A Global Perspective on School Leadership: Evidence from a Latent Class Analysis on OECD TALIS Data

****This version is a post-print of the paper published as: Soncin, M., Bowers, A. J., & Agasisti, T. (2024). A global perspective on school leadership: Evidence from a latent class analysis on OECD TALIS data. Educational Management Administration & Leadership, DOI: 17411432241231902****

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ABSTRACT

Previous research highlighted the existence of multiple educational leadership styles, however evidence on their multidimensional application is limited. The current study defines an innovative cross-national classification for school leaders along the two dimensions of instructional and distributed leadership. We apply a three-step Latent Class Analysis (LCA) to transnationally generalizable OECD's Teaching and Learning International Survey (TALIS) 2013 data, with N=9,384 school principals surveyed across 32 countries. From here, we identify four subgroups of leaders: *integrating leaders* (64.9% of the sample), who adopt instructional and distributed leadership in an integrated way, *participative leaders* (22.2%) and *supportive leaders* (8.5%), who are respectively high only on distributed or instructional leadership, and *contingent leaders* (4.4%), without a specific a priori leadership approach. Features specific to the principals, the schools and the school context are significantly related to leadership subgroup membership and important moderators of the correlation between types of leadership and students' test scores, as analyzed for a subset of countries. As implications for leadership policy and practice, the cross-country prevalence of integrating leaders might increase the level of organizational complexity, while the geographical distribution of leadership classes highlights the important role played by cultural aspects in influencing leadership practices.

Keywords: Principals, Latent Class Analysis, Instructional leadership, Distributed leadership

Word count: 10,058 (including references)

1. Introduction

Over the past three decades of research into K-12 educational leadership, the concepts of school leadership and management have evolved from simple, individual leadership styles, such as the autocratic or the managerial style, to the complexity of more recent theories, whereby several subgroups or "layers" of school leadership types are distributed simultaneously along the two dimensions of instructional and transformational leadership (Day et al., 2016; Marks & Printy, 2003; Urick 2016; Urick & Bowers, 2014a). It has been shown that school leadership relates positively to measures of school effectiveness, although this is mediated by the role played by the teachers (Heck & Hallinger, 2009; Robinson et al., 2008). Notably, leadership is second only to classroom conditions (i.e., teaching practices) as the school factor most capable of influencing student achievement (Leithwood et al., 2004) and as such has gained attention as a determinant of student outcome (Robinson et al., 2008; Tan et al., 2022).

Instructional leadership is a central concept in the literature on leadership styles versus types, along with the notions of transformational, transactional and distributed leadership (Bowers et al., 2017; Boyce & Bowers, 2018; Bush & Glover, 2014; Day et al., 2016; Marks & Printy, 2003; Printy et al., 2009; Tan et al., 2022; Urick & Bowers, 2014a). This literature addresses the question of how normal day-by-day school leadership practices are unlikely to reflect a specific leadership style. A multidimensional approach to leadership in schools is more probable, with different leadership styles being applied jointly and leaders being clustered into subgroups along multiple dimensions of leadership.

Evidence on school leadership leans heavily on Western, majority English-speaking countries, with most studies focusing on the USA and the UK. Nevertheless, cultural aspects can mediate the adoption and effect of school leadership significantly (Agasisti et al., 2019; Liu, 2020). From a methodological point of view, there have been increasing calls for studies examining a number of different countries simultaneously using transnational data to exploit the variation that is not usually

available in the data from single countries (Chudagr & Luschei, 2016; Hanushek & Woessmann, 2010). Moreover, analyzing school leadership transnationally offers the possibility to understand how contextual variables and country level factors affect leadership practices (Liu, 2020). Finally, comparing countries allows to explore the existence of common patterns in leadership distribution, and offers the possibility to generalize findings that otherwise remain country specific.

In the present study, we have addressed these matters in research on multinational education leadership typology by leveraging on the large transnational dataset derived from the Teaching and Learning International Survey (TALIS) 2013, a cross-national survey held by the Organization for Economic Cooperation and Development (OECD). We analyzed the data using a three-step latent class analysis (LCA) approach in order to address the following research questions:

1. How prevalent are the different leadership type subgroups laying along the two dimensions of instructional and distributed leadership within the OECD countries and which subgroups are distributed across and within countries?
2. What main factors relate to the probability of a school principal belonging to each school leader subgroup, when considering his/her personal features and the contextual variables?
3. Are there significant differences in student achievement across schools managed by different school principals, as measured by their standardized test results in reading, mathematics and science, as collected through the Programme for International Student Assessment (PISA) 2012?

We addressed the first two research questions by examining the questionnaire completed by school principals in the TALIS 2013 international dataset, which contains data on 32 countries (OECD, 2013a). Then, to answer our third research question, we examined a subset of data known as the TALIS-PISA link, where the OECD linked TALIS data from eight countries (Australia, Finland, Latvia, Mexico, Portugal, Romania, Singapore and Spain) to PISA 2012 standardized scores for the same schools in each country. TALIS 2013 represents the first wave in which the link with PISA was

possible, which makes it an interesting wave to be investigated (Gil-Izquierdo & Cordero, 2018). Indeed, the 2013 wave represents the first possibility, as much as limited to a subgroup of countries, to link leadership types and student achievement internationally. The focus on instructional and distributed leadership is justified from multiple perspectives. These two leadership styles are those whose significant relationship with student achievement has been confirmed more widely (Heck & Hallinger, 2009; Robinson et al., 2008), and this paper wants to test this relationship through its third research question. In addition, instructional and distributed leadership are the most largely accepted models of leadership, but they imply rather different leadership practices. The instructional leader was originally intended as a centralized role (Urick, 2016), while distributed leadership implies a collegial approach to decision-making (Spillane, 2005). Investigating whether a single leadership style rather than a combination of the two prevails offers evidence that enhances the current knowledge on educational leadership.

This study is innovative from a twofold perspective. First, it offers a typology of school leaders with a transnational approach, building subgroups along the two dimensions of distributed and instructional leadership. Research analyzing school leadership as a continuum along multiple leadership styles is still scarce. This study contributes to this strand providing evidence on multiple countries and allowing us to compare and contrast the results obtained across and within national contexts. Second and foremost, the leadership typology is linked to student achievement for a subset of countries. This offers the possibility to study the correlation between principal leadership types and student outcomes, making this one of the first studies that exploit the possibility of linking two widely used OECD surveys, TALIS and PISA, with their respective international datasets.

2. Related Literature

The concept of educational leadership has evolved over time and different typologies have now been defined (Bush & Glover, 2014), as opposed to the pioneering works in which the topic was

treated as a single, monolithic concept. Overall, *instructional leadership* has emerged as the seminal and most widely investigated approach to educational leadership (Gümüş et al., 2018), as well as being closely related to student achievement (Heck & Hallinger, 2009; Robinson et al., 2008). Urick (2016) reports that there has been an evolution in the concept of the instructional leader, which was initially seen as a centralized and nearly "heroic" role. Instructional leadership was, in fact, defined as "*a role carried out by the school principal*" (Hallinger, 2005; p. 3). In their meta-narrative review of the literature, Boyce and Bowers (2018) analyzed 109 quantitative studies on instructional leadership using the Schools and Staffing Survey (SASS) administered by the US National Center for Education Statistics, with the intention of defining an "integrated" model of instructional leadership relationships. The authors found four factors related to instructional leadership, hence contributing to build an overall picture about this leadership approach: principal leadership and influence, teacher autonomy and influence, adult development and, lastly, school climate.

The school principal's role as an instructional leader evolved over time, given that few principals can implement instructional leadership on their own (Hallinger, 2005). Marks and Printy (2003) re-evaluated instructional leadership as an approach that "*involves the active collaboration of principal and teachers on curriculum, instruction, and assessment*" (p. 371). The authors, therefore, focused their attention on the concept of *shared instructional leadership*, investigating its relationship with *transformational leadership*, where the latter is defined as the principal's ability to be an agent of change when necessary. In their survey of 24 schools selected across the USA, they found that school performance was higher in schools where transformational and shared instructional leadership were applied in an integrated form. In this respect, the concept of *integrating leadership* reflects the multifaceted nature of school leadership in practice, in which multiple leadership styles are applied in an integrated school system.

The concept of *distributed leadership* has also emerged over time among scholars. Spillane (2005) underlined the difference between shared and distributed leadership, stating that distributed leadership is more closely related to leadership practice and interaction than to school functions

shared with teachers. Moreover, studies on distributed leadership show that it is associated positively with staff satisfaction and school improvement (Heck & Hallinger, 2009).

In addition to these central concepts, several nuances of school leadership have been proposed (Bush & Glover, 2014). A lateral concept to distributed leadership is that of *participative leadership*. It is based on collegiality and democratic principles, under the assumption that participated decisions facilitate stakeholders' involvement that in turn prompts school improvement (Harris, 2003). The concept of *supportive leadership* is instead linked to the creation of a positive climate and encouraging teaching environment, in which open discussion and collaboration are key for school effectiveness (Dayanti et al., 2022). Given the centrality of supporting the teaching staff, this approach proposes a perspective in line with instructional leadership. Previous research has also stressed the importance of context in influencing leadership (Bush, 2018). *Contingent leadership* is indeed a leadership approach that adapts to situations and circumstances, rather than adopting a 'one size fit all' stance (Leithwood et al., 2008). However, effective contingent leadership approach should be responsive to the context rather than driven by that (Warwas, 2015). The existence of several concepts of school leadership that are intertwined to that of instructional and distributed leadership makes the possibility to build a typology that covers the multidimensional nature of leadership particularly relevant.

In their review of the literature published between 1960 and 2018, Kovačević and Hallinger (2019) pointed out the mainly UK-USA evidence on school leadership and management, looking at results emerging from European studies. When considering the relationship between school leadership and student achievement, they stated that research in the European context tended to find a non-significant direct effect to a greater extent than in the UK-USA, thus concluding that contextual characteristics may act as mediator to a greater extent in European than in extra-European studies. In the Latin American context, Flessa et al. (2018) analyzed 359 reviews and policy documents, and found that the topic of educational leadership has been studied only quite recently in Latin America, thus limited evidence is available and additional research is advocated. Recently, Tan et al. (2022)

carried out a second-order meta-analysis on the relationship between leadership and school outcomes based on 12 first-order meta-analyses (512 primary studies) referred to the period 1978-2019. They found that the average effect size is relatively small, and larger for leadership models (i.e., instructional, transformational or distributed leadership) than for leadership practices. Thus, the authors suggest the importance of investigating practices alongside leadership models.

To date, most studies have concentrated on nationally specific contexts, with some recent research approaching the topic from a cross-national point of view. OECD datasets appear to serve this purpose well and so are being increasingly investigated (Hanushek & Woessmann, 2010; Chudagr & Luschei, 2016). Bellibas and Liu (2018) investigated the relationship between (perceived) instructional and distributed leadership styles and school climate, as recorded in TALIS 2013. They used regression analysis to find a positive relationship between both the two leadership styles, independently, and one of the two indices of school climate, namely staff reciprocal respect. Urick and Bowers (2019) used the TALIS 2008 dataset to investigate whether and to what extent teachers and school principals perceive instructional leadership differently. They applied a multilevel factor analysis, finding that school principals see instructional leadership as a composite concept while, for teachers, it is one-dimensional and only weakly related to the principals' notion. Somehow related results were reported by Ahn et al. (2021), who applied a multilevel factor analysis to show, in a leadership for learning framework, how distinct are the perceptions of individual teachers, teachers collectively, and principals.

While these studies use cross-national datasets, they do not cover the heterogeneity of the effects from country to country in anywhere near enough detail. Among the few notable exceptions, OECD (2016) applied a 1-step LCA to the TALIS 2013 dataset. The research group used four indicators to determine their respondent subgroups, consisting of distributed leadership, instructional leadership, time spent on educational leadership and educational leadership practice policy. They identified four subgroups of school leaders: integrated leaders (50% of the sample), educational leaders (23%), inclusive leaders (17%) and administrative leaders (10%). The findings showed that integrated leaders

make up the largest class in most OECD countries. Printy and Liu (2021) analyzed the same dataset focusing on principals and teachers' perceptions of distributed leadership. Their results stress the heterogeneity observed across the 32 countries and show the influence exerted by country education policy. Similarly, the relevance of considering cultural contexts at national and school levels is underlined by Liu (2020), who analyzed the same OECD dataset. Using the most recent wave of data, Bowers (2020) used TALIS 2018 data to build a cross-national congruency-typology model of leadership for learning including teachers and principals by means of a multilevel LCA. The results showed the presence of a three-teacher typology and a three-principal typology, with strong differences across countries especially in the principal subgroup proportions. No insights were offered, however, in terms of exploring the potential associations between leadership types and the students' results. The current study contributes to this strand of literature differentiating specifically for its focus on two factors: (i) building an international typology that allows to classify leadership practices along both instructional and distributed leadership, allowing for possible combinations to emerge from the data and (ii) exploring the relationship between leadership types and student achievement.

3. Methods

3.1 Data

We used data collected by the Organization for Economic Cooperation and Development (OECD) within the Teaching and Learning International Survey (TALIS) 2013 (OECD, 2013a). TALIS is a cross-national investigation concerned with the learning environment and working conditions of school principals and teachers (OECD, 2014a). In 2013, the participating countries were 34, with 32 being included in the international dataset[1] and an average sampling of 200 schools per country. OECD carried out a two-stage stratified procedure to select the schools to be included in the survey

[1] Data from Cyprus and Iceland are not in the international dataset.

for each country (OECD, 2014b). Weights were provided for each school and used throughout the analysis, so our findings can be generalized to the entire school population of all participating countries. The international TALIS dataset contains observations from N=10,172 schools across 32 countries (OECD, 2014b) and mainly focuses on lower secondary education (ISCED Level 2). The sample size per country is given in Table 1. As a relevant limitation to the data, all the information collected in the OECD TALIS survey is self-reported.

[Table 1] around here

All PISA 2012 (OECD, 2014c) participating countries could additionally take part in the TALIS scheme and enter the TALIS-PISA link. For these countries, OECD staff selected the PISA schools to be surveyed as part of TALIS, based on equiprobable random sampling (OECD, 2014a). Eight countries decided to take part (these are Australia, Finland, Latvia, Mexico, Portugal, Romania, Singapore and Spain), forming our sample for the third step of this study – while the first two steps are applied to all countries (32). The number of schools included in the sample for each of these eight countries is given in Table 1, Columns 4 and 8.

The principals' questionnaire, which forms the basis of this study, contains a section on school leadership, which is used by OECD to compute the instructional (PINSLEADS) and distributed leadership (PDISLEADS) scales (OECD, 2014a). The scales are obtained by the average value of three different items. For instructional leadership, these items cover aspects relating to how frequently particular leadership and managerial practices are used in the perception of the principal, and are: support for developing new teaching practices (TC2G21C), making teachers feel responsible for improving their teaching (TC2G21D) and for their students' learning outcomes (TC2G21E). All answers are given on a four-point scale (where 1 = *Rarely or never*; 2 = *Sometimes*; 3 = *Often*; 4 = *Very often*). The items used to measure distributed leadership relate to involvement in school decisions, whether on the part of staff (TC2G22A), parents and guardians (TC2G22B) or students

(TC2G22C). School principals are asked whether they agree with the statement: *This school provides staff/parents or guardians/students with opportunities to actively participate in school decisions*, on a scale from 1 to 4 (where 1 = *Strongly disagree*; 2 = *Disagree*; 3 = *Agree*; 4 = *Strongly agree*).

Coherently with the OECD, we used the six items listed above separately as indicators of instructional and distributed leadership. After removing the questionnaires with missing data, we were left with complete information on the six indicators for 9,384 school principals (out of 10,172). To make sure that data were actually aligned with the presence of two dimensions of leadership, we firstly performed an exploratory factor analysis (EFA). The analysis confirmed the presence of two factors, whose eigenvalues were equal respectively to 1.85 and 0.89. All the other factors reported negative eigenvalues, and therefore were dropped. The first factor loads reported positive signs for all the six items, showing a general tendency to agree with any positive-sounding proposition, as emerged from the descriptive statistics reported below. The second factor highlighted a contrast in sign between the first three items, related to instructional leadership, and the other three items related to distributed leadership, in line with the expectations. Moreover, we tested the measures' reliability by computing the Cronbach's alpha (Cronbach, 1951) that was equal to 0.79 for the items related to instructional leadership and 0.71 for those related to distributed leadership, thus showing an acceptable level of internal consistency (Tavakol & Dennick, 2011). Overall, the data appear as statistically robust for the empirical analysis.

For the purposes of the LCA, the response scale was dichotomized, so that an answer of 1 (*Rarely or never/Strongly disagree*) or 2 (*Sometimes/Disagree*) corresponds to 0 and an answer of 3 (*Often/Agree*) or 4 (*Very often/Strongly agree*) corresponds to 1. This procedure not only facilitates the convergence of the model but also, despite the dichotomization, helps to accentuate differences in the answers.

In order to characterize the groups of principals across the different types of leadership (Step 2), data from other sections of the questionnaire were also analyzed. The following personal information was used: gender (TC2G01) – a dummy variable equal to 1 for female principals and 0 otherwise;

age (TC2G02); level of education (TC2G03) – a dummy variable equal to 1 for ISCED 6 level (doctorate or equivalent) and 0 otherwise; years' experience as principal at current school (TC2G04A); years' experience as teacher in total (TC2G04D); employment status (TC2G05) – a dummy variable equal to 1 for full-time status (at least 90% full-time hours) and 0 otherwise; with teaching obligation – a dummy variable equal to 1 for yes and 0 for no.

In addition, we have considered information about the school background, looking in particular at: school location (TC2G09), three dummy variables to distinguish between village, town and city, equal to 1 when flagging up the school's location and 0 otherwise; school status (TC2G10) – a dummy variable equal to 1 if the school is private/independent and 0 otherwise; number of students enrolled (TC2G14); student-teacher ratio, obtained from the number of students (TC2G14) and the number of teachers (TC2G12A); proportion of students whose first language is not the language of instruction (TC2G15A); proportion of socioeconomically disadvantaged students (TC2G15C) – categorical variables on a five-point scale, where 1 = *None*, 2 = *1-10%*, 3 = *11-30%*, 4 = *31-60%* and 5 = *more than 60%*.

At this second step, the sample of school principals dropped to 8,552 observations due to listwise deletion of observations with missing values on the above-mentioned variables.

In addition to our analysis on the school principals' questionnaire, we also utilized the available PISA 2012 data to define, as an outcome of interest, the school's average score in the three subjects tested: mathematics, reading and science (OECD, 2014c). The programme tests the attainment of 15-year-olds, and the available data refer to the eight countries that were used to form the TALIS-PISA link, for a total of 1,215 schools. A complete description of the variables mentioned above is given in Table 2.

[Table 2] around here

3.2 Methodology

In this study, we used Latent Class Analysis (LCA), a mixture modelling technique for identifying homogenous subgroups within a population (Muthén, 2004; Muthén & Muthén, 2000; Samuelsen & Raczynski, 2013), employing the 3-step LCA approach throughout the study (Asparouhov & Muthén, 2014; Nylund-Gibson & Masyn, 2016). The model was run using Mplus Version 7.4 (Muthén & Muthén, 2015), and the conceptual framework is presented in Figure 1.

As a first step, the categorical indicators of self-perceived instructional and distributed leadership were used to identify the subgroups of school principals (N=9,384). In keeping with the definition of instructional and distributed leadership scales (OECD, 2014a), the indicators used to predict the subgroups of responders are the previously described six items in the school principals' questionnaire, with three relating to instructional leadership and three to distributed leadership.

We followed the statistical recommendations given in latent class analysis literature to determine the number of subgroups (Collins & Lanza 2010; Nylund et al., 2007; Nylund-Gibson & Maysn, 2016). Hence, we defined the number of classes to retain by adding classes stepwise until the addition of a class did not result in a better fitting model. The model fit was assessed by using the Bayesian Information Criterion (BIC) and the Lo-Mendell-Rubin (LMR) test (Lo, 2005; Lo et al., 2001; Muthén & Asparouhov, 2006). In addition, we use the entropy of the model as an indicator of a good separation between classes. The closest to 1 is the entropy value, the clearest the separation between classes (Celeux & Soromenho, 1996). In terms of statistical power, the available sample size is sufficient for running a LCA with six indicators, according to the simulations provided by Dziak et al. (2014) and by No and Hong (2017). After defining the number of subgroups within the population, individuals were assigned to their "most likely" class (end of Step 1). In Step 2 of the analysis, we regressed the probability of each principal belonging to a certain class against a set of characteristics relating to the principals, the schools and the schools' context (N=8,552). Finally, in Step 3 of the analysis, we investigated whether there were statistically significant differences across

the classes in a given distal outcome – in our setting, the students' test scores. We used PISA 2012 school average scores in mathematics, reading and science as the outcomes of interest at Step 3, in order to test for statistical differences in student achievement across the groups (N=1,215). A significant test was run to detect the statistically significant differences across the groups (Asparouhov & Muthén, 2018; Bolck et al., 2004)[2]. Given that the final analysis was carried out on the PISA subsample, the "most likely class" membership defined in Step 1 was retained throughout, in order to avoid model bias and ensure that the results could be compared from step to step, using a classify-analyse approach (Collins & Lanza, 2010). The Mplus code for the model is given in the Appendix.

[Figure 1] around here

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4. Results

4.1 Estimating a Typology Model of Principal Leadership

Table 3 gives the model fit statistics for the LCA. As suggested in the literature, we started the model with two classes and then iterated the analysis with additional classes (Nylund et al., 2007). Based on the LMR test, the 2-class model is the only specification with significantly different subgroups (p-value = 0.0291). When looking at the BIC, the 4-class specification shows an elbow in the index value, which starts to decrease less markedly than in previous model specifications. Given the recommendations in the literature, with the stress on the potential drawback of selecting too many classes (Tofighi & Enders, 2008) and the suggestion that BIC provides a better goodness of fit than the LMR test (Collins & Lanza, 2010; Nylund et al., 2007; Nylund-Gibson & Masyn, 2016), we opted for the more conservative and parsimonious four group typology model. The four group latent class

[2] In detail, Pearson chi-square test was run on all observations – whose class membership had not varied from Step 1 – using the Bolck, Croon and Hagenaars (hereafter BCH) procedure.

analysis model fits the data well, with BIC=48,838.30 and an entropy of 0.820 (Celeux & Soromenho, 1996; Nylund et al., 2007).

[Table 3] around here

Figure 2 shows the average percentage of school principals by group, where the horizontal axis reports the items used as indicators. The plot contains four subgroups of school leaders, and we have labelled them according to their main attitude towards leadership, also considering the existing literature: *integrating leaders* (64.9% of the sample), *participative leaders* (22.2%), *supportive leaders* (8.5%) and *contingent leaders* (4.4%).

The *Integrating leaders* represent the most numerous group (64.9% of the sample), and their attitude towards both instructional and distributed leadership is high; their approach to leadership evokes the description given by Marks and Printy (2003), Printy et al. (2009) and Urick and Bowers (2014b). Urick and Bowers (2014b), referring to Marks and Printy (2003), state that: "*integrated leadership [is described] as principals who utilize multiple styles to ultimately build a synergy between themselves and teachers*" (p. 103), which is what we observed for this subgroup in the current study. Instructional leadership is applied in a distributed way, and this not only involves teachers and school staff (as is generally the case in distributed leadership), but also families and students. As a practical implication, adopting an integrating leadership approach implies greater complexity, as an integrated system is reinforced by both school instructional practices and synergies with the stakeholders (Printy et al., 2009; Spillane, 2005).

The group of *participative leaders* (22.2%) state that their approach involves highly distributed and low instructional leadership. This is in line with the definition of participative leadership provided by Bush and Glover (2014), according to whom "*participative leadership is concerned primarily with the process of decision-making. The approach supports the notion of shared or distributed leadership and is linked to democratic values and empowerment*" (p. 18). Most importantly, this attitude towards

distributed leadership does not only apply to school staff, but is equally valid for families and students, as observed in this study. The low instructional leadership observed in this study suggests that the final aim of school improvement and student learning is targeted via stakeholders' empowerment. This finding has strong implications on the dynamics between principals and the main stakeholders. While this approach implies a shared decision-making process, previous literature highlighted that balancing between participative and directive leadership (intended as its opposite) would maximize teachers' performance (Somech, 2005). The implications in terms of school quality and student outcomes are, thus, a matter of interest.

Supportive leaders (8.5%) are associated with high instructional and low distributed leadership. They provide a high level of support to the teaching body, empowering the staff and making them feel responsible for teaching effectiveness and outcomes. They also involve staff in school decisions to a certain extent, but not families and students. They support teachers, but are less likely to distribute their decision-making power down to them compared to *participative leaders*. Their leadership action targets teachers through the development of positive attitudes related to instructional leadership, in line with the concept of supportive leadership (Dayanti et al., 2022). School principals in this class are likely to encourage open discussion between teachers and support their sense of responsibility towards students' success. A supportive school culture has been found to mediate the relationship between instructional leadership and teachers' satisfaction, with relevant implications for teaching quality (Liu et al., 2021).

Lastly, *contingent leaders* (4.4%) report a low level of adoption for both instructional and distributed leadership, although, concerning the latter, their perception of staff participation is not low in absolute terms but is still the lowest across all subgroups. This group of school leaders have no clear perception of what leadership approach they have within their organization. This is in line with the definition of contingent leadership provided by Leithwood et al. (1999), who state that "*this approach assumes that what is important is how leaders respond to the unique organizational circumstances or problems*" (p. 15). It follows that there is no a priori approach, but every decision

depends on the specific time and circumstances in which it takes place. The application of a 'contextually sensitive combination' of leadership practices (Leithwood et al., 2008) could result in a profile in which none of the single practices stand out, making the implications for school effectiveness particularly interesting to be explored.

[Figure 2] around here

In the second step of our empirical analysis, a set of covariates were regressed against the most likely class assigned to each individual, in order to characterize the group. The results are given in Table 4 where, for each class, the mean of the variable is reported together with the estimated coefficient from the logistic regressions and the odds ratio (when statistically significant) as an indication of the effect size. Being the largest class, the integrating leaders are considered as the reference group.

Reversing the odds ratio for values lower than 1, less experienced principals (at their current school) are 1.19 times more likely to be contingent than integrating leaders (p-value<0.01), while schools with a lower proportion of students from disadvantaged families are 2.13 times more likely to be run by contingent rather than by integrating leaders (p-value<0.01). Both in terms of size and significance, the proportion of students coming from a disadvantaged family seems to be particularly important in terms of defining the main features relating to contingent leaders compared to integrating leaders. From a practitioner standpoint, leading a school in a deprived context may imply the need for high instructional and distributed leadership, thus supporting the development of such leadership practices in those contexts could be particularly beneficial.

On the comparison between participative and integrating leaders, men are 1.67 times more likely to be participative leaders (p-value<0.01), while school principals with a part-time contract are 1.89 times more likely to be participative rather than integrating leaders (p-value<0.05). Schools with a low proportion of students from disadvantaged families are 1.43 times more likely to be run by

participative leaders (p-value<0.01), who are also more likely to run schools located in a village or town than in large cities (retained as reference variable). Specifically, they are 2.47 times more likely to run schools in villages (p-value<0.05) and 2.74 times to run schools in towns (p-value<0.01). It is worth noting that the school principals most keen to involve staff, families and students are in schools outside the big cities, and this could be a possible form of a more "informal" leadership approach, more likely to be implemented in small communities.

Finally, on the comparison between supportive and integrating leaders, men are 2.33 times more likely to be supportive rather than integrating leaders (p-value<0.01). Also, school leaders without any teaching obligation set out in their contract are 3.03 times more likely to be supportive leaders (p-value<0.01), while school leaders in private schools are 4.91 times more likely to be supportive rather than integrating leaders (p-value<0.01). A point worth mentioning is that principals who highly support their teaching staff – but do not share the decision-making – are considerably less involved in teaching themselves and that this aspect is more common in private schools.

[Table 4] around here

4.2 The Relationship between Leadership Types and Student Achievement

Table 5 presents the results from the third step of the analysis, where the sample of schools was restricted to the eight countries taking part in the TALIS-PISA link (N=1,215) (see Methods). On comparing school average test scores across the leadership type classes, we were unable to detect any significant differences in mathematics, although this was not the case for reading. Contingent leaders are in schools where the PISA scores in reading are on average statistically higher than for all the other groups. We also found a difference in science results, but only in the schools run by contingent leaders and supportive leaders, with the schools run by contingent leaders once again reporting the highest average scores. It could actually be the case that contingent leaders, with their more flexible approach to all school matters, have a higher positive influence on factors affecting the students'

achievement. They may be more open to questioning their leadership approach and discussing it with the teaching body, and this, in turn, could affect teaching quality overall. For school leaders in the involved countries, this finding emphasizes the opportunity to reconsider their approach to leadership, in favor of a greater responsiveness to the context in which leadership is exerted.

However, it could actually be the case that there are a number of factors mediating the relationship between leadership type and achievement, such as school features or the composition of the student body. For this reason, we ran a post hoc analysis to check whether, having considered all the features relating to the principals, the school and contextual factors (discussed at Step 2 of the LCA in the methods), the statistical difference in the students' results is still significant. To verify this, we ran an Analysis of Covariance (ANCOVA) model where the dependent variable is the school average test score in PISA 2012 in mathematics, reading and science. For each model the covariates are the class membership as well as the personal and background factors used at Step 2 to characterize the groups.

Results are reported in Table 6 and show that the schools run by contingent leaders are those where test scores were adjusted downwards the most. Hence, the difference between this and the other groups is no longer statistically significant, meaning that the difference observed in Step 3 of the LCA could be explained by different school backgrounds or student body composition. The TALIS-PISA link only holds for eight countries in the full sample for the LCA, meaning that we urge caution in drawing lessons beyond these countries. Despite limited to a subset of countries, this finding could suggest school principals the need to adapt leadership practices to the context (i.e., school background and student composition) in which leadership takes place, as there is no a priori leadership approach that is directly related to better learning outcomes.

Our general findings are in line with the outcome of studies showing that there are factors mediating and moderating the relationship between school leadership and student achievement (Leithwood & Levin, 2005; Hallinger & Heck, 2011; Tan, 2016; Agasisti et al., 2019). Given the known indirect effect of leadership on student achievement (Hallinger & Heck 2011, Urick et al., 2018), it is not surprising that our findings, while limited to the TALIS-PISA link countries only,

show that leadership types do not have a direct correlation with student achievement. As Leithwood & Levin (2005) state, school and class conditions – together with teacher skills – mediate the effect of leadership, while the student's background, the teachers' and leaders' personal characteristics and policy-related factors can moderate this relationship. In the current study, we were able to show that contextual factors play a major role in shaping the relationship between leadership and achievement. In detail, Leithwood and Levin (2005, p.29) help to explain how "*the direct effects of leadership on mediating variables, as well as the indirect effects of leadership on pupils, is depressed, neutralized, or enhanced by key features of the situation or context in which leadership is exercised*".

[Table 5 and 6] around here

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5. Discussion and conclusions

5.1. Key messages from the empirical analysis

This section summarizes the four main messages of the present research. First, we descriptively investigated the distribution of leadership types across countries, showing that educational leadership is heterogeneous on a transnational basis. Second, we covered the role played by the cultural factors in the various countries and the influence that these exert within this observed heterogeneous picture. Third, we addressed the relevance of contextual factors in influencing the relationship between school leadership and student achievement. Finally, we contributed to the debate on the coexistence of different leadership styles and their characterization.

As a first point of discussion, Figure 3 illustrates the differences in distributions for the four latent classes across the 32 participating countries. The *integrating leaders* – who represent 64.9% of the sample – form the largest group in most countries (26 out of 32). In Abu Dhabi, Bulgaria, Korea, Latvia, Malaysia, Romania and Serbia, the *integrating leaders* make up nearly 80% of the national sample. In a second group of countries, the integrating leaders are between 60% and 70% of all

principals, followed by *participative leaders*, representing about 20-30% of the sample. This group of countries is well represented by the distribution in Australia, Czech Republic, England, Croatia, Mexico and Portugal. As an additional point, in all the countries cited above, there are very few *contingent leaders* – less than 3% of the sample. The United States is a slightly different case, with the *integrating leaders* making up 68.2%, and remaining leaders split between *supportive* (15.8%) and *participative leaders* (13.4%).

The average percentage of *integrating leaders* is similar to the numbers obtained by Urick and Bowers (2014b), who examined 7,650 schools in the USA, finding that integrating leaders make up 53.93% of the total sample. In general terms, this indicates that the findings of US studies (where existing literature is larger) can possibly be generalized to a wide spectrum of countries, since two thirds of them show a similar distribution. Given that schools characterized by a larger proportion of disadvantaged students are more likely to be run by integrating rather than contingent leaders, exerting high instructional and distributed leadership might be particularly important in deprived schools, representing an opportunity for poverty schools to improve.

The countries where most principals are *integrating leaders* (nearly 50%), but the share of *participative leaders* is not too far below (nearly 35%) form a separate cluster. Spain and France respect this pattern, and Sweden is somewhat similar, although this country is peculiar for its higher share of *contingent leaders*, 11% of the sample. This concentration of *contingent leaders* is second only to Japan and Finland, where respectively nearly 30% and 14% of principals state that their approach reflects low instructional and distributed leadership (and according to our definition, theirs is a contingency approach to leadership). In Japan, the largest class consists of the *participative leaders*, at nearly 33% of the sample. *Participative leaders* are also in the majority in Denmark, Finland and Norway.

The geographical distribution of these countries suggests a culturally-dependent approach to leadership. Cultural context has indeed been found to play an important role in shaping educational leadership (Bush, 2018; Liu, 2020). Liu (2020) stresses the relevance of considering both national

and school contexts when investigating educational leadership in an international setting. The school principal can play an important role in influencing classroom and school culture in terms of shared social norms, values and assumptions, and these beliefs are, in turn, specific to the community and national context in which the leadership is exercised. Countries with a very specific distribution also have a somehow similar cultural context. Chen et al. (2017) underlined the importance of team collaboration and interpersonal care in the Japanese context, which can help to explain the prevalence of participative leadership, where several actors are involved in the decision-making process. In the Scandinavian context, Soini et al. (2016) investigated the principals' leadership approach when school reforms were taking place in Finland, finding that they prefer an inclusive strategy to leadership, and so emphasizing their shared and distributed approach. In a transnational comparison carried out by the International Successful School Principalship Project (ISSPP), Johnson et al. (2008) analyzed school leadership in China, USA and Norway, finding that the last country was strongly inclined towards what is defined as "democratic leadership". This specific approach to school leadership can help in understanding the different distributions across these countries, with regards to higher representation of participative leadership (especially in Scandinavian countries) or contingent leadership (especially in Japan, Finland and Sweden). From an educational policy perspective, findings seem to highlight the differentiation of the Nordic educational model (Esping-Andersen, 1996) represented by Denmark, Finland, Norway and Sweden. As discussed by Kettle (2018), this model is based on the values of equality and participation as means for fostering democratic values. Across these countries, national policies since the 1990s favored greater differentiation and school choice as well as the decentralization of school governance from the central to the local level. The deregulation process has been particularly pushed in Sweden, where voucher-based free school policy has substantially differentiated the Swedish model from the other countries, so to make the existence of a Nordic educational model nowadays questionable (Kettle, 2018). The distinct profile of this cluster of countries stands out clearly from our results, as Denmark, Finland and Norway are the three countries with the highest percentage of participative leaders (at least 44%

of the total observations per country), in line with the participative and collectivist values that characterize their educational context. In this sense, leadership practices may be the result of a collective rather than personal approach to leadership, and the educational model is imbued with it. Educational policies willing to spread participative leadership should consider how to reinforce these set of beliefs together with distributed leadership practices in different national contexts where these values might be less rooted. The slightly different profile of Sweden emerges in the distribution of school principals that is more divided between integrating (44%), participative (36%) and contingent leaders (11%). In this case, the change introduced by the policy fostering school competition since the 2000s may have generated larger differentiation of leadership practices, also enlarging the space for contingent leadership that is more dependent on a situational approach. A high level of school competition is observed also in the Japanese national context (OECD, 2013b), where the distribution of school leaders is split across classes and the percentage of contingent leaders is the highest (30%). Despite not aimed to set any causal links between national characteristics and leadership practices, these considerations want to stimulate reflections on the mechanisms behind observed leadership types.

Cultural context can also influence the perception of leadership from one country to another. When answering these questionnaires, principals can be influenced by the societal purposes of education in their country, which lead to the importance of cultural sensitiveness. Governmental educational policies and level of (de)centralization can also affect the principals' perception of school leadership. Indeed, the way in which national school policies are designed influences the perception that school principals have of their functions, and this in turn may result in a certain polarization of perceptions within countries.

Findings highlight the three-pronged nature of the factors that may influence the perception of school leadership cross-nationally, namely (i) the social aspects related to the interaction with the staff and the community at large, (ii) the cultural aspects that may affect the set of values and beliefs,

and (iii) the policy aspects, which exert an influence on the set of norms at the basis of school leadership, and thus on the perception of school leadership itself.

The widespread presence of integrating leaders across countries raises a point about the management practices connected to a certain leadership type. Is an integrative approach the most desirable from a management (practical-oriented) point of view? School practices that empower teachers and spur them towards higher teaching effectiveness and involve internal and external stakeholders in the making of decisions can increase the level of management complexity, making this a topic that should stimulate reflections at policy level. The distribution of leadership classes across countries highlights the important role played by the set of beliefs, values, social norms and general cultural aspects within which school leadership practices (and perceptions) are applied. The differences may also reflect heterogeneous policy contexts and level of centralization of the educational system, where the boundaries of school leadership perception can vary. Policy-makers should carefully consider cultural-related factors when designing policies for developing leadership, as these perceptions drive principals' actions and, in turn, school effectiveness.

On the mediated relationship between school leadership and student achievement, factors relating to the school's context, such as the students' average socio-economic background and its ethnic composition, emerge as important in shaping the relationship between leadership and student outcome – similarly to the findings reached by Agasisti et al. (2019).

[Figure 3] around here

As a contribution to the theoretical debate on the co-existence of leadership styles and, in line with Marks and Printy (2003) and Urick and Bowers (2014b), Figure 4 shows the relative positioning of the four subgroups with respect to the aggregated indicators (standardized mean of the items) for instructional and distributed leadership. Marks and Printy (2003) have underlined the importance of considering the multi-dimensionality of leadership styles, which has to be interpreted on a continuum

of leadership styles. In their study, they observed that transformational leadership is a necessary but insufficient condition for shared instructional leadership. This finding was subsequently supported by Urick and Bowers (2014b) in their study on a nationally generalizable sample of US school principals. They identified three subgroups of school leaders through a LCA model, calling them *integrating*, *controlling* and *balkanizing* leaders. None of the groups recorded high levels of shared instructional in combination with low levels of transformational leadership. Since transformational leadership can be considered as the precursor of distributed instructional leadership (Urick and Bowers, 2014b), our findings have replicated this previous US-based work, extending it to the transnational context of TALIS. We found the same group of integrating leaders, who again make up the greatest group and see their approach as involving high levels of instructional and distributed leadership (Printy et al., 2009), with the centroid for this group in the top right hand quadrant. The prevalence of principals who respond highly across leadership practices has been also confirmed by Bowers (2020), in particular with reference to the US context. We also identified the group of participative leaders, those who are linked to a high level of distributed leadership and a low level of instructional leadership, and for these the centroid is in the bottom right-hand quadrant, close to the mean of the distributed leadership axis. The next group consists of the contingent leaders (4.4%), for whom their approach involves a low level of both distributed and instructional leadership, and they are situated in the bottom left-hand quadrant. The fourth group in our model is new to this field, and is represented by the supportive leaders, who record low levels of distributed leadership and high levels of instructional leadership, and the centroid of this group is placed in top left-hand quadrant of the figure. It may be the case this is a new group of school leaders, one that is not highly represented or recognizable in the USA, but exists cross-nationally. It may be, on the contrary, that here it is possible to distinguish between the contingent and supportive groups because of the higher statistical power of this study – N=9,384 observations – while the two groups could actually have been combined in the study by Urick and Bowers (2014b) – where N=7,560, or that the two studies measure slightly different constructs that may bring to the creation of the two subgroups observed in our study.

[Figure 4] around here

5.2.Limitations and future directions

From an LCA modelling perspective, the heterogeneity across national contexts could potentially indicate the need for a multiple group latent class analysis model (Collins & Lanza, 2010). These differences could indicate possible issues either with the survey level or the modelling, in terms of measurement invariance across national contexts. In collecting the TALIS data, the OECD was keen to minimize measurement invariance issues across the survey administrations in each country (OECD, 2014a). However, because this is among the first studies to examine leadership typology using a transnationally generalizable dataset of this kind and given that the three-step model specified in the present study is the most parsimonious model - as a multiple group LCA across each national context would greatly expand the number of variables - we decided to analyze the most parsimonious omnibus model with covariates and disaggregate the results by country. We recommend that this matter be taken up and reconsidered in future research.

As a limitation to the present study, indicators based on the principals' perceptions have potential drawbacks. Self-reported data suffer from a possible "social-desirability" bias (Podsakoff et al., 2003), which can be more or less culturally embedded and so vary across countries. Moreover, some missing data are observed in Step 1 and 2, and we acknowledge the potential limitation coming from data missing not at random. Notwithstanding these limitations, our study provides several insights and suggestions to evaluate the state of the art on educational leadership across countries.

An additional point is related to a future extension of the research, and concerns the limited number of countries analyzed at Step 3 of the LCA. As we based our work on the TALIS-PISA link, student achievement in PISA 2012 is only available for a subgroup of eight countries, hence the

results from the sample cannot be generalized. It would be also useful to study in deep the policy-related factors that may influence the perception of leadership and be related to the cultural context in which such leadership is shaped. Moreover, in-depth qualitative study like ethnographic exploratory research would enrich the findings, especially with reference to the integrating leadership type as it is the most widespread and potentially heterogenous across countries. Future research could replicate the current analysis on OECD TALIS 2018 data, also including, if available, additional indicators on instructional and distributed leadership. Additional reflections would be needed in light of the disruptive shock brought by the COVID-19 emergency, that has let new traits of educational leadership emerge (Shaked, 2022).

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Figure 1. Empirical Approach: the three-step LCA model.

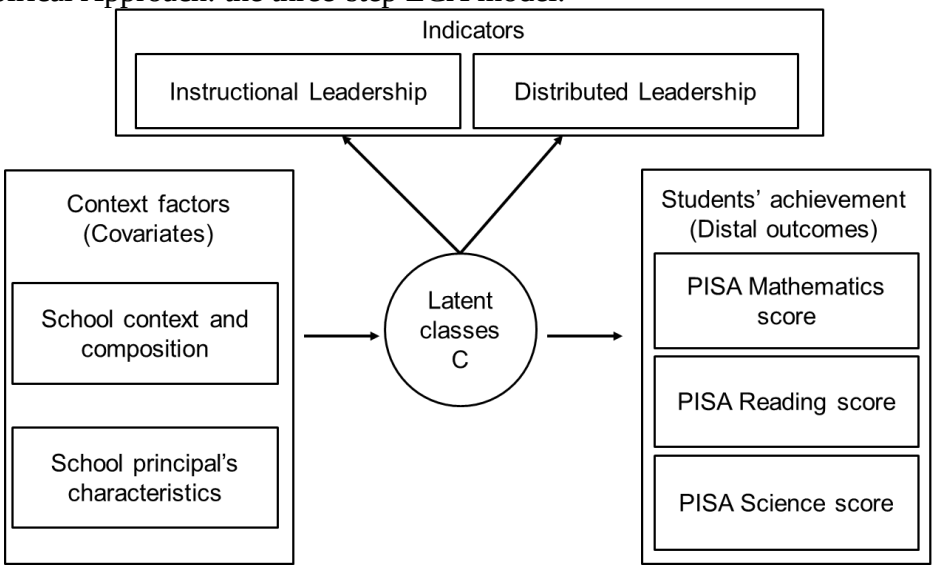


Figure 2. Statistical indicator plots of the groups of school leaders.

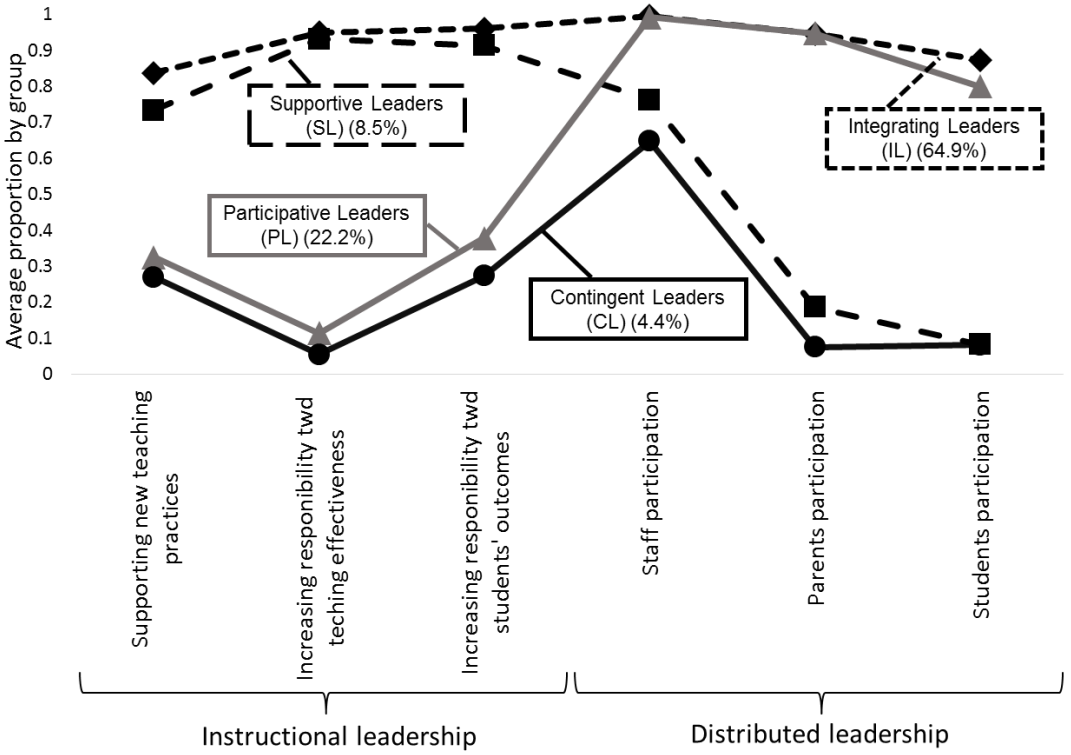
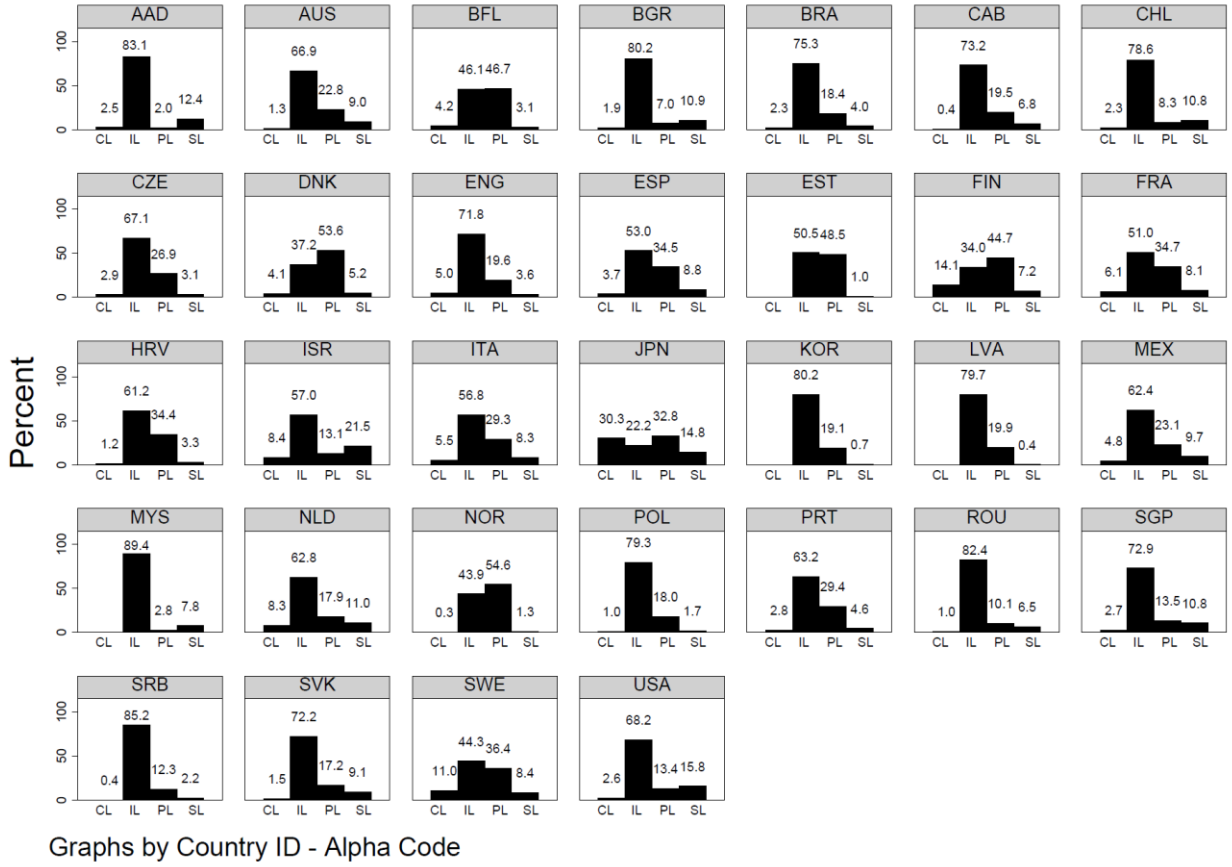


Figure 3. Distribution of leadership types across countries.



Note. CL = Contingent leaders; IL = Integrating leaders; PL = Participative leaders; SL = Supportive leaders. Percentage reported on top of each histogram.
List of ISO codes. AAD = Abu Dhabi (United Arab Emirates); AUS = Australia; BFL = Flanders (Belgium); BGR = Bulgaria; BRA = Brazil; CAB = Alberta (Canada); CHL = Chile; CZE = Czech Republic; DNK = Denmark; ENG = England (United Kingdom); ESP = Spain; FIN = Finland; FRA = France; HRV = Croatia; ISR = Israel; ITA = Italy; JPN = Japan; KOR = Korea; LVA = Latvia; MEX = Mexico; MYS = Malaysia; NLD = Netherlands; NOR = Norway; POL = Poland; PRT = Portugal; ROU = Romania; SGP = Singapore; SRB = Serbia; SVK = Slovak Republic; SWE = Sweden; USA = United States.

Figure 4. Plot of the relationship between distributed leadership and instructional leadership for each class.

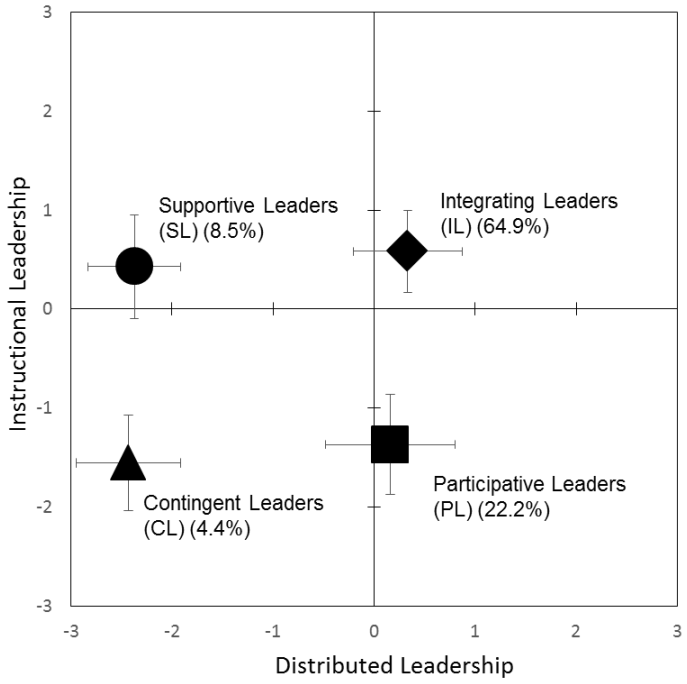


Table 1. TALIS 2013 and TALIS-PISA link participating countries and school sample size.

COUNTRY code	COUNTRY name	Sample size (TALIS)	Sample size (PISA)	COUNTRY code	COUNTRY name	Sample size (TALIS)	Sample size (PISA)
AAD	Abu Dhabi (United Arab Emirates)	240		**ITA**	Italy	194	
AUS	Australia	307	99	**JPN**	Japan	192	
BFL	Flanders (Belgium)	305		**KOR**	Korea	162	
BGR	Bulgaria	192		**LVA**	Latvia	110	103
BRA	Brazil	1024		**MEX**	Mexico	186	137
CAB	Alberta (Canada)	174		**MYS**	Malaysia	146	
CHL	Chile	145		**NLD**	Netherlands	119	
CZE	Czech Republic	220		**NOR**	Norway	106	
DNK	Denmark	344		**POL**	Poland	187	
ENG	England (United Kingdom)	146		**PRT**	Portugal	175	137
ESP	Spain	495	306	**ROU**	Romania	196	140
EST	Estonia	196		**SGP**	Singapore	143	148
FIN	Finland	626	145	**SRB**	Serbia	186	
FRA	France	169		**SVK**	Slovak Republic	186	
HRV	Croatia	192		**SWE**	Sweden	170	
ISR	Israel	181		**USA**	United States	99	

Note: N= 10,172 for TALIS. Country code is based on ISO 3166 coding scheme, as reported in the dataset. The sample size for PISA is reported only for the TALIS-PISA link countries (N= 1,215).

Table 2. Descriptive statistics of the variables.

Step of the analysis	Indicator	Description	Min	Max	Mean	Standard Deviation	N
Step 1 (Indicators)	Instructional leadership	Frequency of occurrence of the statement: *I took actions to support co-operation among teachers to develop new teaching practices;* Often=1; Seldom=0.	0	1	0.65	0.48	9,384
	Instructional leadership	Frequency of occurrence of the statement: *I took actions to ensure that teachers take responsibility for improving their teaching;* Often=1; Seldom=0.	0	1	0.69	0.46	9,384
	Instructional leadership	Frequency of occurrence of the statement: *I took actions to ensure that teachers feel responsible for their students' learning outcomes;* Often=1; Seldom=0.	0	1	0.75	0.43	9,384
	Distributed leadership	Level of agreement with the statement: *This school provides staff with opportunities to actively participate in school decisions;* Agree=1; Disagree=0.	0	1	0.98	0.15	9,384
	Distributed leadership	Level of agreement with the statement: *This school provides parents or guardians with opportunities to actively participate in school decisions;* Agree=1; Disagree=0.	0	1	0.82	0.39	9,384
	Distributed leadership	Level of agreement with the statement: *This school provides students with opportunities to actively participate in school decisions;* Agree=1; Disagree=0.	0	1	0.79	0.41	9,384
	School principals' characteristics						
Step 2 (Covariates)	Gender	Variable = 1 if the school principal is a woman; 0 otherwise	0	1	0.49	0.50	8,552
	Age	Age in years	23	73	50.83	8.08	8,552
	Education	Highest level of education completed: variable = 1 if the school principal got a PhD or equivalent; 0 otherwise	0	1	0.04	0.20	8,552
	Experience as SP at current school	Experience in the school analysed in years	0	47	6.65	6.15	8,552

	Experience in the education system - including teaching	Experience as teacher or school principal (cumulative) in years	0	49	20.22	10.28	8,552
	Full time contract	Variable = 1 if the school principal has a full time contract (90% or more of full-time hours); 0 otherwise	0	1	0.95	0.23	8,552
	Teaching obligation	Variable = 1 if the school principal has teaching obligation; 0 otherwise	0	1	0.42	0.49	8,552
	School and context characteristics						
	School size	Number of students at school	1	8,500	667.43	534.53	8,552
	Student/Teacher ratio	Number of students per teacher in the school	0.07	558	13.67	12.38	8,552
	Students from socioeconomically disadvantaged home	Proportion of socioeconomically disadvantaged students in the school (1 = None, 2 = 1-10%, 3 = 11-30%, 4 = 31-60% and 5 = more than 60%)	1	5	2.72	1.05	8,552
	Students whose first language is different from the language of instruction	Proportion of students whose first language is different from the language of instruction (1 = None, 2 = 1-10%, 3 = 11-30%, 4 = 31-60% and 5 = more than 60%)	1	5	1.96	1.06	8,552
	School in a village	Variable = 1 if the school is located in a village (<3,000 people); 0 otherwise	0	1	0.18	0.38	8,552
	School in a town	Variable = 1 if the school is located in a town (<100,000 people); 0 otherwise	0	1	0.68	0.47	8,552
	Private school	Variable = 1 if the school is privately-managed; 0 otherwise	0	1	0.15	0.36	8,552
	PISA 2012 test scores						
Step 3 (Distal outcomes)	Mathematics score	School average mathematics score in PISA 2012	282.71	752.42	487.97	64.46	1,215
	Reading score	School average reading score in PISA 2012	278.10	698.30	487.05	62.01	1,215
	Science score	School average science score in PISA 2012	268.72	723.49	494.21	63.42	1,215

Table 3. LCA results and fit statistics.

Classes	AIC	BIC	-Log likelihood	LMR test	p-value	Entropy
2	51,318.40	51,411.30	-25,646.20	4,541.30	0.0291	0.759
3	49,147.20	49,290.10	-24,553.60	2,151.60	0.1240	0.818
4	48,645.30	48,838.30	-24,295.70	507.90	0.4623	0.820
5	48,593.40	48,836.40	-24,262.70	64.90	0.6212	0.824
6	48,561.50	48,854.50	-24,239.50	45.30	0.4102	0.771

Note: AIC=Akaike information criterion; BIC=Bayesian information criterion; LMR=Lo-Mendell-Rubin likelihood ratio test. The p-value refers to the significance level of the LMR test.

Table 4. Mean and odds ratios for covariates.

	Contingent leaders			Integrating leaders		Participative leaders			Supportive leaders		
School principals' characteristics	Mean	Coefficient	Odds ratio	Mean	Odds ratio	Mean	Coefficient	Odds ratio	Mean	Coefficient	Odds ratio
Gender (female SP = 1)	0.33	-0.56	-	0.54	-	0.44	-0.508	0.60***	0.42	-0.85	0.43***
Age (years)	50.92	0.037	-	50.78	-	51.04	-0.004	-	50.45	-0.04	0.96*
Education (PhD = 1)	0.01	-3.477	-	0.05	-	0.03	-0.315	-	0.05	-0.992	-
Experience as SP at current school (years)	5.14	-0.178	0.84***	6.76	-	6.62	-0.01	-	6.63	0.026	-
Experience in the education system - including teaching (years)	18.7	-0.025	-	20.47	-	20.07	-0.002	-	19.33	0.005	-
Full time contract (=1)	0.96	1.111	-	0.95	-	0.94	-0.631	0.53**	0.95	-0.457	-
Teaching obligation (=1)	0.38	-0.607	-	0.43	-	0.41	-0.08	-	0.39	-1.117	0.33***
School and context characteristics											
School size (#)	603	-0.001	0.99**	698	-	573	0.000	-	771	0	-
Student/Teacher ratio	17	0.007	1.01**	14	-	12	-0.004	-	14	-0.001	-
Students from socioeconomically disadvantaged home (categorical 1-5)	2.36	-0.75	0.47***	2.82	-	2.55	-0.362	0.70***	2.64	-0.042	-
Students whose first language is different from the language of instruction (categorical 1-5)	1.95	-0.073	-	1.95	-	1.96	0.001	-	2.07	-0.098	-
School in a village (<3,000 people, =1)	0.11	-1.5	-	0.17	-	0.2	0.903	2.47**	0.12	0.397	-
School in a town (<100,000 people, =1)	0.76	-0.294	-	0.67	-	0.7	1.009	2.74***	0.65	0.18	-
Private school (=1)	0.22	0.432	-	0.13	-	0.15	0.049	-	0.3	1.592	4.91***

Note: Significance tests are logistic regressions. *p≤.10. ** p≤.05. *** p≤.01. Odds ratios are reported for statistically significant correlation only and represent the effect of the predictors on the likelihood that one outcome will occur with respect to the reference category (integrating leaders). Listwise deletion applied in Step 2. N=8,552.

Table 5. Means and p-values for distal outcomes across groups.

PISA 2012 mathematics score				
	Contingent leaders (CL)	Integrating leaders (IL)	Participative leaders (PL)	Supportive leaders (SL)
Contingent leaders (CL)	439.29 (12.87)			
Integrating leaders (IL)	0.692	433.78 (5.27)		
Participative leaders (PL)	0.741	0.958	434.29 (7.92)	
Supportive leaders (SL)	0.249	0.279	0.295	416.02 (15.54)
PISA 2012 reading score				
	Contingent leaders (CL)	Integrating leaders (IL)	Participative leaders (PL)	Supportive leaders (SL)
Contingent leaders (CL)	468.05 (5.69)			
Integrating leaders (IL)	0.001*	440.82 (5.82)		
Participative leaders (PL)	0.010*	0.967	440.37 (9.10)	
Supportive leaders (SL)	0.050*	0.762	0.8	435.83 (15.39)
PISA 2012 science score				
	Contingent leaders (CL)	Integrating leaders (IL)	Participative leaders (PL)	Supportive leaders (SL)
Contingent leaders (CL)	455.85 (11.78)			
Integrating leaders (IL)	0.203	439.22 (5.63)		
Participative leaders (PL)	0.472	0.547	445.38 (8.56)	
Supportive leaders (SL)	0.047*	0.183	0.112	417.64 (15.21)

Note: Acronyms refer to the four groups: CL=Contingent leaders; IL=Integrating leaders; PL=Participative leaders; SL=Supportive leaders. The diagonal reports the average school score for each type of school leaders; standard errors in parenthesis. Lower triangular elements refer to the p-values of the difference between each pair of school leadership types. *p≤.05. N=1,215.

Table 6. Means and p-values for distal outcomes across groups adjusting for covariates.

PISA 2012 mathematics score				
	Contingent leaders (CL)	Integrating leaders (IL)	Participative leaders (PL)	Supportive leaders (SL)
Contingent leaders (CL)	432.73 (6.41)			
Integrating leaders (IL)	1.000	433.17 (1.74)		
Participative leaders (PL)	0.973	0.746	429.42 (2.85)	
Supportive leaders (SL)	0.859	0.573	0.243	439.28 (3.76)
PISA 2012 reading score				
	Contingent leaders (CL)	Integrating leaders (IL)	Participative leaders (PL)	Supportive leaders (SL)
Contingent leaders (CL)	454.92 (6.89)			
Integrating leaders (IL)	0.363	442.04 (1.87)		
Participative leaders (PL)	0.081	0.349	435.44 (3.06)	
Supportive leaders (SL)	0.999	0.103	0.007*	453.60 (4.04)
PISA 2012 science score				
	Contingent leaders (CL)	Integrating leaders (IL)	Participative leaders (PL)	Supportive leaders (SL)
Contingent leaders (CL)	445.22 (6.56)			
Integrating leaders (IL)	0.754	437.73 (1.78)		
Participative leaders (PL)	0.928	0.897	440.41 (2.91)	
Supportive leaders (SL)	0.999	0.573	0.913	443.98 (3.85)

Note: Acronyms refer to the four groups: CL=Contingent leaders; IL=Integrating leaders; PL=Participative leaders; SL=Supportive leaders. The diagonal reports the average school score for each type of school leaders; standard errors in parenthesis. Lower triangular elements refer to the p-values of the difference between each pair of school leadership types. *p≤.05. N=1,215.

Annex. Mplus code for Latent Class Analysis.

```
Data:
  File is TALIS2013.dat ;
Variable:
  Names are
     SCHWGT case_id TC2G21Cd TC2G21Dd TC2G21Ed TC2G22Ad TC2G22Bd TC2G22Cd
     GEN AGE PHD EXP EXP_TEACH FULL TEACH VILLAGE TOWN L_CITY PRIV SIZE
     PER_DIS N_TEACH ST_RATIO PER_IMM IDSCHOOL_CNTRY;
  Missing are all (-9999) ;
  IDVARIABLE = case_id;
    Usevariables are TC2G21Cd
       TC2G21Dd TC2G21Ed TC2G22Ad TC2G22Bd
        TC2G22Cd ;
     Categorical are TC2G21Cd
        TC2G21Dd TC2G21Ed TC2G22Ad TC2G22Bd
        TC2G22Cd ;
      classes = c (4);
      WEIGHT = SCHWGT ;
      AUXILIARY = (R3STEP) GEN AGE PHD EXP EXP_TEACH FULL TEACH VILLAGE
TOWN
      PRIV SIZE PER_DIS ST_RATIO PER_IMM;
      AUXILIARY = PV1MATH(bch) PV1READ(bch) PV1SCIE(bch);
  Analysis:
      Type = MIXTURE ;
      PROCESSORS = 4 (STARTS);
      MITERATION = 500;
      STARTS = 2500 25;
      STITERATION = 10;
  Output:
       tech11
  Plot:
       type = plot3;
       series = TC2G21Cd
       TC2G21Dd TC2G21Ed TC2G22Ad TC2G22Bd
       TC2G22Cd (*);
  SAVEDATA:
       file is talis.dat ;
       save is cprob;
       format is free;
```