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School leadership and achievement gaps based on socioeconomic status: a search for socially just instructional leadership

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Abstract

Purpose – The research literature in this field demonstrates that instructional leadership provided by principals is essential for student learning, but the question of its impact on students with high and low socioeconomic status (SES) has remained largely unexplored. In the present study, the authors focus on the moderating role of instructional leadership in the relationship between SES and achievement at both the school and student levels.

Design/methodology/approach – Using cross-national Programme for International Student Assessment (PISA) 2015 data, the authors fitted multilevel models to investigate whether the effect of instructional leadership on student achievement in math, science and reading varies across groups of students with the different individual as well as school SES levels.

Findings – Instructional leadership significantly moderates the relationship between school-level SES and student achievement in math, while the moderation effect for individual SES and instructional leadership is not significant for any subject.

Research limitations/implications – This study calls for more research on the moderation role of leadership in the relationship between SES and student achievement, with a specific focus on the integrated models that include the social justice aspect of school leadership.

Originality/value – The authors conclude that while instructional leadership might be beneficial in reducing the achievement gaps between schools, it may not make much difference in terms of reducing the disparity between different SES groups within schools.

Keywords Moderating effect, Socioeconomic status, Instructional leadership, Student achievement, Achievement gaps

Paper type Research paper

Introduction

The 21st century has been characterized by unprecedented social and political pressure on education and school systems worldwide to produce enhanced student learning outcomes (Chiang, 2009). This context has led both policymakers and researchers to focus more attention on the inequalities in academic outcomes among different social groups (OECD, 2001). Relevant research has provided extensive evidence that students from low socioeconomic status (SES) backgrounds experience major disadvantages in terms of benefiting equally from their education in comparison with their peers with higher SES (Sirin, 2005; Van Ewijk and Sleegers, 2010). Despite such an alarming picture, school leadership

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research has provided little quantitative evidence relating to the role of school leadership in bridging the achievement gaps between students from different SES groups (Smith and Gümüş, 2022; Tan, 2018; Urick *et al.*, 2021).

In recent years, research has offered convincing evidence that effective school leadership is an indispensable component in ensuring increased learning outcomes in schools (Grissom *et al.*, 2021; Tan *et al.*, 2020). Relevant research has also revealed that instructional leadership, which includes the direct involvement of school leaders in the betterment of teaching and learning processes, play an important role in yielding desired student achievement results (Goddard *et al.*, 2020; Robinson *et al.*, 2008). Overall, the literature indicates that leadership matters and that instructional leadership in particular is one of the essential elements in the process of improving schools and raising the student learning outcomes.

School leadership literature has also argued that instructional leadership practices of principals are particularly important for student achievements in low-SES environments (Bryk *et al.*, 2010; Heystek and Emekako, 2020; Vale *et al.*, 2010), while it is yet to develop a comprehensive understanding of the roles of individual- and school-level SES in this process. Educational research has provided significant evidence that the student achievement is linked not only to the students' own SES resulting from their family background, but also to the school-level SES representing peer/community background as well as school resources (Sirin, 2005; Perry and McConney, 2013). This leads to the important question of how instructional leadership interacts with individual- and school-level SES in the process of influencing student achievement.

We, first, argue that instructional leadership might be particularly beneficial for individual students with low-SES backgrounds within schools by compensating the lack of educational support and directions they receive from their families (Darling-Hammond, 2010; Dietrichson *et al.*, 2017; Lareau, 2003). We also know that students in low-SES communities struggle with some hardships that may not be directly linked to their own family background. For example, schools in such communities are often lacking high-quality human and material resources, a robust curriculum, and positive peer effects (Caldas and Bankston, 1997; Perry and McConney, 2013; Yang and Gustafsson, 2004). Therefore, instructional leadership could also play a role in eliminating such difficulties by supporting teacher development, promoting a positive school climate and bringing in external support, etc. (Bryk *et al.*, 2010; Naicker *et al.*, 2013; Tajalli and Opheim, 2005).

Against this background, the present study investigates the moderating role of instructional leadership in the relationship between SES and achievement at both student and school level. By using cross-national data based on the Programme for International Student Assessment (PISA) 2015 survey, our aim is to contribute to the growing international literature on the role of schools in reducing achievement gaps between students from different backgrounds (Chudgar and Luschei, 2009; Huang and Sebastian, 2015), with a school leadership perspective.

Literature review

Instructional leadership

During the 1960–70s, scholars from the US identified various roles and responsibilities of school principals that are regarded as the key to improving teaching and student learning (Erickson, 1967). This line of research, which is known as school effectiveness research, reinforced the discussions on instructional leadership. Specific practices mentioned in the related literature included helping teachers to improve their teaching practices, developing goals regarding student achievement (Edmonds, 1979), recruiting effective teachers, buffering teachers from time-consuming issues, creating an environment for teacher development (Brieve, 1972; Rosenholtz, 1985), and collecting, analyzing and interpreting data about teachers' classroom performance (Zechman, 1977).

After 1980s, several scholars developed concrete instructional leadership models. For example, Bossert *et al.* (1982) conceptualized instructional leadership with three main components: *principal management behavior*, *school climate* and *instructional organization*. Hallinger and Murphy (1985) introduced another conceptualization, which has been used widely in the relevant research, including three main dimensions: *defining the school mission, managing the instructional program* and *promoting a positive school learning climate*. Almost two decades later, the notion of sharing the instructional leadership responsibilities with teachers emerged, thereby adding the perspective of shared responsibility among teachers and administrators for student learning (Marks and Printy, 2003).

With a clearer understanding of instructional leadership and the development of relevant measurement tools, research since the 1980s has mostly concerned itself with investigating the relationship of instructional leadership to teaching and learning outcomes (Hallinger *et al.*, 2020). Accordingly, the strong links between instructional leadership and teacher efficacy (Liu *et al.*, 2021; Goddard *et al.*, 2020), professional learning (Liu and Hallinger, 2018), teacher retention and commitment (Boyce and Bowers, 2018), teaching practices (Bellibaş *et al.*, 2021), and student learning outcomes (Robinson *et al.*, 2008) have been firmly established.

Consistent research findings and the global trend for accountability in education have kept both policy and research interests in instructional leadership alive for a long period. An Organisation for Economic Co-operation and Development (OECD) report based on policy analyses from 22 educational systems around the world states that "while practices vary across countries, it is clear that school leadership is generally expected to play a more active role in instructional leadership" (Pont *et al.*, 2008, p. 26). Related research trend has also confirmed the continuous interest in the concept of instructional leadership globally (Hallinger *et al.*, 2020).

Socioeconomic status (SES) in educational research and its measurement

SES has been a central subject of inquiry in the field of education and has been linked to various student outcomes, such as achievement, ability, efficacy and well-being (Blums *et al.*, 2017; Sirin, 2005; Yerdelen-Damar and Peşman, 2013). A wide body of research reports a persistent pattern that the effects of SES on student achievement are substantial at both individual and group level (Sirin, 2005; Perry and McConney, 2013). This means not only that low-SES students perform worse than their high-SES peers in general, but also that students in schools with more low-SES peers suffer compared to their counterparts studying in schools with a higher level of SES on average.

Despite its importance and popularity, SES is by no means easy to measure. It has been a common practice to measure SES using three main family-related dimensions: education, income and occupation (Baker, 2014; Saegert *et al.*, 2007). Various home resources, including books, computers and music instruments, have also been included in the measurement of SES in recent years, using the cultural capital framework (Eryılmaz *et al.*, 2020; OECD, 2016). However, in education research family wealth or related factors, such as receiving a free and reduced-price lunch, are still widely applied as a proxy of SES (e.g. Godddard *et al.*, 2020; Leithwood *et al.*, 2020).

The majority of the research inquiring into the relationship between SES and student learning outcomes has utilized individual-level SES, while ignoring the effect of school-level SES (Yang and Gustafsson, 2004). School-level SES goes beyond the family's cultural, economic and social capital and refers to "the community's socio-cultural and economic environment" (Yang and Gustafsson, 2004, p. 278). While individual-level SES represents differences between students within a school due to their family background (Baker, 2014; Saegert *et al.*, 2007), school-level SES corresponds to the differences between schools with regard to “peers” (Caldas and Bankston, 1997) and/or the quality of schools’ human and material resources (Yang and Gustafsson, 2004).

Researchers have adopted various strategies to measure school-level SES. For instance, Sirin (2005) indicated that one common way of measuring school-level SES involves using the proportion of students in a school benefitting from free or reduced-price lunches. However, this is only applicable to the schools that have such options. Another common strategy is aggregation. Researchers who use international data sets such as PISA often aggregate individual-level SES by schools and utilize this for school-level SES (Perry and McConney, 2013; Thien, 2016).

In sum, two SES constructs represent distinct mechanisms through which they might influence student achievement. Scholars, therefore, recommend that studies seeking to examine how SES predicts student outcomes should consider SES as a multilevel construct (Yang and Gustafsson, 2004).

The present study

Although the literature in general suggests that instructional leadership might reduce the achievement gaps between low- and high-SES students, the mechanism involved in this is not clear. One reason could be the relatively higher benefit of instructional leadership for individual students who need the most support. The negative effect of low-SES on student achievement has been associated with various issues directly related to students’ own family background such as lack of parental support and directions (Darling-Hammond, 2010; Lareau, 2003). Certain practices associated with instructional leadership such as developing learning goals, monitoring learning progress and creating a positive learning environment at school might make a particular difference for low-SES students by providing the missing support and directions. Therefore, we propose that the increased instructional leadership of principals might diminish the effect of SES on achievement at student level.

H1. Instructional leadership weakens the relationship between individual SES and achievement, meaning that the connection between students’ own SES and their achievement would be less visible in schools with stronger instructional leadership.

The second possible reason for the differentiated effect of instructional leadership on high- and low-SES students may relate more to the overall improvement at school level. On average, students attending low-SES schools are likely to achieve less than students attending schools in advantaged communities due to the lack of high-quality material and human resources (Yang and Gustafsson, 2004). Instructional leadership could be an important intervention to overcome such obstacles, at least partly, to raise the overall achievement at low-SES schools. For example, improving the professional learning and instructional practices of teachers could directly address issues such as the quality of human resources (Naicker *et al.*, 2013; Steinberg and Yang, 2020). Accordingly, we propose that instructional leadership might help to narrow the achievement gap between low- and high-SES students by reducing the effects of school-level SES on student achievement.

H2. Stronger instructional leadership diminishes the strength of the relationship between school-level SES and average student achievement, reducing the achievement gap between students in high- and low-SES schools.

In the present study, we focus on the moderating role of instructional leadership in the relationship between SES and achievement at both school and student levels, as presented in our conceptual framework (see Figure 1).

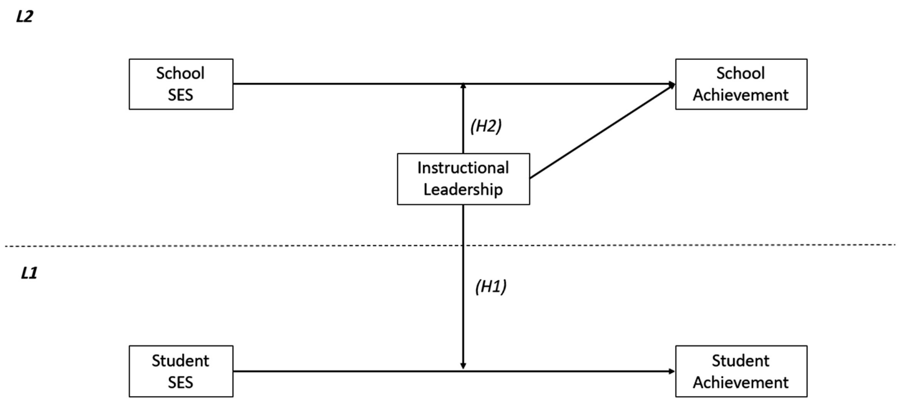

Figure 1.
Conceptual framework

Method

In this section, we start by describing the data source employed in the study, including the sample and variables. Then we describe the data analysis strategy.

Data source

We employed data from the 2015 cycle of the PISA, which is the latest available cycle with a relevant leadership variable. In total, 72 countries and regions participated in PISA 2015. While we intended to use the whole data set, the regions within individual country data sets were excluded from the analysis since those were missing school-weight information, which was essential for the unbiased estimation of the statistical models. Albania was also dropped from the data since it was missing an SES variable.

PISA

PISA is an international test administered by the OECD to assess 15-year-old students' preparedness for the knowledge society. It involves surveys and assessment tools that aim to reveal students' cognitive ability in reading, math and science along with information regarding the non-cognitive abilities of students, family and school background, teacher practices, etc. For sampling, a stratification technique is used in general, although small and remote regions are not included due to inaccessibility. Ideally, the OECD aims to select 150 schools from each country and at least 20 students from each school (OECD, 2017).

Variables and measures

Our data set includes variables at two levels: the student and the school (see Tables 1 and 2). At student level, we used student achievement scores in three subject areas (math, science

Table 1.
Descriptive statistics of continuous variables

Variable	Obs	Mean	Std. dev.	Min	Max
Age	495,000	15.795	0.291	15.17	16.42
SES	485,000	−0.272	1.112	−7.26	4.183
School SES	17,089	−0.327	0.801	−4.851	1.584
Instructional Leadership	12,639	0.141	1.024	−6.737	4.43
Shortage of Educational Materials	12,665	0.202	1.112	−1.321	3.631
School Size	11,983	734.384	672.931	0	15,000
Student-Teacher Ratio	12,045	14.122	9.085	1	100

Variable	Freq.	Percent	Cum.
Student Gender			
Female	248,166	50.13	50.13
Male	246,859	49.87	100.00
Early Childhood Education and Care			
No	10,280	3.06	3.06
1–2 years	142,460	42.35	45.41
More than 2 years	183,637	54.59	100.00
Immigration status			
Native	419,663	88.10	88.10
Second-Generation	28,244	5.93	94.03
First-Generation	28,444	5.97	100.00
School Accountability			
Yes	4,785	38.03	38.03
No	7,798	61.97	100.00
School Location			
A village, hamlet or rural area (fewer than 3,000 people)	2077	16.46	16.46
A small town (3,000 to about 15,000 people)	2,914	23.09	39.55
A town (15,000 to about 100,000 people)	3,633	28.79	68.34
A city (100,000 to about 1,000,000 people)	2,589	20.52	88.85
A large city (with over 1,000,000 people)	1,407	11.15	100.00

Table 2.
Descriptive statistics of categorical variables

and reading) as dependent variables. Instead of using a single achievement score, the OECD developed ten plausible values (PVs) for each subject area. We employed each of these PVs for the analysis as recommended by many researchers (Lorah, 2018; Rogers and Stoeckel, 2008). At student level, we used the index of social, economic and cultural status (ESCS) for socioeconomic status (SES). In addition, students' gender (ST004D01T) (0 = boys and 1 = girls), age (AGE), immigration status (IMMIG) (0 = native, 1 = second-generation, and 2 = first-generation), and duration in early childhood education (DURECEC) (0 = no early childhood education, 1 = one or two years of early childhood education, and 2 = more than two years of early childhood education) were used as control variables.

At school level, we have two main independent variables: school-level SES (SSES), measured by the average ESCS for each school, and instructional leadership. We used the index of "LEAD", which was created based on the principals' self reports, as an indicator of instructional leadership. Index of "LEAD" is capable of capturing the essential components of instructional leadership highlighted in the literature (Blasé and Blasé, 2000; Hallinger and Murphy, 1985; Marks and Printy, 2003), such as improving teaching or the creation of a better classroom environment, focusing on the professional development of teachers, praising successful teachers, developing and communicating student achievement goals, etc. Cronbach's alpha value (0.987) indicated that this index is reliable. Then we conducted a confirmatory factor analysis (CFA). The result (RMSEA = 0.060, CFI = 0.990, TLI = 0.987, SRMR = 0.008) showed evidence of a good model fit (Hu and Bentler, 1999).

We also employed several controlling variables at school level based on their potential influence on student learning as highlighted in the previous literature. First, we included school location (SC001Q01TA) 0 = village (less 3,000 inhabitants) 1 = small town (3,000 to 15,000), 2 = town (15,000 to 100,000), 3 = city (100,000 to 1,000,000) and 4 = large city (more than 1,000,000), which found to significantly influence student achievement (Xu, 2009). Second, we added "achievement data shared with the public" as a measure of accountability (SC036Q01TA) (0 = yes and 1 = no) because school accountability is likely to improve student achievement and reduce the gap between different student groups (Hanushek and Raymond, 2004). We also included student-teacher ratio (STRATIO); an index for the shortage of educational materials (EDUSHORT); and school size measured as the number of students enrolled (SCHSIZE). Such variables were included since they might influence achievement, particularly for disadvantaged students (Gershenson and Langbein, 2015; Yang and Gustafsson, 2004).

Data analysis

Multilevel analysis makes it possible to examine the variance in hierarchically structured data, with people being nested within a higher cluster. The data set used here represents a three-level nested structure, with students nested within schools and schools nested within countries. Students are regarded as level 1, schools are level 2 and countries are level 3. So we conducted a three-level multilevel analysis to examine how student and school-related variables predict student achievement in reading, math and science, controlling for variation due to the countries in question. More precisely, we followed the suggestions for handling large-scale assessment data with a large number of countries made by Muthén and Asparouhov (2018) and Scherer (2020), and thus treated countries as random with schools nested within countries and students nested in schools.

However, several issues need to be considered when analyzing complex surveys (Lorah, 2018). One of these issues is PVs. Student achievement data in PISA involves ten PVs for each subject area. It is preferable to incorporate all the values instead of simply using one PV or a sum of PVs (Rogers and Stoeckel, 2008). We handled PVs by writing out ten data sets – one for each PV – and combined these data sets in Mplus using the IMPUTATION function. Thus, analyses are conducted for each set of PVs and combined automatically afterward in Mplus (Scherer, 2020). Scholars also recommend the use of sample weights due to the unequal probability of selection (Lorah, 2018), but it is largely unclear which weights should be used and how to achieve robust results (Laukaityte and Wiberg, 2018). As it has been shown for PISA 2015, "using only the school weights provide the most unbiased estimates for hierarchical models" (Mang *et al.*, 2021, p. 36), we employed school weights (W_SCHGRNRABWT) to correct for imperfections due to the difference between the sample and the reference population.

Several multilevel models were fitted to measure the variation in student achievement between students, schools and countries in Mplus 8.3 (Muthen and Muthen, 2017). The parameters were estimated by applying robust maximum likelihood (MLR), which is robust in relation to the non-normality and non-independence of responses. As there was no missing data for the PVs and the amount of missing data for all other variables was small (ranging from 0.6% to 12.7%), we handled missing data by applying full information maximum likelihood (FIML).

The first model is:

$$Y_{ijk} = \gamma_{000} + r_{0_{jk}} + u_{00_k} + e_{ijk},$$

where Y_{ijk} is the dependent variable (each PV) of student i in jth school from country k. γ_{000} is the overall grand mean, representing the mean achievement score of all students in all schools and all countries. $r_{0_{jk}} + u_{00_k} + e_{ijk}$ represents the error terms for level 2, level 3 and level 1, respectively, where e_{ijk} is the residuals for i student in j school of k country. In addition, $r_{0_{jk}}$ represents the residuals for school j in country k, and finally u_{00_k} is the residual for country k.

The first estimated model was an unconditional model, which does not contain any independent variables at any level. This basic model makes it possible to estimate the intra-class correlation coefficient (ICC), which reveals the proportion of variance in student achievement in level 2 (school) and level 3 (country) clusters (Lorah, 2018). More specifically, it helps to determine the extent to which variation in student achievement can be attributed to within and between schools as well as between country factors.

The combined equation for the second model is:

$$Y_{ijk} = \gamma_{000} + \pi_{ujk} * \mathrm{L1}_{ijk} + \beta_{0vk} * \mathrm{L2} + e_{ijk} + r_{0_{jk}} + u_{00_k}$$

where π_{ujk} and β_{0vk} represent the slopes of level 1 and level 2 predictors respectively. The second model contained the interaction of school-level SES (SSES) with instructional leadership (LEAD), along with all other control variables at level 1 (student gender, age, immigration status, attending early school) and level 2 (school location, shortage of educational materials, size, teacher-student ratio and an accountability index). We also estimated cross-level interactions to test if instructional leadership moderates the relationship between individual SES and student achievement at level 1.

For this reason, we introduced a random slope at level 1 as suggested by Heisig and Schaffer (2019) to explain differences in the slope coefficient of individual students' SES and achievement by the level 2 variable LEAD. Adding this effect to our model enabled us to test whether the strength of the relationship between student SES and achievement at level 1 changes as a function of (is moderated by) the higher-level instructional leadership (Aguinis and Culpepper, 2015). To reduce potential multicollinearity in level 2 estimation, and to make meaningful interpretations of the cross-level interaction effects, we group-mean centered (i.e. centering the level 1 predictors by the school mean) the level 1 predictors in all models as recommended (Enders and Tofighi, 2007). Consequently, in our analyses the difference between the slopes for the student and school-level associations represents an emergent (also known as contextual or incremental, see Hofmann and Gavin, 1998) effect (Bliese *et al.*, 2018). Thus, this last model helps us to identify the moderation effect of school leadership in the relationship between student achievement and student SES on the individual and school level.

Results

In this section, we start by presenting the results for our unconditional models. Then we report the results of interaction (moderation) models.

Unconditional models

Table 3 demonstrates results for unconditional models for math, reading and science, respectively. ICC values, in the unconditional model, were 0.202 and 0.401 for level 2 and level 3 variance, respectively, in students' math achievement. This means that 20% of the total variation in students' math achievement is accounted for by differences between schools, while 40% of the variation can be attributed to differences between countries. The remaining 40% of the variation is between student differences within schools. The results were also similar for students' science and reading achievement scores. ICC values were 0.237 for reading and 0.215 for science at level 2, and 0.367 for reading and 0.290 for science at the third level. Overall, the analyses show that the largest variation in student achievement is due to differences between students, followed by differences between countries.

Control variables

The second model included all selected variables at level 1 and level 2 for each subject, including interaction effects (see Table 3). Among control variables, students' gender is related significantly to student test scores in all subject matters. While male students perform better in math ($\beta = 10.116$, $p < 0.001$) and science ($\beta = 6.447$, $p < 0.001$), female students

Table 3. Results of the unconditional and direct random effects models

	Model 1			Model 2					
	Math	Read	Science	Math		Read		Science	
				Beta	SE	Beta	SE	Beta	SE
LEVEL 1									
SES				47.623***	8.321	50.848***	8.737	46.946***	7.091
Gender (Ref: female)				10.116***	2.936	−21.352***	1.465	6.447***	1.163
Age				7.278***	3.713	7.266***	1.532	7.910***	1.439
Immigration Status (Ref: native)									
Second-generation				−2.898	4.756	−1.549	5.166	−6.616	5.110
First-generation				−7.500	7.097	−11.685	6.892	−11.960	6.895
Early Childhood and Care (Ref: no)									
1–2 years				7.257***	1.929	8.960***	2.059	6.439***	1.964
More than 2 years				8.696***	1.860	8.258***	1.747	6.203***	1.714
LEVEL 2									
Student-Teacher Ratio				−0.002	0.092	−0.007	0.108	−0.050	0.095
Accountability				−4.480**	0.577	−5.403**	1.650	−4.170**	1.446
Location (Ref: village)									
Small Town				−7.539***	1.837	−4.963*	2.058	−7.436***	1.191
Town				−11.251***	2.088	−7.794**	2.514	−11.661***	2.291
City				−10.329***	2.361	−6.843*	2.833	−11.762***	2.615
Large City				−10.538***	3.124	−5.723	3.729	−11.474***	3.201
Shortage of Educational Materials				−1.664**	0.577	−1.441	0.779	−1.615*	0.667
School Size				0.008***	0.002	0.010***	0.003	0.009***	0.002
Instructional Leadership				−3.207***	0.882	−2.355*	0.947	−2.597**	0.886
School SES				57.360***	4.022	61.843***	4.392	60.101***	4.250
INTERACTIONS									
Instructional Leadership and SES				−0.002	0.269	0.038	0.293	0.108	0.251
Instructional Leadership and School SES				−1.999*	0.864	−0.982	0.909	−1.317	0.912
ICC (school)	0.202	0.237	0.215	0.307		0.338		0.327	

(*continued*)

Table 3.

	Model 1			Model 2					
	Math	Read	Science	Math		Read		Science	
				Beta	SE	Beta	SE	Beta	SE
ICC (country)	0.401	0.367	0.290	0.233		0.193		0.201	
BIC	3,265,505	3,303,003	284,252	2,919,103		2,949,707		2,929,913	
AIC	3,265,463	3,302,961	283,971	2,918,842		2,949,446		2,929,651	
Ll	−1,632,727	−1,651,476	−141,949	−1,459,396		−1,474,698		−1,464,800	
N	21,606	21,606	21,606	18,864		18,864		18,864	

Note(s): *Unstandardized* beta coefficients; IL: Instructional leadership; SES: Socioeconomic status; ICC: Intra-class correlation; BIC: Bayesian information criterion; AIC: Akaike information criterion; *ll*: Log likelihood; $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.00$

outperformed their male counterparts in reading ($\beta = -21.352$, $p < 0.001$). There is also a positive and significant relationship between student age and their test scores in all subjects, math ($\beta = 7.278$, $p < 0.001$), reading ($\beta = 7.266$, $p < 0.001$) and science ($\beta = 7.910$, $p < 0.001$). A significant difference was also observed based on students' attendance in preschool. Regardless of years of attendance, students who attended preschool outperformed those who did not in all subjects, math ($\beta = 8.696$, $p < 0.001$), reading ($\beta = 8.258$, $p < 0.001$) and science ($\beta = 6.203$, $p < 0.001$).

As for school-level control variables, school location was significantly related to student achievement. On average, students living in other locations had less achievement than those who live in a village. The difference is statistically not significant only between a village and large city for reading ($p > 0.05$). School size was a positive and significant predictor of student achievement in all subjects, math ($\beta = 0.008$, $p < 0.01$), reading ($\beta = 0.010$, $p < 0.001$) and science ($\beta = 0.009$, $p < 0.001$). External accountability demands also related significantly to achievement in all subjects: math ($\beta = -4.480$, $p < 0.01$), reading ($\beta = -5.403$, $p < 0.01$) and science ($\beta = -4.170$, $p < 0.01$), showing that schools sharing achievement data with the public obtained higher test scores. Lastly, the shortage of school resources was significantly and negatively related to student test scores in math ($\beta = -1.664$, $p < 0.01$) and science ($\beta = -1.615$, $p < 0.05$), indicating lower achievement in schools lacking educational resources.

Moderation effects

The second model (see Table 3) also included two interaction effects to examine the moderating role of instructional leadership in the relationship between SES and achievement at both student and school levels. The coefficients for the level 2 interactions between school-level SES and instructional leadership were significant for math ($\beta = -1.999$, $p < 0.05$), showing evidence that instructional leadership moderates the relationship between SSES and the school's overall achievement in math, partly confirming hypothesis 2. While it was not significant for reading ($\beta = -0.982$, $p > 0.05$) and science ($\beta = -1.317$, $p > 0.05$), the tendency was also negative for these subjects. This means that the effects of school SES on student achievement in all subjects were reduced when principals placed more emphasis on the improvement of teaching and learning, although the reduction was statistically significant only for math. However, for the cross-level interaction, interaction between instructional leadership and individual student SES, coefficients were not significant for any subject and the directions of the interaction were mixed, rejecting hypothesis 1. This means that instructional leadership does not significantly moderate the relationship between students' individual SES and their achievement.

We also calculated the practical significance of the cross-level interaction effects in terms of the degree to which they explain the total variance in the slope of students' SES and achievement across schools within countries, following Aguinis *et al.* (2013). This seemed necessary to us, as "the power to detect significant cross-level interactions, even under fairly advantageous conditions, is quite low" (Mathieu *et al.*, 2012, p. 960). Thus, we calculated the proportion of the total variability of the slope of individual SES on students' achievement, explained by the moderating effect of instructional leadership. The relevant values were about 0.01 for math, reading and science respectively, indicating that instructional leadership accounted for only one percent of the total variation in students' achievement scores due to their individual SES. Thus, the instructional leadership has hardly any influence on the relationship between individual SES and student achievement.

We further calculated effect size measures according to Tymms (2004) for school level interactions, whereby ES = $(2 \times B \times \text{SDpredictor})/\sigma$, with B being the unstandardized regression coefficient, SDpredictor being the standard deviation of the interaction predictor variable at level 2, and σ being the total standard deviation. These effect sizes are equivalent to Cohen's d (Cohen, 1988). Regarding the effect sizes for the interaction between school-level SES and instructional leadership in different subjects our estimation yielded values of ESmath = −0.06, ESreading = −0.03 and ESscience = −0.04. These effect sizes indicate that instructional leadership may explain relatively higher percentages of student achievement due to school-level SES, compared to student achievement due to individual SES.

Discussion

In this section, we start by presenting the limitations inherent in the data and method used, and then move on to the interpretation of the main findings as well as the possible implications.

Limitations

The main limitation in this research is that the respondents assessed their own level of instructional leadership. Self-reporting could be biased due to problems such as social desirability tendencies (Brown and Chai, 2012). We suggest that future research should use a teacher-reported leadership survey to validate our findings. Second, while the main objective of instructional leadership is to improve teaching and learning, a variety of practices have been associated with the concept (Hallinger and Murphy, 1985). The scale we employed in the present study involves a comprehensive set of relevant items, but still does not represent all aspects of instructional leadership. Third, while we believe it is important to control for a number of principal background variables (experience, training, etc.), as they might also be related to student achievement (Gümüş *et al.*, 2021a), we could not include them in our analysis since PISA 2015 does not do so.

Lastly, our outcome variable, student achievement, may not truly represent the actual student learning because of the issues related to the implementations of large-scale assessments. For example, Hopfenback (2016) highlighted several issues about how PISA is conducted, which might have an impact on students' performance, such as the uneven difficulty of items when translated into different languages and the varying effects of computer-based and pencil-paper versions on student test results. There have also been critics about the sampling strategy and the methodological approaches used in PISA (Zhao, 2020). Scholars with similar interest might search for different student achievement data to further investigate the proposed relationships in our study.

Interpretations and implications

Our results first show that principals' instructional leadership significantly moderates the relationship between school-level SES and student achievement in math. Effect sizes for the relevant interactions further suggest that instructional leadership accounted for from 3% to 6% of variation in student achievement due to the school-level SES. However, the moderation effects of instructional leadership for the school-level SES are not significant for science and reading. This means that our results confirm the hypothesis 2, instructional leadership weakens the relationship between school-level SES and student achievement, only for math. In terms of cross-level interaction, however, our results do not confirm our hypothesis that instructional leadership might diminish the strength of relationship between individual-level SES and student achievement within schools for any subject. The relevant interaction effects were not significant for any of the subjects and the effect sizes for the interactions were only about 0.01. This result aligns with the literature, which confirms the school's limited role in closing the student achievement gap caused by their individual SES (Chudgar and Luschei, 2009; Strand, 2016). For example, by using cross-national PISA data, Huang and Sebastian (2015) investigated the relationship between specific school-level factors, including the school learning environment, and within-school inequality in achievement and found no significant relationship.

Our findings suggest that although the school-level SES aggravates the achievement gap between students of different SES, instructional leadership might moderate this tendency and reduce the impact of SES on student achievement. This supports research indicating that the focus of principals on teaching and learning can help the overall improvement of schools in disadvantaged communities (Bryk *et al.*, 2010; Hitt and Meyers, 2018; Ylimaki, 2007). Instructional leadership, therefore, could be regarded as a supporting school mechanism capable of at least narrowing the achievement gap between low- and high-SES schools by decreasing the detrimental effect of school SES on the student test scores. This confirms the important role of instructional leadership in seeking equality through school improvement efforts in low-SES schools (Shaked *et al.*, 2020; Wilson and Urick, 2017) by providing quantitative evidence based on a cross-national data set.

Overall, the result related to school-level SES provided partial support for the argument that instructional leadership might eliminate some of the negative consequences of studying in low-SES schools (Lim *et al.*, 2014). We believe that this influence might result from the improvement of the quality of human resources at schools (Naicker *et al.*, 2013). Since low-SES schools often have teachers with a lower level of quality (Peske and Haycock, 2006), the support of principals for teacher development and emphasis on instructional improvement could diminish the negative impact of the lack of high-quality teaching at such schools (Ylimaki, 2007). In addition, principals with more instructional leadership practices might trigger a higher level of community engagement and support, which could in turn compensate partially for the adverse effect of a low-SES environment on student achievement (Bickmore and Dowell, 2014).

Despite the above-mentioned possible explanations, we should not forget that the moderation effect was only significant for math and the effect sizes for the interaction of school-level SES and instructional leadership are small for all subjects. Therefore, there is a need for more research on this topic with different data sets and methodological approaches to confirm our findings. Data collected with different instructional leadership measurements and from different participants (e.g. teachers) might provide better insights about the topic. Various other leadership models focus on school improvement (transformational, distributed, etc.), and their integrated versions could also be utilized in similar research to check if different aspects of school leadership are able to explain more of the relationship between school SES and student achievement.

Our finding that instructional leadership had no significant impact on reducing the achievement gap between students within a school might also have some important meanings. It might mean, for example, that the existing understanding of instructional leadership may not be sufficient in itself to compensate for the disadvantages of students from a difficult home/family background. Therefore, a shift in the focus of instructional leadership from a school effectiveness perspective towards an individual needs perspective might be needed. This can be achieved by integrating a social justice leadership notion, which has become increasingly popular in recent years (Gümüş *et al.*, 2021b), into the instructional leadership concept (DeMatthews, 2014; Mugisha, 2013; Shaked, 2020) to improve learning opportunities for disadvantaged groups within schools (Chiu and Walker, 2007). For example, by creating a socially just school environment, principals might develop a particular focus on disadvantaged students and better address the inequalities within schools caused by family background (Çevik *et al.*, 2020; Huchting and Bickett, 2021).

Socially just instructional leaders could take "purposeful, well-intentioned, creative, and collaborative actions" to improve the academic engagement and learning of students with disadvantaged backgrounds (Mugisha, 2013, p. 2). Research evidence supports that principals could influence the achievement of such students by working closely with teachers to ensure that teachers implement appropriate teaching practices (Grissom *et al.*, 2021). For example, they might organize teacher professional development and support classroom teaching to align teaching with the needs of disadvantaged students (Khalifa *et al.*, 2016; Salisbury and Irby, 2020) and help teachers to take into account diversity and equity to ensure the learning of each individual student, particularly (Mckenzie *et al.*, 2006; Rigby, 2014) those who suffer from their disadvantaged background. Such practices of school principals, which have been missing in most conceptualizations of instructional leadership, might increase the potential of instructional leadership to narrow the achievement gap within schools.

Lastly, we believe that the type of external demands relating to student achievement (increasing the overall achievement of the school, pushing everyone above the minimum requirements or increasing numbers of high achievers, etc.), expectations from principals and other school staff in terms of leadership enactment, and the practical meanings of the various items related to instructional leadership, may vary from one country to the next. While PISA does not include such factors, those might lead to different results in terms of the interaction of instructional leadership with SES in different contexts. For instance, increased pressure on schools to improve overall student achievement might result in larger achievement gap in some contexts (Koyama and Kania, 2014). Such pressure might lead some administrators to direct more of their attention toward students who are already close to passing standardized testing (Hursh, 2007; Tienken, 2013). In such contexts, the low-SES and special education students who are well behind passing the tests might suffer from low expectations, be abandoned and even be excluded from the tests (Booher-Jennings, 2005; Hursh, 2007). We believe more context-based research is needed to show how various accountability orientation might have a different effect on the interaction of school leadership and achievement gap.

Conclusion

Social inequality and its consequences for school outcomes have been a major problem for international communities including agencies, policymakers and researchers. While remedies require a broad range of interventions, including social, cultural and economic support, recent educational reforms and initiatives focus on the role of schools in helping to reduce the achievement gap between different groups of students. Contributing to these endeavors, we further the existing knowledge by providing empirical evidence on the moderating role of instructional leadership in the relationship between SES and achievement. We indicate that, on the one hand, instructional leadership might help to reduce inequalities by weakening the relationship between school-level SES and students' overall achievements at school. On the other hand, instructional leadership seems to be ineffective in terms of alleviating the effects of individual-level student SES on students' achievement.

Taking into account the previous research findings and the results of this study, we conclude that instructional leadership can play a role in reducing learning inequalities between schools from different socioeconomic communities to a certain extent. However, a revised conceptualization of instructional leadership with greater attention to social justice perspective of school leadership might be helpful to strengthen the impact of leadership in reducing achievement gap between different student groups.

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