The Influence of School Climate on Reading Literacy: A Cross-cultural Comparative Study Based on pisa 2018 Database

Qin Zhang[1,a,*]

[1]*Graduate School of Education and Human Development, George Washington University, Washington, DC, the United States*
a. qinzhang69@gwu.edu
*corresponding author

Abstract: Despite considerable interest in research and practice in the effect of school climate on academic reading achievement, little is targeted at analyzing the generalizability and distinctiveness of the influence from various dimensions in a cross-cultural study. This research adopted the multilevel linear model (HLM) and the database of PISA 2018 (Program for International Student Assessment) to investigate the constructs of school climate perceived by two specific groups of school stakeholders, students and principals, in four countries/regions, including B-S-J-Z [China], Brazil, Switzerland and the United States. The results indicated that some dimensions of school climate, such as disciplinary climate, teacher-directed instruction, teacher enthusiasm and student competition, were positively associated with the learning outcomes of reading with a statistical significance and demonstrated the cross-cultural consistency. However, some dimensions, consisting of teacher feedback, bullying and principal-perceived student hindering learning behavior, could exert a negative impact on reading achievement. Moreover, under the diverse sociocultural contexts, some dimensions may reveal different influences, showing the intercultural differences. These indicators were teachers' stimulation of reading engagement, adaptive instruction, sense of belonging at school, student cooperation and parental involvement in school activities. Last, teacher support and principal-perceived teacher hindering learning behavior had no effect on reading literacy.

Keywords: School Climate, Reading Literacy, Cross-cultural Comparative Study, PISA 2018.

1.   Introduction

1.1.   Background

The effect of schooling on students has long been of interest to educational researchers and stakeholders since many studies have shown that school and classroom contexts, to some extent, have shaped students' learning experiences and outcomes [1]. School climate has increasingly become a key concern in discussions about school effectiveness and students' academic achievement because of its profound relationship with every member of the community (e.g., students, parents and school personnel). For example, [2] analyzed the impacts of school climate

from multilevel perceptions — student and school, finding that it was positively correlated with students' GPA. Furthermore, some results suggested that a positive school climate played a pivotal role especially in improving reading skills through promoting collaborative learning, building group cohesiveness and lightening the classroom atmosphere [3]. Another reason for focusing on reading achievement is that it serves as a core competency for full participation in adult life and lays a solid foundation for succeeding in other subject areas [4]. As a daily activity for most people, proficiency in reading prepares students to "adapt to the variety of scenarios" ranging from their own personal objects and development initiatives to their further education and interactions with public entities [5]. Hence, this study was designed to examine the relationship between students' reading literacy and school climate from a cross-cultural comparative aspect and manage to explain how the multidimensional variables of school climate were responsible for students' reading performance against these diverse social circumstances.

1.2. Purpose and Significance of the Study

This cross-cultural comparative research targeted the 15-year-olds who participated in the Program for International Student Assessment (PISA) in 2018 to examine and analyze the influence of school climate on their reading performance. The statistical comparison was implemented among four representative countries and economies, including Beijing, Shanghai, Jiangsu and Zhejiang (China) (hereafter "B-S-J-Z [China]"), the United States, Switzerland and Brazil. Based on the findings from previous studies as aforementioned, there was sufficient evidence to reveal that school environment and student academic achievement were closely related [6] [7] [8]. Generally, the logic is that students are more likely to perform better academically within school settings where they feel safe, cared for, appropriately supported and strong sense of belonging [9] [10]. However, many theoretical and empirical studies on school climate were investigated in a single country or region, for one of the North American or Western European countries in particular. There is not enough attention given to comparatively evaluating the effect of school climate in these culturally various educational contexts. In light of which construct of school climate, in which direction, and to what extent, the findings might vary greatly because of sociocultural differences. Despite the students from diverse cultural backgrounds possibly at the equivalent reading level, the explanations of variations in school context characteristics that relate to their academic achievement remain unclear. Thus, it is scientifically significant to take up this research gap, extract more information about the extent to which school climate contributes to between-country (regional) differences in reading performance and generalize its impacts on the cross-cultural environment. Also, from a microcosmic perspective, the results are socially relevant and significant to every student, parent, teacher, educator and policymaker. In many cases, the studies demonstrated that numerous critical factors of school climate affected student academic achievements, such as teachers' educational support, student-teacher relationships and students' self-regulated learning behaviors, and etc. [11]. Parents also overwhelmingly cited school climate "as the most important criteria" when choosing a school for their child [5]. Other educational stakeholders may use the findings for reference to adjust the instruction, optimize the decisions, and rationalize the management.

2. Literature Review

2.1. Conceptualization of School Climate

The conception of "school climate" interchangeably defined as school environment and learning environment could date back to the earlier research on organizational climate in the 1930s [12]. With more in-depth studies conducted subsequently, some scholars such as [13] adopted this

analogy to demonstrate the significance of school climate that "Personality is to the individual what "climate" is to the organization" (p1). Meanwhile, having reached its developmental culmination since the 1960s, school climate has been one of the focal points of the growing body of educational research. It was interpreted in different ways when combined with other concepts in the education literature, such as school culture, school connectedness, school bonding and the milieu of the school [9][14][15]. Therefore, the researchers have hitherto not reached a consensus on identifying a single definition for school climate due to the complexity of this subject [16]. Some definitions mainly focused on the outcomes of school climate, while others paid more attention to its affective nature. Specifically, school climate was described as "the result of the promotion of satisfactory and productive experiences, with a sensitivity towards human needs" [17], the soul of a school with different schools expressing tones to provoke interpersonal vibrations within the same setting [18], and "the quality of relationships among students, teachers and school staff" [19]. Given the purpose and essence of this study, school climate is conceptualized as "the heart and soul of a school" [15]. and a relatively stable property that is experienced by every participant under the environment of school education. It affects their behavior and exerts vital influence on the development of both school itself and students on the basis of their collective perceptions of behavior [20].

2.2. Factors of School Climate

As an essential factor that occupies a prominent place in the literature of elements associated with student learning, school climate is multifaceted and covers an extremely diverse range of dimensions, such as safety, interpersonal relationships, social media, personality and health metaphors, teaching and learning and the institutional environment [21]. Besides, there are various multi-levels of interaction among individuals within the school (e.g., parents, teachers and students) as well [5]. Accordingly, most researchers in the area recognized the complexity of its nature [9][22][23], and probed into this multidimensional construct from virtually every aspect of the school experience [24]. After conducting extensive school climate evaluation practice, the U.S. National School Climate Center (NSCC) has summed up four indicators of school climate from the experiences of school life in different populations, namely students, parents and school personnel. These four spheres are currently the most widely accepted standard in academia, including:

A) *Safety* refers to physical and emotional feelings that students are assured they are safe. Even if the perceived and actual risks including victimization, bullying, harassment, truancy and other maladaptive behaviors occur, the access to and use of substances and emergency plans are always in place necessarily.

B) *Teaching and Learning Issues* presents three sub-factors of the construct. First, the quality of instruction, such as robust academic support, responsive feedback, and enthusiastic attitudes. Second, the process of learning, such as the socioemotional skills development and civic learning about shared norms, goals, and values — the accepted and endorsed behaviors [25]. Last, the indicators of teacher professional commitment and school leadership, such as teacher efficacy, teacher appraisal, teacher cohesion and morale, administrative support and the school vision.

C) *School Community (also known as Relationships)* encompasses respect for diversity, student-teacher relationships, student collaboration and teamwork, student morale, parental involvement and community partnerships, and the derivatives of these variables, such as school "connectedness".

D) *The environmental-structural dimension (also known as Institutional Environment)* covers physical surroundings and educational resources, policies and technology.

In view of the practical difficulties in investigating all parameters simultaneously, the study employed the database of PISA in 2018 and selected nine major portions of school climate from the student and school questionnaires to test empirically. These nine indicators were analyzed in detail respectively and were grouped into three broad spheres illustrated by the graph below (Figure 1.).

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                          ┌──────────────┐
                          │ School Climate│
                          └──────┬───────┘
        ┌────────────────────────┼────────────────────────┐
┌───────────────────┐   ┌──────────────────┐   ┌──────────────────┐
│Student Disruptive │   │Teaching & Learning│   │ School Community │
│     Behavior      │   └──────────────────┘   └──────────────────┘
└───────────────────┘            │                       │
        │                ┌───────────────┐   ┌──────────────────────────────┐
  ┌──────────┐          │Teacher Enthusiasm│  │Student Co-operation and Competition│
  │ Bullying │          └───────────────┘   └──────────────────────────────┘
  └──────────┘                  │                       │
        │          ┌──────────────────────────────┐   ┌───────────────────────┐
┌──────────────────┐│Teachers' Support and Teaching │  │Sense of Belonging at School│
│Disciplinary Climate│         Practices           │  └───────────────────────┘
└──────────────────┘└──────────────────────────────┘            │
        │          ┌──────────────────────────────┐   ┌──────────────────────────────────┐
┌──────────────────────┐│Teacher Behavior and Student │ │Parental Involvement in School Activities│
│Student Truancy and Lateness│      Learning          │ └──────────────────────────────────┘
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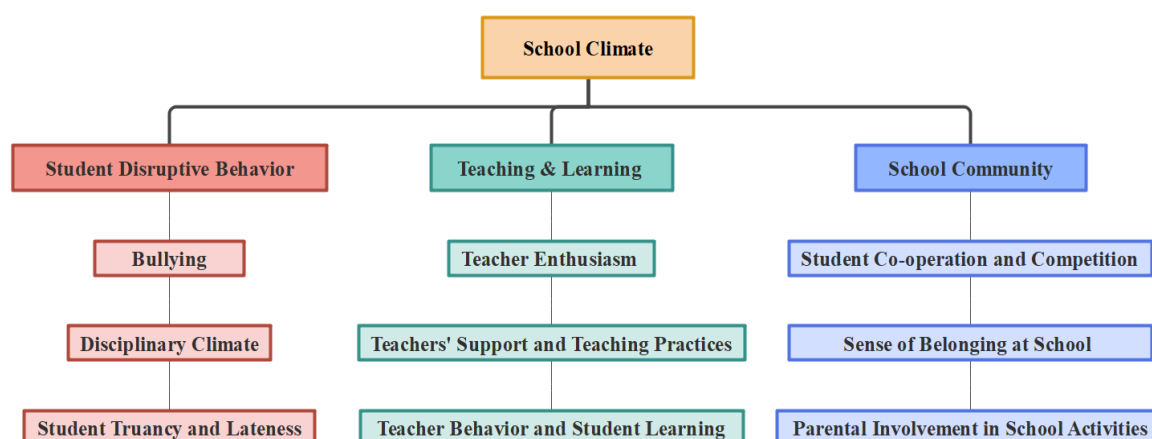
Figure 1: The Measurement of School Climate in PISA 2018.

The aggregation of these abovementioned school climate factors from the respective student level indices were proved to be reliable and valid in each participant country or economy (See details in Methodology).

2.3. The Relationship Between School Climate and Reading Literacy

The triennial survey, PISA, comprises three major domains to measure students' fundamental proficiency — reading, mathematics and science. The assessment of one of the major domains is rotated with each round of PISA [26]. Amongst the completed seven rounds of PISA tests since 2000, reading literacy has been the main focus three times and been placed more emphasis on its changing nature under the influence of the recently rapid digitalization [27]. In the *PISA 2018 Assessment and Analytical Framework*, reading literacy was defined as students' capabilities of "understanding, using, evaluating, reflecting on and engaging with texts" in order to achieve both social expectations and personal goals [27]. Many educators also underlined the importance of reading literacy by asserting that it was not enough to cultivate students to just be a proficient reader, they should be able to read for a variety of purposes too [28][29].Consequently, it is of vital significance to explore further the contributing factors of reading literacy.

There is mounting evidence showing that a positive school climate can greatly enhance students' academic performance [30][31]. According to the aforesaid three constructs of school climate in the diagram, a panoply of supporting elements therein is directly related to students' academic success in reading. For example, teacher enthusiasm and supportiveness were positively associated with students' sense of cooperation so that there was more group reading activities stimulated [32][33]. In many cases, teachers' instructional and emotional support rendered active students' self-regulated learning behaviors and established rapport between themselves and students, leading to students' better reading performance [11].

Additionally, given the dimension of school disciplinary climate, some studies suggested that teachers could only implement effective and meaningful instruction on the condition that an orderly

classroom environment was provided [34]. Because many researchers like [35]found that disruptive behaviors, whether from teachers or students, hindered students' levels of engagement and their attention to follow the lessons.

As for the other crucial group in the school community, parents have likewise been long encouraged to involve in education [36]. Because parents have the "prerogative to direct their children's upbringing and education" [37]. Appropriate parental involvement in child's education was conducive to student academic achievement [38].

Last, on students' own part, their attitudes and sense of belonging towards the schools could be partly reflected by the level of their participation in learning and the outcomes as well [8]. In general, the parameters used to measure school climate have been inspected their relevance to students' reading academic achievement by the previous studies. However, what is worth mentioning in the next section is that the conclusions might vary widely when taking these variables and other confounding factors into account (e.g., class size, gender, student's economic, social, and cultural status (ESCS), student-faculty ratio, etc.) cross countries or economies.

2.4. Previous National and Regional Results

Within the same schoolyard, the students' perceptions of the school environment could be divergent. The school setting that was cognized supportive by some students might turn out to be psychologically problematic for some others [39]. Not to mention the fact that differences in cultural values and education systems across the globe can substantially alter the impact of school climate on fostering students' reading literacy [40]. For instance, the related studies on bullying prevalence conducted by [41] have shown that it appeared to be higher in schools with wider "disparities in affluence" and in countries with a greater gap between rich and poor (p907). Also consistent with the hypothesis that cultural differences were very likely to influence school climate, in the [42] study, the researchers attributed finding greater bonding between faculty and student in the Chinese schools than that in the United States. Based on the results of Jia et al.'s study, it was reasonable to assume that Chinese students would view two determinants of school climate, sense of belonging at school and teacher's support, more favorably than American students, thereby emerging a distinct whole picture of school environment [43].

Some empirical studies about the database of PISA in 2003 have shed light on the variations in students' experience of school climate across countries. For instance, compared with the average score of classroom disciplinary climate in the U.S., the result in Japan was significantly higher for the reason of its well-known strict and concrete educational management [11]. Besides, in PISA 2009, despite being the similar excellent reading performers, the scholars in Finland and China ascribed the success to different school climate variables. Some researchers believed that Finnish students' reading achievement was positively associated with their appreciation of school rather than the relations with their teachers [44]. However, it was the exact opposite in Shanghai, China [8].

Meanwhile, what aroused the awareness of the researchers was that students' perceptions of school climate were not a unidimensional attribute merely shaped at school, but also were largely affected by cultural and contextual characteristics outside. According to the report of [45] in 2011, Chinese students expressed much more learning initiative than American students, even though the former produced more depressive symptoms simultaneously [42]. By and large, although these studies have laid the foundation for analyzing the various constructs of school climate from a cross-cultural perspective, there is limited literature on providing a systematic and comprehensive comparative investigation in the influence of school climate on reading literacy particularly. As a result, this study aims to fill this gap in this respect.

3.   Methodology

3.1.   Measurement Instrument

Owing to the complexity of school climate constructs, the measurement of this research field has equally taken on a pluralistic look. Overall, the instrument utilized in evaluating school environment is basically classified into the objective and subjective measurements [46]. The former depicts and reports the school climate in an "objective" way mainly by collecting the dataset of school size, average intelligence, socioeconomic status, as well as participants' specific behaviors, such as number of hours of study, number of times certain behavior occurred, and so forth. Regarding the latter, it relies on the perceptual data from all the members of the school community, which is deemed as the reflection of school normative climate [6]. Although the validity of participant perceptions is under the phenomenological debate because of its several flaws, it is still broadly accepted as a direct indicator in the measurement for the following two reasons [13]. First, an outsider would probably not be able to observe some behaviors that may only be available to the participants. Second, some behaviors may occur regularly but are not easy for the outsider to capture [47]. Therefore, this study sticks to adopting this perceptual measurement.

Aside from the above-mentioned advantages of this surveying tool, this method allows educators to take a variety of information sources into consideration (e.g., students, parents, faculty, and administrators). The multifarious information sources within the same group do not purely serve as an efficient self-assessment by means of providing diagnostic messages. What counts most is that the biased understanding of school climate in a certain group could be offset by the others since they have different levels of familiarity with multiple facets of school environment [46]. Thus, a relatively thorough and accurate description of school climate is more likely to be generated.

3.2.   Data Source

PISA, as an international consortium, gathered thousands of questionnaires completed by the 15-year-olds from 79 countries and regions to test their skills in Mathematics, Science and Reading Literacy in 2018. This was the seventh cycle of PISA. Evidence-based comparisons between the participating countries and economies were more comprehensive as its framework and benchmark have been constantly refined since 2000. In order to maximize the cross-national comparability of complex constructs, PISA is dedicated to monitoring the process of translation, standardizing the administration of the assessment, selecting questions with caution, and considering the use of scenarios. Thus, the scientific and representative sampling offered a sound base for intercultural comparative research. In the meantime, for the purpose of this study, the student and school questionnaires distributed with assessment included more than 20 items directly related to school climate, which synthesized the large body of typical indicators for school climate [5]. It was shown that the approach of assessing the real and concrete situations provided valid, reliable and interpretable data [27]. Last but not least, reading, as the major domain in PISA 2018, its framework acknowledged and evaluated the nature of the subject from a "goal-driven, critical and intertextual" angle [27]. The coverage of ability ranges was more extensive than that of 2015, such as stressing a greater emphasis on multiple-source texts, introducing the explicit assessment of reading fluency, and highlighting the investigation of students' reading motivation, practices and awareness of reading strategies. Therefore, the dataset had quite strong relevance to measuring students' reading achievement.

3.3. The Selection of Participants

This study selected four countries and economies in the database of PISA 2018, including B-S-J-Z [China], the United States, Switzerland and Brazil. The main reason for the selection was that these participants were typical examples in the PISA reading tests. First, students in B-S-J-Z [China] significantly outperformed those from all other countries and occupied the very first place in the ranking of all subjects. Second, the United States is a nation with unique population composition and massive educational influence so that it was frequently regarded as one of the classic comparison objects in a cross-cultural study. Besides, the reading mean scores of these two countries (555,505 respectively) were both above the OECD average— 487. Third, as for Switzerland, although the mean score (484) in 2018 was virtually the same as the OECD average, it ranked 6th in the annual Best Countries Report, Countries with the Best Educational Systems, published by U.S. News and World Report last year. Its education system was even ranked the best in the world according to the World Economic Forum (WEF) World Competitiveness Reports. Hence, the reading performance in Switzerland was also worthy of attention. Finally, being the largest country in South America, the score in Brazil (413) was none the less below the general average in spite of increasing enrollment rates over its participations in PISA. As a result, it was reasonable to further dig into its overall school environment that affected students' academic achievement.

After dealing with the missing values of the related indices, the total number of the 15-year-old participants in four countries/regions was 16731. The male-female ratios respectively were: B-S-J-Z [China] 0.94:1, Brazil 1.08:1, Switzerland 1.00:1, the U.S. 1.04:1. Table 1. showed the total number of the participating students and schools.

Table 1: The Descriptive Statistics of the Total Subjects Amount.

Subject \ Country	B-S-J-Z (China)	Brazil	Switzerland	United States
Student	10486	2629	1195	2421
School	361	350	109	117

3.4. The Selection and Declaration of Variables

This study accepted the perceptions of the students and schools towards school climate as the independent variables from the PISA 2018 questionnaires. As outlined above (See Figure 1. for more details), school climate was measured by nine parameters of three branches contained in the research. The student perception variables included exposure to bullying, disciplinary climate, teacher enthusiasm, teacher support, teacher-directed instruction, adaptive instruction, teacher feedback, teachers' stimulation of reading engagement, student competition, student co-operation and sense of belonging. The school (principal) perception variables included teacher behavior hindering learning, student behavior hindering learning and parental involvement in school activities. According to [5]. PISA 2018 Results (Volume III), the Cronbach's Alpha of all the scaled indices in the four participants was above 0.72 so that the internal consistency indicated the acceptable and reliable comparability across school systems (2019b). Therefore, students' reading literacy was predicted on the basis of these independent variables as well as the control variables, student backgrounds (See the declaration and scoring formula of the variables in Table 2.).

Table 2: The Variable Declaration of School Climate.

Dimensions	Scaled indicators (Survey Content)	Respondents	Scoring Formula (Except the last parental involvement was expressed as a percentage, the rest indices utilized the four-point Likert Scale to assess.)
Student Backgrounds	Student Gender	Students	Categorical Variable Female-1 Male-2
	Students' economic, social and cultural status (ESCS)	Students	Measured by a synthesized indicator including two aspects: the highest level of schooling by the parents and the quantity of family properties
Student Disruptive Behavior	Bullying	Students	The higher the value, the more serious bullying
	Disciplinary Climate	Students	The higher the value, the better disciplinary climate
	Student Behavior Hindering Learning	Principals	The higher the value, the student behaviors hinder learning to a greater degree
Teaching & Learning	Teacher Enthusiasm	Students	The higher the value, the higher teacher enthusiasm students perceived
	Teacher Support	Students	The higher the value, the stronger teacher support students perceived
	Teacher-directed Instruction	Students	The higher the value, the more frequently teacher-directed instruction, adaptive instruction, teacher feedback and cognitive stimulation students perceived
	Adaptive Instruction	Students	
	Teacher Feedback	Students	
	Teachers' Stimulation of Reading Engagement	Students	
	Teacher Behavior Hindering Learning	Principals	The higher the value, the teacher behaviors hinder learning to a greater degree
School Community	Student Competition	Students	The higher the value, the more fierce competition students perceived
	Student Co-operation	Students	The higher the value, the more frequent cooperation between peers students perceived
	Sense of Belonging	Students	The higher the value, the stronger students' sense of belonging at school
	Parental Involvement in School Activities	Principals	The higher the value, the higher degree of parental involvement in school activities

3.5. Data Processing & Analysis

All the figures were gathered from the official PISA website (https://www.oecd.org/pisa/) and adopted SPSS 28.0.1 and Stata/SE to cleanse the data and integrate Hierarchical Linear Model (HLM) to analyze.

4. Results

4.1. Student & Principal Perceptions of School Climate

In order to more intuitively compare the differences in school climate in the four countries/regions, Figure 2. was presented in form of the line charts to demonstrate the different facets of school climate perceived by students and principals.
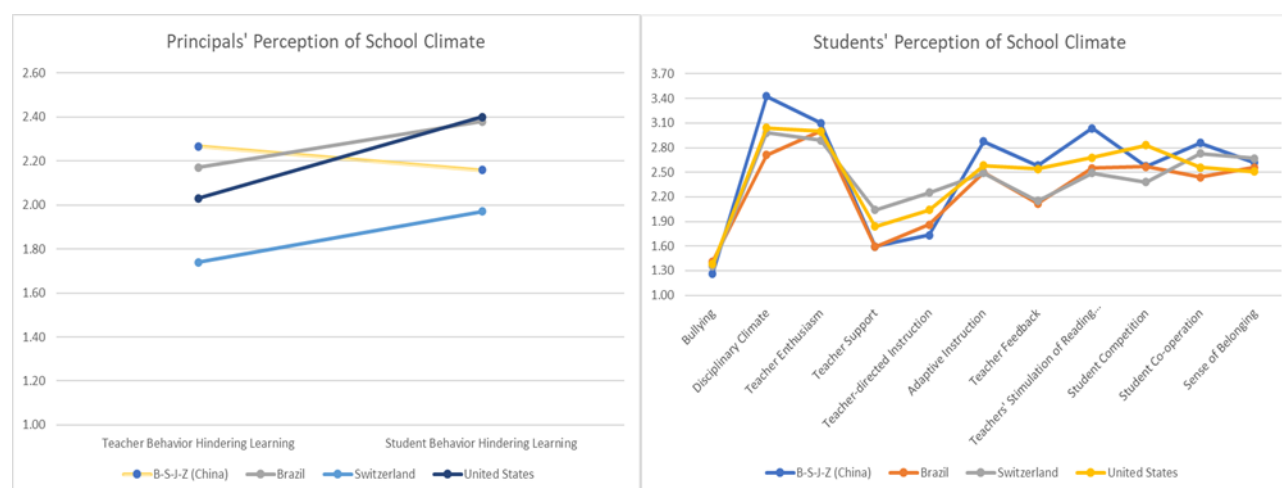

Figure 2: Principals' & Students' Perception of School Climate.

As shown, it was obvious to notice that the scores of B-S-J-Z (China) were higher than other participants in many dimensions, such as disciplinary climate, teacher enthusiasm, adaptive instruction, teacher feedback, teachers' stimulation of reading engagement, student cooperation and teacher behavior hindering learning. On the other hand, Brazil ranked last in some dimensional assessments, e.g. disciplinary climate, teacher support, teacher feedback, student cooperation. Conversely, it occupied the second place in teacher behavior hindering learning and student behavior hindering learning. Combined with the scoring formula in Table 2., the smaller values of some indices (e.g., bullying, teacher behavior hindering learning and student behavior hindering learning) referred to a better school environment, on the whole, the higher scores signified that the more positive learning atmosphere was generated. These differences in the constructs, to some extent, accounted for the distinguishable students' reading literacy in the target countries/regions. Naturally, the subsequent question arose: what is the extent to the effect of each predictor on student reading achievement? Which one has a more significant influence? Which is less? To answer these questions, HLM has been put into use in the following content.

4.2. The Findings of Null Model

Reviewing the previous relevant literature, most studies employed the approaches of correlation analysis, regression analysis, structural equation model, etc., which generally aimed at a particular level either student or principal. But due to the "ad hoc" nested structure of PISA database and the statistic principles of multilevel linear model, this study stratified the variables into two "layers". The first one was related to students. The second was linked to principals.

The primary step of processing the data was to establish a null model, analyzing the data frame where there was no prediction variable added and garner the contributions of the variations both within and between the schools to the total variations of the students' reading literacy.

Table 3: The Estimation of the Variations in Reading Scores between and within the schools.

	B-S-J-Z (China)	Brazil	Switzerland	United States
Variances between Schools	3698.23	3113.70	3461.55	1275.53
Variances within Schools	3572.35	4881.99	5639.77	8511.13

According to the information in Table 3., the proportions of the variations between the schools accounting for the total variations of the reading scores in four participants were 50.87%, 38.94%, 38.03% and 13.03% respectively. All the between-group variances reached a significant level so that the nested structure of the data was proven not to be ignored and the multilevel analysis was essential to be conducted.

4.3. The Findings of School Climate Direct Impacts on Student Reading Achievements Based on the Complete Models

Under the base of studying the null model, the rest of the variables ranging from student backgrounds to the dimensions of school climate perceived by students and principals were required to be added so as to complete the model and investigate their predictive roles on students' reading performance. More details were illustrated in Table 4.

Results from Table 3. and Table 4. reflected the fact that the added variables have partly explained the variations in the reading scores. It was not difficult to observe that all the participating subjects revealed the decline in some degree regarding the variations in reading scores. The decreasing proportions of variations between schools in B-S-J-Z [China], Brazil, Switzerland and the United States were 14.90%, 36.67%, 55.21%, and 38.33%. Concerning the variations within schools, the decline percentages were 3.07%, 7.26%, 12.39% and 11.19%.

In terms of the two control variables, there was a significant gender difference with respect to the reading scores in three subjects apart from finding no significant one in Brazil. It turned out that the scores of the boys were significantly lower than those of the girls (B-S-J-Z [China]: $\gamma=-2.923$, p=0.016, Switzerland: $\gamma=-11.602$, p=0.009 and the United States: $\gamma=-12.154$, p=0.001). Furthermore, there was also a significant ESCS difference in all four participants. And students' economic, social, and cultural status could predict their reading performance positively. In other words, the higher ESCS the students were in, the better academic achievement in reading they were more likely to obtain. This phenomenon was particularly obvious in Switzerland and Brazil (Switzerland: $\gamma=46.035$, p<0.0001 and Brazil: $\gamma=22.664$, p<0.0001). By contrast, the effect of ESCS in China and the U.S. was relatively small (B-S-J-Z [China]: $\gamma=6.379$, p<0.0001, the United States: $\gamma=2.985$, p=0.045).

Table 4: The Results of Multiple Linear Regression of School Climate Influence Factors on Reading Literacy.

	B-S-J-Z (China)		Brazil		Switzerland		United States	
	B	SE	B	SE	B	SE	B	SE
Fixed Effects								
Intercept	561.545***	2.996	438.529***	2.812	494.318	4.383	524.428***	3.118
Student Background Variables								
Students' economic, social and cultural status (ESCS)	6.379***	1.756	22.664***	3.467	46.035***	5.718	2.985*	5.783
Gender	-2.923*	1.161	-3.360	2.861	-11.602**	4.373	-12.154***	3.269
Student-perceived School Climate								
Bullying	-3.068*	1.570	-14.429***	2.453	-19.972***	4.668	-23.006***	3.585
Disciplinary Climate	8.103***	1.312	4.314	2.242	9.335**	3.409	16.636***	3.018
Teacher Enthusiasm	-2.433	1.352	10.274**	2.859	10.567**	3.815	14.976***	3.861
Teacher Support	4.725***	1.251	4.062	2.871	6.008	3.166	8.772	3.474
Teacher-directed Instruction	10.411***	1.196	21.456***	3.151	17.946***	3.814	29.448***	3.357
Adaptive Instruction	3.245**	1.086	9.036***	2.121	2.913	3.128	0.601	3.139
Teacher Feedback	-3.958***	0.908	-8.765***	2.312	-10.257**	2.881	-3.290	2.504
Teachers' Stimulation of Reading Engagement	11.423***	1.220	-1.007	2.840	1.128	3.822	19.064***	3.321
Student Competition	1.921*	0.979	6.915**	1.959	-3.816	2.503	15.177***	2.923
Student Co-operation	-2.277*	0.964	-3.804	2.188	4.600	3.399	-12.1728**	3.008
Sense of Belonging	7.818***	2.363	23.016***	4.205	4.556	6.736	-22.213**	6.212
Principal-perceived School Climate								
Teacher Behavior Hindering Learning	11.218*	5.501	7.266	5.585	-1.670	11.147	4.245	7.209

Table 4: (continued).

Student Behavior Hindering Learning	-15.033**	4.298	-30.469***	4.890	-6.786	8.641	-15.978*	6.724
Parental Involvement in School Activities	0.417**	0.128	-0.003	0.154	-1.841***	0.368	0.403	0.206
Random Effects								
Variances between Schools	3147.315		1972.061		1550.305		786.598	
Variances within Schools	3462.673		4527.419		4941.199		7558.522	

Investigating through the lens of student perceptions, on the whole, the dimensions of school climate had a stronger predictive power on student reading literacy. The perceived disciplinary climate by students in four countries/regions could positively predict the reading scores when controlling the two background variables. With the exception of Brazil, the rest three had an apparent prediction function. Among them, there was a pretty high statistical significance in the four provinces of China and the U.S. (B-S-J-Z [China]: $\gamma=8.103$, $p<0.0001$, the United States: $\gamma=16.636$, $p<0.0001$). It was a positive prediction in light of teacher support. Nevertheless, the effect was insignificant in most subjects other than China ($\gamma=4.725$, $p<0.0001$). While looking into teacher-directed instruction, it could forward predict the performance with a high level of significance in all the four countries/regions ((B-S-J-Z [China]: $\gamma=-10.411$, $p<0.0001$, Brazil: $\gamma=21.456$ $p<0.0001$, Switzerland: $\gamma=17.946$, $p<0.0001$ and the United States: $\gamma=29.448$, $p<0.0001$). The significant influence of adaptive instruction only was exerted on the students in Brazil and the four provinces in China (Brazil: $\gamma=9.036$, $p<0.0001$, (B-S-J-Z [China]: $\gamma=3.245$, $p=0.001$). Teacher feedback was negatively associated with the reading literacy of all the participants. In their midst, Brazil and China had a highly noticeable impact, but the result was insignificant in the United States (B-S-J-Z [China]: $\gamma=-3.958$, $p<0.0001$, Brazil: $\gamma=-8.765$, $p<0.0001$). Teacher enthusiasm played a significantly positive role in three countries besides the regions of China, which showed a negative correlation (Brazil: $\gamma=10.274$, $p=0.001$, Switzerland: $\gamma=10.567$, $p=0.008$ and the United States: $\gamma=14.976$, $p<0.0001$). There were different impacts of teachers' stimulation of reading engagement in the four participants. In China and the U.S., the effect was extremely significant and positive, whereas, in Switzerland and Brazil, the function was insignificant (B-S-J-Z [China]: $\gamma=11.423$, $p<0.0001$, the United States: $\gamma=19.064$, $p<0.0001$). For the dimension of bullying, all the contributors presented the result that was significant but negatively predictive. Additionally, Brazil, Switzerland and the U.S. have reached a greatly significant level. There was a positive and highly significant predictable relation between students' sense of belonging at school and the reading scores in B-S-J-Z [China] and Brazil (B-S-J-Z [China]: $\gamma=11.423$, $p<0.0001$, Brazil: $\gamma=23.016$, $p<0.0001$). However, in the U.S., the stronger sense of belonging students perceived, the less the academic reading goals they may achieve (the United States: $\gamma=-22.213$, $p=0.001$). Considering the index of competition, three participants demonstrated a positive predictable effect but Switzerland (B-S-J-Z [China]: $\gamma=1.921$, $p=0.031$ Brazil: $\gamma=6.915$, $p=0.001$, the United States: $\gamma=15.177$, $p<0.0001$). The last parameter, student cooperation, could negatively forecast the learning outcomes

of reading in China and the U.S. (B-S-J-Z [China]: γ=-2.277, p=0.013, the United States: γ=-12.1728, p<0.0001).

From the standpoints of principals, the behavior hindering learning by students was negatively correlated with the academic reading performance in all the countries/regions. Three of them manifested a significant relationship, including B-S-J-Z [China], Brazil and the United States (B-S-J-Z [China]: γ=-15.033, p=0.003, Brazil: γ=-30.469, p<0.0001, the United States: γ=-15.978, p=0.009). Nonetheless, the behavior hindering learning by teachers suggested itself not significantly associated with the reading literacy in any participating country or region. As far as parental involvement in school activities, the interpretations of the results in B-S-J-Z [China] and Switzerland were discordant. It was shown that parental involvement in the former one was had a positive and relatively significant effect, but when considering it in the latter, it produced a remarkably negative prediction in reading (B-S-J-Z [China]: γ=0.417, p=0.002, Switzerland: γ=-1.841, p<0.0001). Thus, for the former, the more actively parents are involved in the school activities, the higher scores students might attain. On the contrary, in Switzerland, the reverse applied.

5.   Discussion

5.1.   The Student & Principal Perceptions of School Climate

School Climate is an imperative predictor of "students' emotional and behavioral outcomes" [48]. It serves as a considerable role in students' life with many-sided contents. Specifically, it incorporates students' adaptive psychosocial adjustment [49], the formation of a healthy mentality [50], students' behaviors [51] and academic achievement [52]. According to [53], an effective quality school climate embraces norms, values, expectations from members of the school community, a positive attitude towards learning and a shared school vision among students, families and educators. The aggregation of all these elements mirrors the holistic quality and characteristics of schools. The findings of this study indicated that the perceptions of students and principals towards school climate varied widely both between and within countries/regions, thereby reflecting the cultural differences in education in the meantime.

Comparatively speaking, from the aspects of disciplinary climate, teacher-directed instruction and teachers' stimulation of reading engagement, the overall performance in the United States and the four provinces of China exceeded the other two nations and the reading scores of the first two were also above the OECD average and higher than the latter ones. Therefore, to some degree, the findings illustrated the importance of the teacher-student relationship in the teaching course. The positive and healthy relationship was bound up with developing a respectful, inclusive and supportive classroom atmosphere, which could facilitate learning.

What was also noteworthy was that teacher-directed instruction was the only construct that had a significantly positive predictive function in all subjects. The highest-scoring participant was the United States. The reason behind it was probably related to the fact that educators in the country have recently put much more emphasis on the learning of at-risk students. This highly structured instructional approach could effectively accelerate the learning and implement successfully among these students [54].

Yet, although the students' perceptions of teacher feedback were also the dimension that remained consistent in the four countries/regions, its correlation with the academic reading achievement was negative, even showing the significance in three ones except for the United States. One criticism of feedback theory [55] might be responsible for this phenomenon. The objective and impartial evaluations from teachers were hard to be acquired by students when touching on the complicated tasks without a single answer. Additionally, the teachers in China, Brazil and

Switzerland were not given as much autonomy like those in the U.S. so that the standardized feedback could not meet the needs of students.

Based on the reported figures, teacher enthusiasm had a markedly crucial impact in the United States, Brazil and Switzerland, especially in the U.S.. In these countries, teacher enthusiasm is intentionally fostered when student teachers enter the sound pre-service systems. Because some pieces of evidence have supported that teacher enthusiasm is a teaching behavior, displayed in the initial stage of being a teacher [56][57]. Hence, qualified teachers usually keep this attribute in their teaching activities continuously to enhance students' learning motivation [57].

In addition to teacher enthusiasm, there was a statistical positive significance between the index of student competition and reading literacy in the United States as well as Brazil and B-S-J-Z [China]. Thereinto, the effect in the U.S. was the most pronounced. Some American researchers assumed that this increased awareness of appropriate academic competition among students could be ascribed to the affective benefits it brought about, such as serving as strong motivators, nurturing a healthy self-concept, and earning the competitor desirable attributes, e.g., resilience [58][59].

As the last significant variable in the student questionnaire, the issues of exposure to bullying were very serious in all four countries and regions. Excluding B-S-J-Z [China], the results have shown that bullying was extremely significant to correlate with reading performance in a negative way for the other three countries, the U.S. in particular. Some studies dug into the incidents of bullying and explored the macroeconomic and social indicators associated with it. For instance, in Brazil and the United States, substantial income inequality could reduce social cohesion across communities and increase abuse inflicted on those in disadvantaged groups [60][61]. (Bradshaw et al., 2009; Kawachi, Kennedy & Wilkinson, 1999). Besides, the insecure areas with a high level of community violence and strong belief in support of aggression in a broader social and geographical context could mislead the students to accept bullying as an efficient way to achieve what they want. Thus, it is necessary to alert parents, teachers and students about this theme and take preventive measures to avoid its occurrence.

In the principal questionnaire, the two dimensions, student behavior hindering learning and parental involvement in school activities, should be addressed by further discussion due to the notabilities of their effects on reading literacy.

The results regarding student impeding learning behaviors have attested the cross-cultural homogeneity among Brazil, B-S-J-Z [China] and the United States. Students could engage in problematic behaviors for many reasons, such as health and family problems, adjustment issues or general academic difficulties. These factors could be triggered across cultures and exhibit similarities. However, meanwhile, each nation possesses its sociocultural uniqueness so that the concrete analysis of specific situations in different countries is equally indispensable. Taking the U.S. classroom for example, as a cultural mélange, the classroom culture in the USA is not homogenous as well. Even though the same basic academic values were delivered to all the students in the class, those from different cultural backgrounds might not understand implicit expectations for proper classroom behaviors. Consequently, if the instructors have experienced classroom incivilities of students, hopefully, they could gain some insight from the several following strategies.

A) Explicitly expounding the rules for classroom behaviors to students in a respectful tone may curb the undesirable behaviors in advance.

B) Increasing student participation in formulating the ground rules for classroom behaviors may improve their execution.

C) Building connections with students to personalize the learning objectives may potentially reduce the possibility of them to engaging in thoughtless unfavorable behaviors.

Given the different results of parental involvement in school activities in Switzerland and B-S-J-Z [China], it was of vital importance to pay attention to the reasons behind this heterogeneity. The findings indicated that there was a significantly negative correlation between parental involvement and student reading performance in Switzerland. Some scholars believed that the concept of parents as "actors" in the education context has sparked heated discussion in Switzerland's educational policies and pedagogical discourse [62]. The home-school relationship has been reshaped by many societal and organizational factors and educational policies, such as the increasing awareness of equal opportunities in education, the new demands of parents to the school, and the pluralization of society, etc. [63]. These changes might reconstruct the understandings of some educational stakeholders that teachers and parents, in some cases, would not cooperate on an equal footing because the latter may intend to interfere in an invasive way [64]. In contrast, the results showed that Chinese parents were pleased to involve in school development and participate in parent associations. Furthermore, the Chinese Central Government called for a greater effort to improve parental involvement in schools, thereby promoting school and family relationships and enhancing student learning. Some recent findings also supported the proposition that Chinese parents were in favor of home-school collaboration and willing to work with teachers to foster better communication, but they also required professional guidance and initiation from teachers and school administrators [65].

5.2. Limitations

Throughout the treatise, some limitations inevitably arose concerning the data and methods used in variables selection and analysis. Consequently, the interpretations of the conclusions need to take as far as possible all these limitations into account.

First, due to the limitation of using a secondary data source (PISA 2018 datasets), school climate was confined to surveying the quality and characteristics of school life through the students' and principals' lenses. The selection of school climate variables was not based on a robust theoretical framework. Thus, there might be a more complex network of school climate constructs needed to navigate. For instance, the effect of school environment on reading performance might also correspond with public policies at the national level, whereas, the country level was not discussed in the study.

Second, in the past, the samplings of many cross-border studies were given the same weight, namely the senate weight for each participating country, no matter how large or small in population. Yet, in the case of PISA datasets, a senate weight was not used. As a result, notwithstanding being more likely to achieve a realistic estimation of the general effects of each argument, the findings of the evaluation were closely linked to the total number of the target population in each participant and the characteristics of the relatively smaller one may be neglected.

Third, against the attributes of the broad cross-cultural backdrop, the research ineluctably suffered from the limitation that the same measurement, that was, self-reports from the students and the principals in PISA, could not fully elaborate on the between-country differences in reading achievement. Any seemingly unremarkable distinctions amid disciplinary climate in different classrooms may exert an influence on the final conclusions. Therefore, the constructs discussed in the previous sections could not deduce causal inferences on the outcomes of students' reading achievement necessarily. A longitudinal study with changes over time observed might be more convincing and make up for the insufficiency of the methods.

6.   Conclusions

Based on the analysis of PISA 2018 database for four countries/regions, B-S-J-Z [China], the United States, Switzerland and Brazil, the results of this study revealed that school climate had a significant predictive impact on reading achievement. Some dimensions discussed in the previous sections maintained the cross-cultural consistency, whereas, some others presented the national or regional distinctness.

The constructs of school climate below have shown the significant relevance to reading literacy and relatively high consistency among the participating countries/regions.

A)   The dimensions perceived by students including disciplinary climate, teacher-directed instruction, teacher enthusiasm and student competition could positively predict the student reading performance.

B)   The dimensions perceived by students including teacher feedback, and bullying would negatively predict the student reading performance.

C)   The dimension, student behavior hindering learning, perceived by principals would negatively predict the student reading performance as well.

The constructs of school climate below have shown the significant relevance to reading literacy but also differences among the participating countries/regions.

A)   Teachers' stimulation of reading engagement perceived by students could positively predict the student reading performance with high significance in B-S-J-Z [China] and the United States.

B)   Adaptive instruction perceived by students had significant positive effects on reading only in B-S-J-Z [China] and Brazil.

C)   Sense of belonging at school perceived by students could positively predict the student reading performance with high significance in B-S-J-Z [China] and Brazil, but negative prediction in the United States.

D)   Student cooperation perceived by students would negatively predict the student reading performance only in B-S-J-Z [China] and the United States.

E)   Principal-perceived parental involvement in school activities could positively predict the student reading performance with significance in B-S-J-Z [China], but negative prediction in Switzerland.

Given the above, the results of this study hopefully have shown a forward direction for future researchers and educators that the evaluation of school climate is socially and culturally diversified. In other words, the perceptions from the various school communities towards multivariate school climate lead to different effectiveness. Hence, in future studies, the researchers may combine quantitative and qualitative methods to analyze the distinctiveness of the perceptions from students, teachers and principals as well as the direct and indirect influences of school climate elements on student academic performance in different countries/regions.

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