared rules, and teacher initiative). Therefore, TALIS does not provide a comprehensive measure of overall school climate. Instead, TALIS includes various scales that rather partially represent specific aspects of the broader school climate construct. Thus, by utilizing stand-alone items, we seek to provide an overall climate measure that captures the shared aspects of school environment (shared beliefs, shared rules, shared trust, shared initiatives). In addition, because the items were included in both teacher and principal questionnaires in TALIS, we analyzed the extent to which perceptions of these shared characteristics differ between teachers and principals. Such insights provide important knowledge about the theoretical

aspects of the tight connection between school climate and leadership for learning as an organizational quality (Ahn et al., 2021).

2.2 Teachers' and principals' perceptions of school climate

The majority of school climate research relies on a single perspective, that is, principal, teacher, or student (Ramsey et al., 2016). Although multiple perspectives can provide a more accurate and comprehensive account of the school environment (Park & Ham, 2016; Thapa et al., 2013; Veletić & Olsen, 2021b), those are not frequently reported. For instance, students, teachers, and parents rate differently the aspects of school climate related to connectedness, safety, academic emphasis (Price, 2016; Ramsey et al., 2016), bullying (Stockdale et al., 2002), leadership (Park & Ham, 2016), and overall climate (Mitchell et al., 2010). Different perceptions of the same phenomena are due to numerous factors, including individuals' organizational position, experience, knowledge, and self-awareness, or methodological aspects, such as whether the respondents are asked to rate themselves or others (Atwater et al., 1998; Braddy et al., 2014; Fisher & Katz, 2000).

As such, the perceptions of teachers and principals within the same school are being recognized as important, but empirical evidence about their coexistence is scarce (Moye et al., 2005; Park & Ham, 2016; Price, 2012). According to some authors, a total congruence between principals and teachers perceptions is an ideal, but hardly (if ever) achievable in practice (Braddy et al., 2014). Hence, we represent this (in) congruence through reporting the climate as perceived by teachers and principals. Recognizing such differences may be vital to understand behaviors within an organization and gain insights into organizational quality and teacher–principal dynamics. Moreover, understanding the differences in perception between principals and teachers regarding the school environment can offer a more precise representation of the effectiveness of school leadership and, ultimately, the quality of the organization (Park & Ham, 2016).

For instance, Park and Ham (2016) utilized TALIS 2008 data and found that the gap in perception of instructional leadership between teachers and principals negatively associated with teacher engagement in collaborative activities and collegial interactions in Australia, Malaysia, Korea, and Turkey. Moreover, using the same sample, Ham et al. (2015) established a negative association between the principal–teacher gap regarding the instructional leadership and teacher self-efficacy. Brezicha et al. (2020) examined the teacher and principal perceptions of teachers' involvement in decision-making and teachers' job satisfaction. Using TALIS 2013 data across 29 countries, the authors demonstrated large differences between teacher and principal reports. The association between these gaps in reporting and teacher job satisfaction in the US sample was negative and significant.

Gaps are not necessarily counter-productive. For instance, Brezicha et al. (2020) found that even in the presence of the gaps, the opportunity to collaborate improved teacher job satisfaction, adding to the argument about the importance of constant communication and good relationships between teachers and principals. Ahn et al. (2021) using TALIS 2018 demonstrated that collective teacher perceptions and

principal perceptions of leadership tasks were not correlated globally which was interpreted as concerning given that leadership for learning advocates that collective efforts of school members are crucial for effective leadership and ultimately school improvement. Similarly, Price (2012) suggests that cultivating positive relationships between school members, particularly teachers and principals, can enhance the school climate and ultimately align their perceptions of the environment. Finally, Bellibas and Liu (2017) showed that principals' perceived distributed and instructional leadership are significant predictors of mutual respect in schools (one aspect of school climate). However, they did not find a correlation between leadership style and school delinquency and violence (another aspect of school climate). These findings suggest that, indeed, school leadership appears to have a greater impact on teacher-related outcomes such as efficacy and job satisfaction (García Torres, 2019; Liu et al., 2021; Sun & Xia, 2018; Veletić & Olsen, 2021b) whereas the association with school climate might be less stable and dependent on the specific aspect of school climate being investigated. Thus, this study seeks to establish a comparable measure of school climate that relate to shared beliefs, rules, trust, and encouragement of new initiatives between teachers and principals which collectively embody what is considered effective leadership for learning.

2.3 Leadership for learning

The roles, practices, and actions of principals and teachers in schools bridge leadership and learning (Hallinger & Heck, 2010; Leithwood & Mascall, 2008; Lovett & Andrews, 2011; Sims, 2019). Principals are responsible for setting the ground for teachers to achieve their full working potential. Principals are also fundamental in developing the school learning climate, managing instructional programs, and communicating high-order goals through the school mission and vision (Hallinger, 2009, 2011). Leadership theories that emerged in the USA in the 1950s focused on principals' roles in shaping and nurturing high-quality instruction in schools. Such theories are commonly known as instructional leadership (Hallinger, 2015). However, over the years, perceptions and practices of leadership functions dispersed among other school members, allowing for a distributed and shared leadership practice (Day et al., 2016; Marks & Printy, 2003; Spillane et al., 2004). Although little is known about the shortcomings and inadequacies of distributed leadership practice (Harris, 2009), this approach to leadership was embraced by many and it became an advocated approach of leading schools. It allowed for more people in leadership roles, emphasizing the complex process of mutual influences and the importance of the context. Moreover, attention shifted from *instruction* to *learning*, which is particularly detectable in the LFL model that unites previously established models of leadership, mainly instructional and distributed approach (Bowers, 2020). Thus, leadership becomes more responsive to students as actors, connected to the broader community outside of the school, and less hierarchical (Dempster, 2019; Imig et al., 2019).

Data from TALIS have been extensively used to study leadership because it provides a comprehensive source across as many as 47 countries from both teacher and

principal perspectives. Apart from being used to study teacher–principal agreement, TALIS data are extensively used to study distributed leadership (Çoban & Atasoy, 2020; García Torres, 2019; Kılınç et al., 2022; Liu, 2020; Liu et al., 2018), instructional leadership (Bellibas & Liu, 2017; Eryilmaz & Sandoval Hernandez, 2021; Gumus & Bellibas, 2016), or both conceptualizations simultaneously (Bellibas & Liu, 2018; Xia & O'Shea, 2022). There are several attempts in the literature where TALIS data are used to map the leadership for learning framework (Ahn et al., 2021; Bowers, 2020; Veletić & Olsen, 2021a).

Scholars proposed several LFL models, of which four are widely used in the literature: (1) the comprehensive assessment of LFL (CALL) study in the USA (Kelley & Halverson, 2012), (2) Murphy et al.'s (2007) research-based model and taxonomy of behaviors, (3) Hallinger's (2011) synthesis of literature, and (4) Boyce and Bowers' (2018) multilevel factor analysis. These models share the same fundamental concepts but broadly capture LFL practice differently. The CALL study captures leadership practice and school cultures across five domains: focus on learning, monitoring teaching and learning, building nested learning communities, acquiring and allocating resources, and maintaining a safe and effective learning environment. Murphy et al.'s LFL model suggests eight dimensions of LFL: vision for learning, instructional program, curricular program, assessment program, communities of learning, resource acquisition and use, organizational culture, and social advocacy. Hallinger, in contrast, proposes four dimensions of the model of LFL: values leadership, leadership focus (vision and goals, academic structures and processes, and people), the leadership context, and leadership sharing. Lastly, Boyce and Bowers describe six factors at the teacher level (classroom control, teacher commitment, school influence, collegial climate, student attendance, and neighborhood context) and three at the school level (instructional leadership, management, and social environment).

Significant overlaps exist between these LFL models. In Fig. 1, we synthesize the LFL domains by combining the elements of the four above-mentioned models. Our framework (Fig. 1) represents four main actors of LFL (represented in ovals): principals and school management team, teachers, students, and the system features.[1] The purple hexagon divides actions inside and outside of the school. The figure further shows that certain LFL domains are achieved by one actor (e.g., principal or teachers only), whereas others (the intersecting parts) are achieved jointly, either by principals and teachers, principals, teachers, and students, or principals and stakeholders outside of the school. Figure 1 shows that joint efforts and shared perceptions are crucial for successful leadership and enhanced school climate. Therefore, in this article, we focus on school environment aspects that are achieved jointly by teachers and principals (dotted area of Fig. 1). The overall framework of leadership for learning as presented in Fig. 1 encompasses both instructional leadership, distributed leadership, and shared aspects of school climate as important indicators of quality of organization. The framework further clarifies how school

[1] The figure does not show parents although they are important for certain LFL domains, e.g., student attendance.

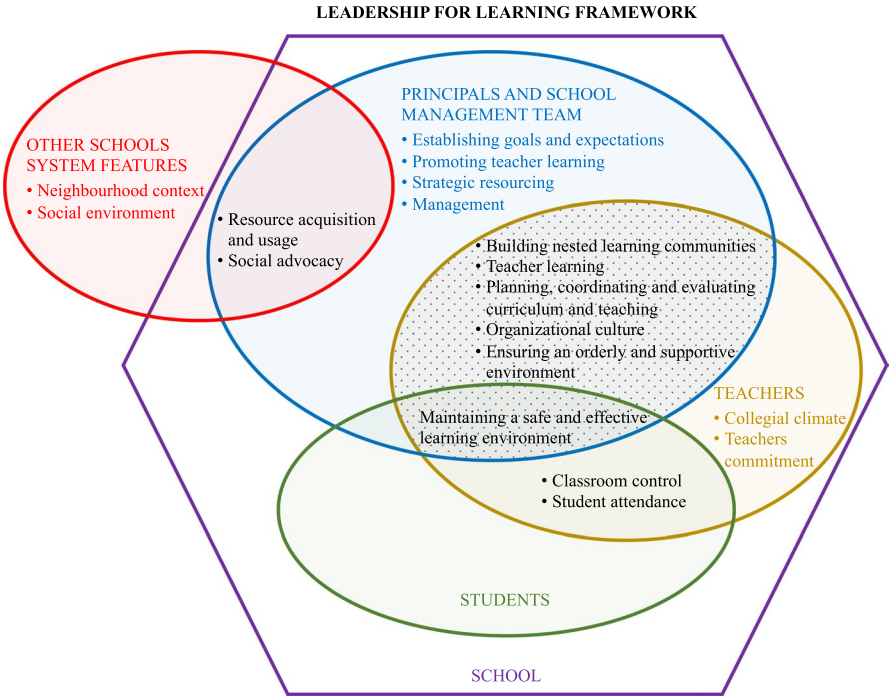

Fig. 1 LFL framework synthesizing domains proposed by the four most common LFL conceptualizations

leadership may be considered a part of school climate, while also emphasizing how school climate may be considered an integral part in school leadership.

2.4 Control variables

School-level factors, such as school size, location, and composition, shape the school environment directly or indirectly (DiPietro et al., 2015; Goldkind & Farmer, 2013; Koth et al., 2008; McCoy et al., 2013; Sulak, 2018). Analyzing the data from the Schools and Staffing Survey (SASS) in the USA, Shakeel and DeAngelis (2018) showed that private schools may have an advantage over public schools in the USA in the form of fewer restrictions on school climate and safety and more comfortable and trustworthy environment for students.

Teacher-level factors are also important, among which the association between teachers' years of experience and school climate is particularly intriguing. Students internationally report that schools with experienced teachers tend to have a good school climate in the PISA study. The average number of years of experience among teachers had a significant, positive association with classroom disciplinary climate in several countries (Avvisati, 2018). Furthermore, Kalis (1980) showed that experienced teachers (more than 6 years of experience in the same school) perceive a less favorable school climate. These findings suggest an inconsistent or

nonlinear association between teachers' years of experience and their perception of school climate.

Moreover, the average socioeconomic status (SES) for schools influences several variables reflecting school climate. However, findings are ambiguous, and consistent evidence of the importance of school SES does not exist (Armor et al., 2018; Marks, 2015). Lastly, school facilities and resources are found to be consistently significant (Akomolafe & Adesua, 2016; Greenwald et al., 1996; Uline & Tschannen-Moran, 2008). Taken together, these results indicate that models investigating school climate should consider school and teacher characteristics.

3 Present study

In the present study, we examined the broader framework of leadership for learning as "an organization-wide practice" that goes beyond that of principal (p.1, Ahn et al., 2021). This framework not only emphasizes learning, but also encompasses other sources of leadership, "and paths and means by which leadership contributes to overall improvement including school climate" (p.8, Ahn et al., 2021). Therefore, first, we established and investigated a new measure of school climate by combining a set of parallel items included in both the principal and teacher questionnaires of the TALIS 2018 survey implemented in 37 countries. This measure represents an overall measure of school climate and has an advantage over the existing sub-dimensions of school climate in the TALIS dataset as it allows for comparisons across principals and teachers. We use this new measure to examine the differences in perception of school climate across teachers and principals in the overall sample and within countries included in the final analyses. Moreover, we investigate the association between school climate as perceived by principals/teachers and leadership styles. Thus, we aim to answer the following research questions (RQ):

1. What are the measurement properties of the proposed school climate indicators based on teacher and principal reports?
2. Based on the newly proposed measures, to what extent do teachers' and principals' views of school climate differ?
3. To what extent is leadership style associated with school climate as perceived by principals?
4. To what extent is leadership style associated with school climate as perceived by teachers?
5. To what extent do features of the national context associate with the teacher and principal perceptions of school climate?

Figure 2 displays the measurement model applied in this study. We modeled teacher responses in a multilevel setting with a saturated structure and factor structure at levels 1 and 2, respectively. Principal data are modeled at level 2, with correlated residuals among the same worded items from principal and teacher questionnaires (P26G-T48F... P26K-T49E).

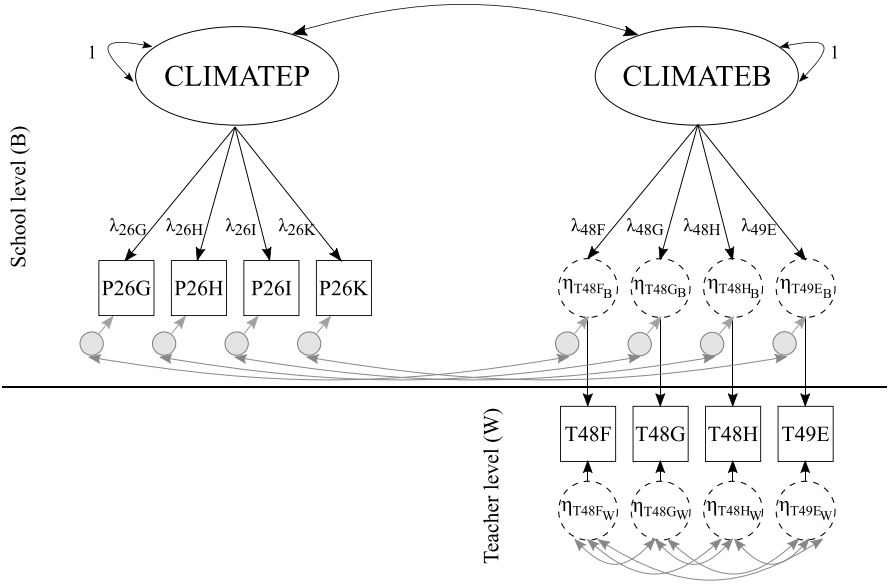

Fig. 2 Configural model of principal and teacher responses for school climate. *Note*: The ovals represent latent constructs of school climate reported by principals (CLIMATEP) and teachers (CLIMATEB). The rectangles (P26G-P26K…T48F-T49E) represent observed variables, whereas the curves with arrowheads on both sides represent correlations. The shaded cycles represent correlated residuals. The dashed line cycles (η_{T48Fb}—$\eta_{T49Eb...}$ η_{T48Fw}—η_{T49Ew}) represent latent variables at the between (b) and within (w) levels

4 Methods

4.1 Data and sample

The data for this study come from the third and most recent cycle of the TALIS study administered in 2018. TALIS is an international large-scale survey concerned with teaching and learning conditions, learning environments, and school leadership among others (Ainley & Carstens, 2018). In TALIS 2018, 48 countries or provinces participated in the core survey including teachers and principals from lower secondary education (ISCED level 2). TALIS 2018 set the minimum sample size at 20 teachers within each participating school and required a minimum sample of 200 schools from the national population. This two-level complex survey design implies that schools and teachers had unequal probability to be included in the final sample and creates a cluster structure in the dataset. In the analyses, we accounted for these deviations from simple sampling. For additional details about the sampling design in TALIS, we refer to the TALIS technical report (OECD, 2019).

In this study, we analyzed data only for countries, excluding provinces or cities, such as Alberta, Canada, and Ciudad Autónoma de Buenos Aires, Argentina. In addition, we excluded five countries (Italy, Singapore, Romania, Israel, and the Netherlands) due to systematically missing data on key items. According to the

Table 1 Parallel items measuring school climate

Item wording	TQ	PQ
How strongly do you agree or disagree with these statements as applied to this school? (1-strongly disagree; 2-disagree; 3-agree; 4-strongly agree)		
The school staff share a common set of beliefs in teaching and learning	TQ48F	PQ26G
The school staff enforce rules for student behavior consistently throughout the school	TQ48G	PQ26H
This school encourages staff to lead new initiatives	TQ48H	PQ26I
Teachers can rely on one another	TQ49E	PQ26K

TQ, teacher questionnaire; *PQ*, principal questionnaire

TALIS technical report, data from Australia for ISCED level 2 did not meet the standards for inclusion. Consequently, we also excluded this country. As a result, the final sample included 125,520 teachers clustered in 7384 schools from 37 countries. The average cluster size was 16.65 teachers per school within the country. Appendix 1 provides an overview of the final sample sizes per country, and Appendix 2 shows the basic descriptive statistics for the entire sample and each country separately.

4.2 Measures

4.2.1 Outcomes

Teacher Perception of School Climate (CLIMATEB) The school climate measure based on teacher responses (*CLIMATEB*) was assessed by teacher ratings of four statements as shown in Table 1. We modeled teacher responses using multilevel confirmatory factor analysis (MCFA) to obtain factor scores at the school level. The modeling included factor structure at the school level and a fully saturated model at the teacher level, commonly referred to as a shared cluster construct (Stapleton et al., 2016). The reliability omega coefficients ranged from 0.849 in France (FRA)[2] to 0.972 in Kazakhstan (KAZ). Appendix 3 shows detailed information about model fit and reliability coefficients.

Principal Perception of School Climate (CLIMATEP) The school climate measure based on the reports of principals (*CLIMATEP*) was assessed by their ratings on the same four statements (see Table 1). Using confirmatory factor analysis (CFA), we modeled principal responses at the school level and extracted factor scores. The scale reliabilities were decent in most countries when the model worked, with the omega coefficient ranging from 0.625 in Japan (JPN) to 0.830 in United Arab Emirates (UAE). Appendix 3 provides details about model fit and reliability coefficients.

[2] For a complete list of country codes, see Appendix 1.

4.2.2 Predictors

Instructional Leadership (T3PLEADS) The scale for instructional leadership was available directly from the TALIS dataset. The scale combines principal ratings on three items where principals indicated (on a 4-point Likert scale) how frequently they engaged with the following activities in the last 12 months: (1) "supporting co-operation among teachers to develop new teaching practices," (2) "ensuring that teachers take responsibility for improving their teaching skills," and (3) "ensuring that teachers feel responsible for their students' learning outcomes" (OECD, 2019). A higher score indicates stronger instructional leadership practice. As reported in the 2018 TALIS technical report (OECD, 2019), the scale achieved a metric level of invariance across countries and the omega reliability coefficient was high for all populations (excluding Hungary), ranging from 0.702 in Kazakhstan (KAZ) to 0.962 in Australia (AUS) (OECD, 2019).

Distributed Leadership (T3PLEADP) The scale for distributed leadership combines five items in the 2018 TALIS study. TALIS refers to this scale as participation among stakeholders (OECD, 2019). The measure combines principal ratings on a 4-point Likert scale indicating how much they (dis)agreed with the following: (1)–(3) "This school provides [staff], [parents], [students] with opportunities to actively participate in school decisions," (4) "This school has a culture of shared responsibility for school issues," and (5) "There is a collaborative school culture which is characterized by mutual support" (OECD, 2019). A higher score represents stronger distributed leadership in the school, that is, decision-making involves several people, and a strong culture of shared responsibilities and mutual respect can be observed. The scale is metrically invariant across countries with acceptable scale reliabilities in most countries, ranging from 0.599 in Japan (JPN) to 0.927 in the Russian Federation (RUS) (OECD, 2019).

4.2.3 Control variables

In addition to the main independent variables, the final model controlled for several principal and school characteristics relevant to school climate. We carefully selected these variables to limit data loss due to systematically not administered questions about school and principal characteristics in certain countries. For example, several countries skipped questions about school location and level of formal teacher education (e.g., New Zealand and Spain). Therefore, we did not include these two aspects as control variables, though they may be relevant to school climate in certain countries. In other cases, countries did not administer questions about principals' years of experience and private and public schools (e.g., Italy, Singapore, and Israel). Nevertheless, we argue that such factors influence the final model. Consequently, we excluded these countries from the analysis. Table 2 below shows the final list of control variables at the school level.

Table 2 List of control variables

Original variable name TALIS	Variable name	Label	Coding
NENRSTUD	School size	Number of enrolled students	Ordinal treated as continuous
TC3G12	Public	Publicly or privately managed school	0 = private 1 = public
TC3G17A	Language of students	% students [first language] diff. from instr. language	Ordinal treated as continuous
T3PLACPE	LACK_PESRON	Lack of pedagogical personnel	0 = not a problem 1 = a problem
T3PLACRE	LACK_RESOUR	Lack of resources	0 = not a problem 1 = a problem
TT3G11A	Teachers' experience	Teachers' average experience in this school	Continuous
TC3G01	Female	Gender of the principal	0 = male, 1 = female
TC3G04A	Principal experience	Principals' years of experience in this school	Continuous

4.3 Statistical analysis

We estimated the main measurement and regression models using Mplus Version 8.4 (Muthén & Muthén, 2017) through the Rstudio package "MplusAutomation" (Hallquist & Wiley, 2018). To account for the possible non-normality of the data, we used the robust maximum likelihood (MLR) estimator. The MLR estimator is also used to handle missing data. No variables had more than 5% missing values. We incorporated the final school weight for the analysis at the school level and the teacher and school weight for the multilevel analysis to account for unequal selection probabilities (Rutkowski et al., 2010). Due to the high complexity, we performed analyses in four steps as follows:

Step 1: We identified parallel items in the teacher and principal questionnaires regarding school characteristics closely related to school climate and modeled these items in separate CFAs for the two groups. As illustrated in Fig. 2, the principal data are modeled at the school level, whereas the teacher measure is based on a multilevel model of a shared cluster construct (Brown, 2015; Kim et al., 2018; Stapleton et al., 2016). We used standard fit indices to evaluate the model fit: the chi-square (χ^2) with corresponding degrees of freedom (df), the root mean square error of approximation (RMSEA) close to 0.06 or below, the comparative fit index (CFI) close to 0.95, the Tucker–Lewis index (TLI) close to 0.95, and standardized root mean square residual at within and between level (SRMRw and SRMRb) close to 0.08 (Hu & Bentler, 1999). We allow for certain deviations from these criteria due to model complexity (Asparouhov & Muthen, 2018).

Step 2: We tested measurement invariance (MI) across respondents (teachers and principals), which itself consists of numerous steps. Establishing MI is a precondition for comparison across groups (Chen, 2008; Millsap, 2012; Rutkowski & Svetina, 2014). For a meaningful comparison of cluster means, the scalar level of invariance is necessary (Millsap, 2012). Because exact invariance is rarely achieved in practice (Byrne & Vijver, 2010; Rutkowski & Svetina, 2014; Zieger et al., 2019), certain authors suggested that constraining at least two fixed parameters across groups while freely estimating the remaining items is sufficient to compare latent means (Byrne et al., 1989; Steenkamp & Baumgartner, 1998). To add to the complexity of model estimation in this article, the standard procedures for testing MI were not possible. The reason is that teachers and principals were at different hierarchical levels of the model, with teachers clustered in principals (schools). Therefore, we followed Kim et al.'s (2018) recommendations and used MCFA to test the invariance between teachers and principals at the school level. The focus of this article on the cluster (school) level supports our choice. We performed analyses on a pooled sample and for each country separately and evaluated models based on common guidelines for model fit evaluation and invariance testing (e.g., $\text{CFI} \geq 0.95$, $\text{RMSEA} \leq 0.08$, $\text{SRMR} \leq 0.06$, $\Delta\text{CFI} \leq -0.010$, $\Delta\text{RMSEA} \leq 0.015$, $\Delta\text{SRMR} \leq 0.030$) (Chen, 2008). Again, we allowed for deviations from common guidelines due to the complexity of the sample and models (Byrne et al., 1989; Marcoulides & Yuan, 2020; Marsh et al., 2004; OECD, 2019).

Step 3: We ran a school-level multivariate regression analysis to assess the association between school leadership and the climate as reported by teachers and principals while controlling for other school and principal characteristics, separately.
Step 4: We ran the final model on the pooled dataset with fixed effects for countries. This analysis provides us with an estimate of systematic variation in the climate measures across countries, thus informing us about the extent to which the climate measure as reported by teachers versus the climate measure as reported by principals relate to the system features of the countries.

5 Results

5.1 Appropriateness of the multilevel approach

To ensure that the items included in the model have substantial variability at the cluster level needed for multilevel modeling (Snijders & Bosker, 1999), we inspected the intraclass correlation coefficient 1 (ICC1) as a measure of agreement, and intraclass correlation coefficient 2 (ICC2) as a measure of clustering for teacher ratings of school climate for each country separately (see Appendix 3). The coefficients for all items in all countries were acceptable according to common guidelines (Geldhof et al., 2014; Stapleton et al., 2016), with ranges (ICC1) 0.062 (KAZ)–0.265 (NZL), 0.041 (KAZ)–0.345 (NZL), 0.065 (MLT)–0.236 (NZL), and 0.076 (USA)–0.248 (MEX) for items TT3G48F, TT3G48G, TT3G48H, and TT3G49E, respectively. The majority of the teachers in New Zealand were consistent in their ratings of school climate, with high ICC1 (>0.20) across all items, followed by Swedish and Norwegian teachers. On the contrary, teachers in Kazakhstan did not agree with each other consistently, followed by teachers in Saudi Arabia, Latvia, Lithuania, Portugal, and Cyprus. Across all countries, the teachers showed the most agreement when responding to item TT3G49E ("Teachers can rely on one another"), with the highest ICC1 on average.

5.2 Evaluating the measurement models and testing the measurement invariance of teacher and principal ratings for school climate

We tested the measurement properties of teacher and principal ratings of the newly established school climate scale to answer RQ1. According to standard fit indices, the MCFA model of teacher ratings of school climate (CLIMATEB) with the saturated structure at level 1 exhibited an excellent fit to the data for the entire sample ($\chi^2 = 14.986$, df $= 2$, CFI $= 0.999$, TLI $= 0.991$, RMSEA $= 0.007$, SRMRw $= 0.001$, SRMRb $= 0.029$), and within each of national samples, according to standard fit indices. The CFA model of principal ratings of school climate (CLIMATEP) exhibited an excellent fit to the data for the entire sample ($\chi^2 = 13.227$, df $= 2$, CFI $= 0.976$, TLI $= 0.929$, RMSEA $= 0.028$, SRMRw $= 0.027$). When tested separately for each country, excellent model fit was exhibited in 22 countries (CFI > 0.095, TLI > 0.095, RMSEA < 0.08, SRMRw < 0.06). In eight countries, the model fit was acceptable

with CFI, TLI, and SRMR within the recommended cut-offs and RMSEA above the recommended cut-off, though still below 0.1. In five countries, the model did not fit the data well (see Appendix 3).

With the school climate scale reported by principals and teachers now established at the school level, we proceeded to the MI testing across teachers and principals to provide evidence about the comparability of these two measures at the school level. First, we tested the MI on a pooled dataset where the configural and metric models across teachers and principals yield an excellent fit. The scalar model with constrained intercepts across two groups was also acceptable. However, the fit for this model was significantly lower than for the metric model, particularly regarding SRMRb ($\Delta CFI \leq -0.010$, $\Delta RMSEA \leq 0.004$, $\Delta SRMRw \leq 0.000$, $\Delta SRMRb \leq 0.083$). In the second step of MI testing, we performed analyses for each country separately. The configural model showed an excellent model fit in all countries. The metric model with constrained factor loadings across respondents also showed an acceptable fit in the majority of the countries. However, when we constrained intercepts to be equal across teachers and principals to establish scalar invariance, the model fit deteriorated significantly in most countries, with $SRMRb > 0.10$ (see Appendix 5 for the complete reports by country). We were unable to establish full scalar invariance across teachers and principals. Thus, we established the minimum requirements for partial invariance as recommended by certain authors (Byrne et al., 1989; Steenkamp & Baumgartner, 1998). According to these authors, in addition to the marker item loading fixed to 1 and intercept fixed to 0, at least one indicator must have invariant loadings and intercepts across the groups. Table 3 shows the final model fit of the partial scalar model across respondents, with a saturated structure at level 1.

5.3 School climate reported by principals and teachers

After establishing the partial invariance model, we extracted factor scores at the school level for the climate measure reported by teachers and principals addressing RQ2 (see Fig. 3). The descriptive statistics show that principals across countries consistently reported a better climate than teachers did, except for Georgia (GEO) and Bulgaria (BGR), where we find the opposite. The differences in perception of school climate between principals and teachers were, on average, the widest in Korea (KOR), Vietnam (VNM), and the United States (USA), whereas the narrowest average distance, close to zero, occurred in Bulgaria (BGR), France (FRA), Latvia (LVA), Estonia (EST), Malta (MLT), and Norway (NOR). Within countries, standard deviations for principal reports range from 0.2 in the Czech Republic (CZE) to 0.4 in Turkey (TUR). Given that the factor scores (at the school level) for teachers reflect an average measure across several teachers, the associated dispersions are, as expected, smaller, with standard deviation ranging from 0.084 in Kazakhstan (KAZ) to 0.029 in New Zealand (NZL) (for details, see Appendix 2, Table 12, and Table 13). We also find similar results in the entire sample as displayed in Fig. 4. We will return to this issue as a potential limitation of the study.

Table 3 Partial scalar measurement invariance model across teacher and principal responses at the school level

Model fit estimates by country								Correlation between latent factors at the school level	
Model	χ^2	df	CFI	TLI	RMSEA	SRMRw	SRMRb	Estimate	*SE*
ARE	61.37	17	.995	.991	.017	.001	.08	.326***	.058
AUT	34.08	17	.995	.989	.015	.001	.082	.545***	.102
BEL	63.34	17	.983	.966	.023	.002	.093	.598***	.075
BGR	14.14	17	1	1	0	.001	.052	.290**	.109
BRA	22.69	17	.997	.994	.012	.001	.048	.263**	.101
CHL	14.26	17	1	1	0	.001	.039	.322**	.102
COL	24.95	17	.994	.988	.014	.001	.072	.455**	.132
CYP[a]	31.50	17	.99	.98	.023	.003	.137	.506**	.165
CZE	26.28	17	.997	.993	.013	.001	.068	.473***	.097
DNK	26.14	17	.992	.983	.016	.001	.058	.757***	.078
ESP	38.20	17	.993	.985	.013	.001	.062	.537***	.108
EST	24.23	17	.998	.996	.012	.001	.059	.488***	.102
FIN	24.94	17	.997	.993	.013	.001	.073	.391***	.100
FRA	60.71	17	.974	.948	.029	.002	.09	.340**	.118
GEO	20.37	17	.999	.998	.008	.001	.054	.310*	.132
HRV	29.44	17	.995	.99	.015	.001	.082	.518***	.141
HUN[a]	55.22	17	.989	.978	.026	.002	.106	.395***	.098
JPN	29.72	17	.996	.992	.015	.001	.074	.607***	.097
KAZ	44.01	17	.992	.983	.016	.002	.096	.346**	.105
KOR	28.43	17	.996	.992	.015	.002	.058	.253	.128
LTU[a]	43.01	17	.991	.981	.02	.002	.135	.294*	.134
LVA[a]	46.40	17	.986	.972	.027	.002	.1	.484***	.125
MEX	24.64	17	.996	.993	.012	.002	.071	.432***	.107
MLT[a]	31.95	17	.989	.979	.023	.001	.112	.371**	.129
NOR	25.70	17	.996	.993	.011	.001	.08	.600**	.090
NZL[a]	33.08	17	.983	.965	.021	.005	.143	.573***	.110
PRT	36.38	17	.992	.985	.018	.001	.085	.275*	.124
RUS[a]	39.70	17	.991	.981	.018	.001	.105	.613***	.101
SAU[a]	47.22	17	.986	.971	.026	.004	.113	.108	.171
SVK	21.17	17	.998	.996	.009	.001	.058	.551***	.109
SVN	30.92	17	.993	.987	.02	.002	.069	.567***	.122
SWE	21.59	17	.997	.994	.01	.002	.058	.760***	.065
TUR	29.11	17	.996	.992	.013	.002	.075	.229	.134
USA[a]	25.88	17	.99	.98	.014	.002	.113	.227	.157
VNM	36.54	17	.99	.98	.017	.001	.099	.028	.153
ZAF	25.59	17	.996	.991	.016	.003	.084	.423**	.134

[a]The data did not fit the model (SRMRb > 0.1), and the results should be interpreted with caution

*, **, and *** denote significance level at 0.05, 0.01, and 0.001, respectively

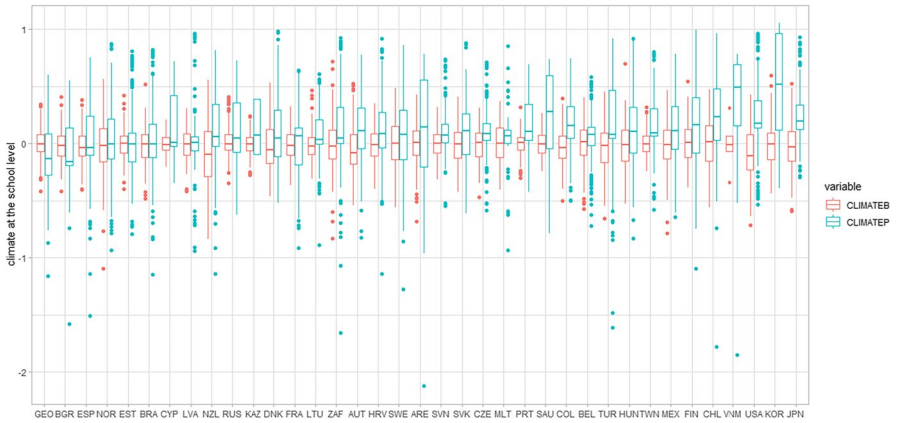

Fig. 3 The averages of school climate reported by principals (CLIMATEP) and teachers (CLIMATEB) at the school level. *Note*. The mean and SD of the climate measures should not be compared across countries as we have limited evidence about cross-country comparability. *Note*. The box in the boxplot represents the middle 50% of scores for each of the groups whereas the line that divides the box into two parts represents median

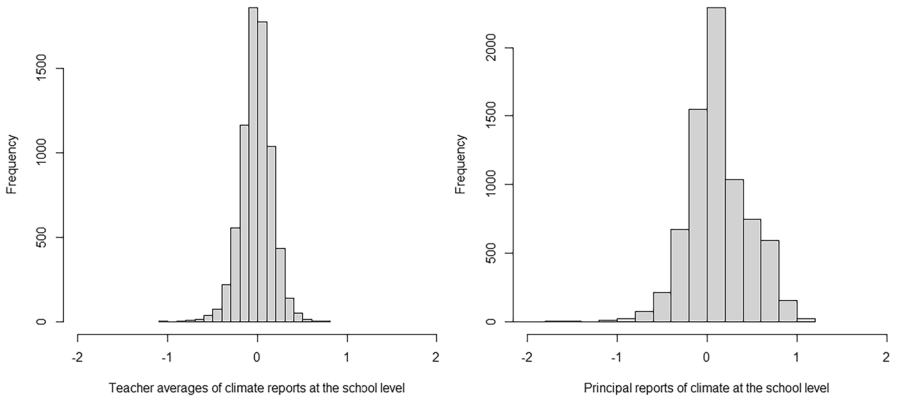

Fig. 4 Histograms representing the distribution of the factor score of climate measure reported by teachers and principals in the entire sample

The positive correlation between the climate reports by the principals and teachers is another interesting element showing partial congruence between the two groups across countries (see Table 3). The correlations were the highest in the Scandinavian countries, namely, Sweden (SWE), Denmark (DNK), and Norway (NOR), and in Japan (JPN) (0.76, 0.76, 0.60, 0.61, respectively). We find that in countries with no significant correlations, such as Vietnam (VNM), Saudi Arabia (SAU), the United States (USA), and Turkey (TUR), the differences between teachers and principals average perception of school climate were also the largest (see Fig. 3). However, in countries where the correlation was

Table 4 Standardized regression coefficients showing the association between leadership style (T3PLEADS and T3PLEADP) and climate reported by principals (CLIMATEP), in the entire sample

	Model 1			Model 2			Model 3		
	beta	*SE*	*p*	beta	*SE*	*p*	beta	*SE*	*p*
Climate reported by principals									
Instructional leadership (*T3PLEADS)*	0.15	0.02	0.00	0.14	0.02	0.000	0.13	0.02	0.00
Distributed leadership (*T3PLEADP)*	0.31	0.02	0.00	0.32	0.02	0.000	0.32	0.02	0.00
Control									
School size				−0.04	0.01	0.01	−0.06	0.01	0.00
Language of students				−0.06	0.02	0.00	−0.01	0.02	0.48
Lack of personnel				−0.06	0.02	0.00	−0.08	0.02	0.00
Lack of resources				0.01	0.02	0.63	0.00	0.02	0.90
Principal experience				0.07	0.02	0.00	0.10	0.01	0.00
Teachers experience				−0.12	0.02	0.00	0.00	0.02	0.97
Female				−0.03	0.02	0.07	0.04	0.02	0.01
Public				−0.09	0.02	0.00	−0.12	0.02	0.00

Model 1: $R^2 = 0.14$ (0.01); model 2: $R^2 = 0.17$ (0.01); model 3: $R^2 = 0.26$ (0.01)

Table 5 Standardized regression coefficients showing the association between leadership style (T3PLEADS and T3PLEADP) and climate reported by teachers (CLIMATEB), in the entire sample

	Model 1			Model 2			Model 3		
	beta	*SE*	*p*	beta	*SE*	*p*	beta	*SE*	*p*
Climate reported by teachers									
Instructional leadership (*T3PLEADS)*	0.05	0.02	0.01	0.04	0.02	0.02	0.04	0.02	0.04
Distributed leadership (*T3PLEADP)*	0.16	0.02	0.00	0.17	0.02	0.00	0.17	0.02	0.00
Control									
School size				−0.15	0.02	0.00	−0.16	0.02	0.00
Language of students				−0.03	0.02	0.14	−0.03	0.02	0.15
Lack of personnel				−0.03	0.02	0.07	−0.04	0.02	0.03
Lack of resources				−0.00	0.02	0.86	−0.00	0.02	0.79
Principal experience				0.08	0.02	0.00	0.09	0.02	0.00
Teachers experience				−0.02	0.02	0.31	−0.00	0.03	0.74
Female				0.01	0.02	0.47	0.02	0.02	0.20
Public				−0.13	0.02	0.00	−0.14	0.02	0.00

Model 1: $R^2 = 0.03$ (0.01); model 2: $R^2 = 0.08$ (0.01); model 3: $R^2 = 0.08$ (0.01)

high, the agreement in terms of simple averages was not necessarily among the highest (e.g., Denmark (DNK), Japan (JPN) and New Zealand (NZL)). This indicates that teachers and principals in the same schools, indeed, responded in the same direction; however, the strength or magnitude of the climate as perceived by teachers and principals differed.

5.4 Association between leadership style and school climate reported by principals and teachers

We addressed RQ3, RQ4, and RQ5 by conducting a set of multivariate regression models in the entire sample to assess how the school climate perception as reported by principals (see Table 4) and school climate as reported by teachers (see Table 5) associate to different leadership styles (models 1–3). Model 1 is the reference model and includes only the main variables. Model 2 controls for the school and principal background factors, and Model 3 includes a country dummy variable.

The analysis of the pooled sample revealed small positive association and moderate positive association between leadership styles and the school climate as perceived by teachers and principals, respectively (see Table 4 and Table 5). A stronger instructional leadership in school associates with stronger school climate as perceived by principals in the entire sample ($\beta_{T3PLEADS} = 0.15^{***}$ [0.02]). Moreover, teacher perceived school climate positively associates with instructional leadership in schools; however, this association is very small ($\beta_{T3PLEADS} = 0.05^{**}$ [0.02]). On the other hand, distributed leadership in schools associates with stronger school climate as perceived by both teachers and principals ($\beta_{T3PLEADP} = 0.16^{***}$ [0.02], $\beta_{T3PLEADP} = 0.31^{***}$ [0.02], respectively); however, this association is much stronger in the sample of principals. After controlling for school and principal characteristics in Model 2, the effects of leadership styles only slightly change in the model that predicted teacher perceived school climate ($\beta_{T3PLEADS} = 0.04^{*}$ [0.02]; $\beta_{T3PLEADp} = 0.17^{***}$ [0.02]), similarly to the model that predicted principals' perceived school climate ($\beta_{T3PLEADS} = 0.14^{***}$ [0.02]; $\beta_{T3PLEADp} = 0.32^{***}$ [0.02]). The change in explained variance from Model 1 to Model 2 was approximately 2% in both instances, indicating that the control variables did not greatly contribute to the analyses.

To address RQ5, we also included a set of dummy variables in Model 3, identifying the countries to estimate country fixed effects. A similar approach was used in other leadership studies with the same sample to control for unobserved country characteristics and their effects on the outcome variable (Bellibas & Liu, 2018; Gumus & Bellibas, 2016). After including the country dummy, the effect of leadership styles and climate only slightly changed. However, R^2 almost doubled ($R^2 = 0.26^{***}$ [0.01]) in the model that included principal perceptions of school climate, indicating that, after controlling for between-country variance, we could explain approximately 26% of the variance in the climate as perceived by principals. On the contrary, Table 5 shows that between-country variance did not substantially matter for the teachers' results.

We expand RQ3 and RQ4 by isolating the country context using a within-country analytical approach (see Appendix 4). This approach provides a robustness check to the reference model in Table 4 and Table 5. The within country analysis showed that both leadership styles together can explain on average 16% of the variation in principals' perceived school climate, ranging from 37% in Korea (KOR) to only 2% in France (FRA). Both leadership styles can on average explain 5% of the variation in teacher perceived school climate, ranging from 15% in Croatia (HRV) to close to zero values in Bulgaria (BGR) and Estonia (EST).

Following the analysis of the pooled international sample, principals perceive stronger school climate in schools where they also report stronger instructional and distributed leadership approaches. Compared to instructional leadership, distributed leadership has a stronger and more consistent relationship with the principals' perception of school climate. The regression coefficient for distributed leadership is substantial and statistically significant in the majority of countries ($n = 30$), whereas that of instructional leadership is more moderate and statistically significant in less than half of the included countries ($n = 16$). For the rest of the countries, this relationship appears insignificant. Moreover, the results do not reveal a pattern among countries with geographical proximity or linguistic similarities.

In comparison to principals, teachers' perceived school climate cannot be explained with instructional leadership in the international sample nor within countries. This is only partially true for Vietnam (VNM), Portugal (PRT), Mexico (MEX), and Brazil (BRA) where stronger instructional leadership as reported by principals was positively associated with teachers perceived school climate. The results point instead to the predominance of the distributed leadership, as reported by principals, positively relating to teacher perceived school climate in many countries (HRV, CHL, NZL, DNK, ARE, BEL, COL, BRA, ZAF, SWE, AUT, SAU, GEO, FIN, SVN, SVK).

6 Discussion and conclusion

Over the three cycles of TALIS, the principal questionnaires consistently included items on school leadership and school climate. With each new cycle, the teacher perspective received increasing attention, allowing us to now study the features of these organizations comprehensively (OECD, 2019; Veletić & Olsen, 2021a). In this study, we utilized parallel items in the teacher and principal questionnaires from TALIS 2018 to capture certain core aspects of school climate jointly achieved by teachers and principals (dotted parts in Fig. 1). Figure 1 further emphasizes the importance of a strong shared climate for strong LFL. Comprehending the connection between leadership, how climate is perceived, school environment, and teacher–principal actions and roles provides additional insights into overall organizational quality in schools. The first step toward such an understanding was to examine how perceptions of school climate differ between teachers and principals.

Altogether, we found that teachers and principals consistently rate their environment in the same direction, albeit to differing magnitudes. In the majority of countries principals rate school climate as better than the teacher average in the same schools. This finding is consistent with previous research investigating the gap between teachers' and principals' perceptions of other school-level factors, such as leadership and decision-making (Braddy et al., 2014; Brezicha et al., 2020; Park & Ham, 2016). A notable exception is the teachers from BGR and GEO who on average reported a better school climate than their principals. Only in Spain (ESP), Norway (NOR), Estonia (EST), Brazil (BRA), Cyprus (CYP), and Latvia (LVA) is the difference in magnitudes of perceptions of school climate negligible.

This distance between teachers and principals about the strength of school climate does not necessarily indicate a weakened school climate. For several countries, both groups reported about a good school climate, but since principal reports were higher, we still perceived differences. However, if everyone agrees that the climate is negative, there were not degrees of perceptual difference between two groups. Our analysis shows that it is, therefore, the average direction of the climate as positive or negative, rather than the magnitude of the climate, more informative for the overall study of school climate (Van Vianen et al., 2011). So, indeed, it is possible to have a strong school climate even when there are some disagreements in magnitudes of the perceptions, as long as these perceptions are positive.

The LFL framework presented in Fig. 1 highlights that responsibilities and opportunities for teachers to participate in various school decisions create a strong LFL. Indeed, both leadership measures in TALIS deal with (1) the extent to which staff, parents, and students are given opportunity to participate in school decisions and (2) the extent to which teachers take responsibility to develop new teaching practices and improve teaching skills and student learning (OECD, 2019). Thus, schools seeking to implement LFL are characterized by activities where principals interact with other school stakeholders around specific tasks related to decision-making and instruction.

Our finding regarding the consistent positive association between principals' reported school leaderships and their perception of school climate is not surprising. In most countries, a principal who reports that leadership in their school is strongly distributed also tends to report about a good school climate. In a lower number of countries, the same tendency is observed for the relationship between instructional leadership and school climate.

Overall, the similar associations are weaker between teachers' perceived climate and their principal's reported level of instructional and distributed leadership. In particular, there is no substantial association between principals' level of instructional leadership and teachers' perception of school climate. However, we find that stronger distributed leadership predicts the school climate as perceived by teachers in almost half of the countries. This finding is partially in line with previous research that shows that distributed rather than instructional leadership associates positively with teacher outcomes (Çoban & Atasoy, 2020; García Torres, 2019; Kılınç et al., 2022). We believe that other factors not accounted for, such as teacher collaboration or decision-making, are essential in the countries where we did not find significant associations (Brezicha et al., 2020; Çoban & Atasoy, 2020; Hariri et al., 2016; Sarafidou & Chatziioannidis, 2013). Moreover, because effective leadership assumes that climate and leadership are aligned (Døjbak Haakonsson et al., 2008), finding such no association between the two might also indicate that leadership in these countries is poor.

Another interesting finding is that when representing countries as fixed effects in the model, the increase in explained variance for the model of teachers' reported school climate was close to zero, while for model for the principals, we observed a 10% increase in the explained variance, approximately a doubling of the explained variance. This finding indicates the need to consider how cultural norms and assumptions on educational expectations influence normative views on successful leadership and how high-quality school climate differs across educational systems. Compared

with several other measures included in international comparative studies, this represents a large between-country variability. Thus, further studies are needed to explore and understand how specific country characteristics or stable features of educational systems could account for this variability across countries (e.g., features reflecting educational policy, governance structures, and shared norms, values, or beliefs).

Knowing that the perceptual differences between school stakeholders is one of the indicators of effective leadership in schools calls for more attention, especially in school leaders' professional development. Principals can be more effective with their teachers if they work with teachers to understand where the school climate could be improved. This is crucial in circumstances where, for instance, principals believe that there is a common climate of shared beliefs about teaching and learning but teachers think they are excluded or left on their own (Brezicha et al., 2020). Such a situation can create a disruption in the process of teaching and learning further influencing student outcomes. Therefore, identifying such discrepancies can raise awareness of and stimulate efforts to improve communication and collaboration, and ultimately lead to enhanced organizational quality. Consequently, this reciprocal interaction between teachers and principals becomes crucial to improving school climate. Particularly, the principal has an important role and thus must be approachable, socially oriented toward their teachers, supportive, and trustful; these attitudes will create a school environment where teachers can thrive (Price, 2012, 2015). Principals are expected to perceive themselves as directly responsible for establishing conducive school leadership and climate. Accordingly, social desirability, self-awareness, personal characteristics, and culture are likely to be involved in the principals' self-report of such phenomena (Daniëls et al., 2020; Devos et al., 2013; Fleenor et al., 2010).

7 Future directions and limitations

This study applies organizational quality theoretical concepts in an LFL framework to communicate the tight connection between school leadership and climate, particularly addressing the tight connection between the two core actors within schools, principals, and teachers. The proposed LFL framework in Fig. 1 illustrates the need to deepen the communication and relationship between teachers and principals. As Fig. 1 shows, only a small fragment of leadership is solely in the hands of principal. However, principals still feel most pressed and responsible for creating and maintaining organizational quality. The dotted area in Fig. 1 emphasizes organizational factors directing teachers and principals. This part explains the existence of different perceptions of school climate as reported by principals and teachers.

Once we established a comparable measure of school climate across teachers and principals, our original intent was to represent the dissonance as a simple gap measure (difference in school climate score) for the two actors within schools to enable further and more detailed examination of this phenomena. However, closer inspection of this absolute measure of the dissonance clearly indicated that such a gap score is largely decided by principals' reports of school climate, simply because teachers' average reports have much less variability across schools. For

further studies investigating phenomena from different perspectives and levels of analysis, we generally warn against using simple differences since the measure from individual reports (either teachers or principals) will largely influence the final measure of dissonance.

In this study, we focused on teacher–principal relationships, though other actors are also important. Students, the broader community, and parents have important functions to realize LFL and school climate. However, TALIS does not include students and parents as respondents, thus limiting the investigation for LFL with the available data.

Although the present study used advanced statistical methods, including MI tests between principals and teachers at the school level, certain methodological limitations should be noted. The complexity of the models and computational challenges did not allow us to test cross-country, cross-level, and cross-respondent MI in one comprehensive model. Consequently, direct comparisons across countries are not advisable. A two-level model with countries at the higher level was not possible with the TALIS dataset because it does not provide any country-level variables for analysis and the sample size is limited. However, the countries as fixed-effects model demonstrates a large variability in how principals perceived school climate across countries.

The main strengths of this study are threefold. First, it brings several different LFL models into one comprehensive framework, thus exhausting leadership functions and actors. Second, it examines school climate from both teachers and principal perceptions by providing a comparable measure at the school level. Third, it applies organizational quality ideas to educational research, expanding the opportunities to understand and describe complex networks and relationships between school stakeholders and their association with leadership style. Together, our framework establishes a better understanding of how leadership and climate perceptions affect school organizational quality.

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Data availability Data for this study come from Teaching and Learning International Survey TALIS 2018 and are publicly available here: https://www.oecd.org/education/talis/talis-2018-data.htm

Declarations

Conflict of interest The authors declare no competing interests.

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