

The Relationship Between Autonomy, Funding, And Instructional Barrier Perceptions in Pisa Countries: A Comparison of Canada, Singapore And Estonia

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Abstract

The purpose of this study is to examine the patterns of relationships between school autonomy, quality assurance systems, hindrances to a school's instructional activities, source of school funding, and school location in high-performing countries (Singapore, Estonia, and Canada) and middle- and low-performing countries in the PISA 2022 exams. The PISA 2022 school data were used for this study. Singapore, Estonia and Canada were selected as the three high-performing countries along with 26 countries with average scores and 28 low-performing countries were included in this study. Results revealed that in the countries included in the study, school autonomy ranges from high to low in Estonia, Canada and Singapore. In all three countries and in other countries of the world participating in the PISA exam, the proportion of decisions made within the school is higher than the proportion of decisions made by local and central governments. In each of the three high-performing countries in PISA, a single relationship pattern emerged for all three education systems among all variables examined. According to this pattern, there was a negative relationship between school autonomy and school funding coming from the government, and a moderate positive relationship between school funding coming from students and parents.

Keywords: School autonomy, quality assurance system, school funding, PISA.

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Introduction

The Programme for International Student Assessment (PISA) is a triennial international comparative assessment of student learning, coordinated by the Organisation for Economic Co-operation and Development (OECD). First administered in 2000, PISA measures the competencies of 15-year-old students in three core domains—mathematics, reading, and science—focusing on how well students can apply their knowledge to real-life challenges. By 2022, PISA had completed its eighth assessment cycle (delayed from 2021 owing to the COVID-19 pandemic) and included more than 80 countries and economies. In the 2022 cycle, mathematics was the major domain, with OECD mean scores of 472 in mathematics, 476 in reading, and 485 in science (OECD, 2023). Singapore ranked first among all participating education systems, with scores of 575 in mathematics, 543 in reading, and 561 in science—more than two standard deviations above the OECD average. Estonia was the highest-performing European country, with scores of 510 in mathematics, 511 in reading, and 526 in science. Canada also ranked above the OECD average in all three domains, scoring 497 in mathematics, 507 in reading, and 515 in science (OECD, 2023). These three countries were selected for the present study because of their consistently high PISA performance and their structurally distinct educational governance systems. Understanding the school-level factors—such as school autonomy, quality assurance systems, and instructional resource conditions—that underpin such performance is the central motivation of this research.

School autonomy refers to the degree of independence the school's personnel enjoy in making valid and rational decisions about educational practices, policies, management, administration, and other educational operations. The concept of school autonomy was first articulated in Europe in the 19th century as a way of ensuring academic freedom which, later, was justified by religious and philosophical considerations in the first half of the 20th century (European Commission/EACEA/Euridyc, 2007).

Contemporary to this, the concept of “school autonomy” started to be discussed more widely in the literature especially in the late 1990s with a wider application when the school development efforts started developing against the rigid system of centralized administration (Barrera et al., 2009). The researchers argued that an administrative design in which the main decisions about the school are made by the school personnel provides more consistent answers to increase student achievement in particular and raise school performance in general (Amelsvoort & Scheerens, 1997; Supriadi et al., 2021; Yuki & Igei, 2020).

While ‘school autonomy’ generally refers to shifting decision-making authority from central system to individual schools—giving them autonomy to adapt to their policies to address their needs—the term is used differently across studies and policies such as school development (Hashim et al., 2023), and planning of school management processes, restructuring and reform, self-management and decentralization in decision-making (Cheng et al., 2016). However, in general, school autonomy refers to the distribution of authority between decentralized or centralized administration and the level of independent decision-making and implementation by students, teachers and school administration (Pearson & Moomaw, 2005). Arcia et al. (2011) reiterated school autonomy as a form of school governance in which schools are given decision-making authority over their own activities, including the hiring and firing of staff and the evaluation of teachers and pedagogical practices.

School reform efforts are based on the findings that a school autonomy approach can promote innovation and quality teaching and improve school performance (Bulkley et al., 2010; Hallinger & Heck, 2010; Robinson et al., 2009; Yuki & Igei, 2020). The basic approach supported by advocates of school autonomy is that school administrators and teachers, who can analyze the needs and capacities of schools and students' local and cultural dynamics better and more closely than the central administration, will be more successful in developing policies and practices to improve educational quality. As a matter of fact, there is a considerable amount of research in the literature on the positive relationship between the autonomous structure of schools and student achievement (Caldwell, 2016; Cheng et al., 2016; Feri et al., 2016). Studies (Hanushek et al., 2013; OECD, 2013) point to a positive

relationship between schools' ability to organize curricula according to students' needs, evaluate student achievement, and give administrative authority and initiative to school administrators for school improvement.

On the other hand, Fink and Brayman (2006) found a significant relationship between the autonomy of school leaders and the formation of effective working teams towards the school's goals. Fink and Brayman (2006) found that school leaders need significant autonomy to encourage and empower teachers to work together in order to improve the quality of teaching and learning activities in schools and to achieve significant results in educational achievement. Others found school autonomy as a critically important aspect for enhancing organizational learning (Marks & Louis, 1999) to sustain organizational performance, collective work, and performance of teachers and administrators. To do otherwise is to repeat dysfunctional professional development practices that are centrally determined and often not needs-focused.

Research findings (Clark, 2009; Galiani et al., 2008; Siddle & Koelble, 2012; Hanushek et al., 2013) suggest that empowered and autonomous school administrations lead to better educational outcomes. Decentralization, school autonomy and empowering local communities and institutions have been at the forefront of education policy debates for many years. As countries implemented these reforms, emerging evidence suggested that higher levels of governance quality were strongly associated with better educational outcomes (Bloom et al., 2015). Having more managerial responsibility at the school level means that a school should be accountable to national and local authorities, as well as to local stakeholders. On the other hand, the autonomous structure of schools necessitates an accountable and transparent organizational structure. Otherwise, it is not possible to predict the consequences of an arbitrary and unevaluated functioning. In this respect, accountability is defined as accepting responsibility for one's actions and being accountable for them. The main indicators of accountability in terms of school management can be listed as the level of compliance with rules and regulations, reporting to those who have supervision and control authority over the school, and linking rewards and sanctions to expected results (Heim, 1996; Rechebei, 2010).

Research on accountability and organizational capacity suggests that schools with strong organizational capacity tend to develop internal standards of accountability for their activities; on the other hand, centrally managed schools with strong external accountability have relatively weak organizational capacity (Marks & Louis, 1999). Thus, to enhance organizational learning and achieve educational goals, schools need to be both more autonomous and more accountable for their work. To a large extent, accountability also serves as a counterweight to the greater autonomy granted to schools. However, the relationship between autonomy and accountability is multifaceted and complex. One important criterion for effective and meaningful accountability is that it requires certain levels of organizational autonomy. Without autonomy and decision-making authority, it is not reasonable to hold decision-makers to be accounted. For an accountability system to foster improvement, schools must have the autonomy to make meaningful decisions in pedagogical, managerial and organizational areas. If schools lack the decision-making capacity to address their specific challenges, development and reform efforts, it is not fair to hold them accountable for results (Quilabert, 2024).

PISA results also show that when autonomy and accountability are meaningfully and functionally integrated in schools, they lead to better learning and developmental outcomes for students (OECD, 2011a; Hanushek et al., 2013). In schools, the key elements that make effective accountability functional can only be standardized, measured and evaluated based on quality assurance systems. Quality assurance in education refers to the mechanisms and processes put in place to monitor, evaluate and improve the quality of learning, teaching, school leadership, and student outcomes. Quality assurance systems ensure that learners receive quality education, which is their fundamental right. In this respect, the strength of accountability-linked quality assurance system ensures that schools operate efficiently and effectively, adhering to high standards in the quality and management of education.

Accountability-based quality assurance processes, which focus on rules, procedures, and performance indicators, aim to promote accountability, purposeful quality improvement and trust in the systemic functioning of the school (Caldwell & Spinks, 2013). In this respect, quality assurance systems bring consistency to procedures, reduce idiosyncratic actions and set standards and principles for quality improvement. These elements enable the benchmarking of academic standards as well as the identification and sharing of good practices in teaching, learning and assessment across educational institutions (Williams, 2016; Winstone & Carless, 2021).

Quality assurance systems, which determine the quality of an effective school autonomy, provide accountability and guarantee non-arbitrary organizational behavior. The functional aspects of quality assurance systems, such as performance indicators, standards for learning and teaching processes and outcomes, and conformity to purpose and objectives, also provide an important opportunity to determine the quality of teaching activities (Wöbmann et al., 2007; Hanushek & Raymond, 2004). Strengthening school autonomy based on quality assurance systems will ensure that the two main areas of “human resources” and “physical resources needed in the school” serve the purpose in the best way possible.

A quality assurance system that operationalizes school autonomy serves to recruit teachers and other staff who are skilled and aligned with the institutional vision and mission (Elmore, 2004). On the other hand, the quality assurance system should have the capacity to effectively improve the quality of existing human resources, as well as to foster cohesion and establish a fair career system in order to build a diverse set of rules and a good working system.

Another determinant of the quality of educational outcomes in schools is physical resources and related facilities. The quality of teaching materials, technological facilities, basic equipment and the quality of physical space across countries and schools is one of the main determinants of the quality of learning (OECD, 2017; UNESCO, 2021). With the contribution of quality assurance systems in education systems with a high level of autonomy, it is hoped that it will become more possible to establish standards among schools in terms of human resources and physical facilities, and that schools will be able to provide students with close and high-quality facilities in all aspects. This quality is expected to improve the quality of educational outcomes.

The purpose of this study is to examine the patterns of relationships between school autonomy, quality assurance systems, hindrances to a school's instructional activities, source of school funding, and school location in high-performing countries (Singapore, Estonia, and Canada) and middle- and low-performing countries in the PISA 2022 exams. Research questions were as follows:

- 1) To what extent do school administrations in high-performing countries and in medium and low-performing countries perceive autonomous? Does this level differ according to countries?
- 2) What are the descriptive statistics on existing quality assurance systems for schools in high-performing countries and in medium- and low-performing countries?
- 3) To what extent are there hindrances to the teaching activities of schools? Do these barriers differ significantly across countries?
- 4) Are there significant relationships between the geographical location of the school (being in a big or small city), the school's funding sources, the autonomy level of schools, quality assurance systems, and the issues that hinder teaching activities?

Method

Research Design

This research was designed in survey model. Descriptive statistics were calculated to measure the level of autonomy of schools, the quality assurance systems that schools have, and the issues that hinder the teaching activities of schools. Following the descriptive statistics, the correlational design was used to examine the relationships between these variables (Fraenkel et. al., 2012).

The Population and Sample

The principals of the schools in the countries/economies participating in the PISA 2022 exam were included in the study. Singapore, Estonia and Canada were selected as the three high-performing countries in the study based on the standing among the top 10 countries in the PISA 2022 exam, with average scores above 500, and were located on different continents; so, it was assumed that they would represent the high-performing countries of the world more comprehensively. In order to compare these high-performing countries with other countries, 26 countries with average scores and 28 low-performing countries were included in this study. 81 countries/economies participated in PISA 2022. The top 27 countries with the highest scores were categorized as high-performing, while countries between 28-53 were categorized as medium-performing and countries between 54-81 were categorized as low-performing (PISA 2022 Worldwide ranking, 2024). Accordingly, Singapore (first), Estonia (seventh), and Canada (eighth) were selected among the top 27. In addition to these three countries, countries with medium performance are ranked from high to low scores (Hungary, Spain, Lithuania, Italy, Norway, Croatia, Vietnam, Israel, Slovak Republic, Iceland, Serbia, Ukraine, Brunei, Greece, Chile, Romania, United Arab Emirates, Malaysia, Moldova, Bulgaria, Qatar, Kazakhstan, Mexico, Mongolia) and countries with low performance (Montenegro, Uruguay, Costa Rica, Cyprus, Peru, Colombia, Brazil, Jamaica, Argentina, Thailand, Saudi Arabia, Georgia, Azerbaijan, Panama, North Macedonia, Indonesia, Albania, Guatemala, Palestine, El Salvador, Paraguay, Jordan, Morocco, Philippines, Uzbekistan, Kosovo, Dominican Republic, Cambodia) have been included in the scope of the study. The study included 164 schools representing Singapore, 196 schools representing Estonia, and 863 schools representing Canada. A total of 14,066 schools from countries with medium and low performance were also included in the study. High-performing countries were analyzed individually, while countries with medium and low performance were analyzed collectively. This allowed for a comparison of the education systems of high-performing countries with those of countries with medium and low performance, and an attempt to discover patterns of relationship between them. Statistics on the geographical locations of the schools from which data was collected are provided in Table 1.

Table 1

Statistics on the Geographic Location of Schools

Level	Singapore		Estonia		Canada		PISA Count	
	F	%	f	%	f	%	F	%
1) A village, hamlet or rural area (fewer than 3 000 people)			54	27,6	136	15,8	2562	18,2
2) A small town (3.000 to about 15.000 people)			48	24,5	141	16,3	2616	18,6
3) A town (15.000 to about 100.000 people)			41	20,9	155	18,0	3201	22,8
4) A city (100.000 to about 1.000.000 people)			53	27,0	264	30,6	3142	22,3
5) A large city (1.000.000 to about 10.000.000 people)	159	97			111	12,9	1601	11,4
6) A megacity (with over 10.000.000 people)							204	1,5
Missing / No Response	5	3			56	6,5	740	5,3
Total	164	100	196	100,0	863	100,0	14066	100,0

As can be seen in Table 1, since Singapore consists of a single metropolitan area, all data come from schools in the same city; in Estonia, data come from schools located in relatively small cities; and in Canada, schools in small cities as well as large cities participated.

The number of students per school in Singapore is high, and the vast majority of teachers have the necessary certification with a bachelor's degree-level education. The percentage of teachers with postgraduate degree is 22%, and the number of students per teacher is slightly above 12. In Estonia, the number of students per school is at a reasonable level, with three-quarters of teachers having a bachelor's degree and the necessary certification, and two-thirds having a master's degree or higher. The number of students per teacher is 11. There are no statistics available on the number of students per school or per teacher in Canada, but more than 90% of teachers are certified, more than three-quarters have a bachelor's degree, and 23% have a master's degree or higher. When examining other countries that participated in the PISA exam, the number of students per school is 772, three-quarters of teachers have at least a bachelor's degree and certification, 30% have a master's degree or higher, and there are 15 students per teacher.

Instruments

The PISA 2022 school data were used for this study, and school principals responded to the questions in the survey. Validity and reliability analyses were conducted for the items that form a unified structure, and the term "scale" was preferred to describe them. Validity and reliability analyses were not conducted for the items that did not form a structure together and were independent of each other, and the term "survey" was preferred to describe them. The scales used in this study and their explanations are given below.

School Autonomy Survey (SAS)

SAS consists of 12 items coded Q13 that describes who or which administrative authority makes decisions on important matters in schools. The survey response options follow as: a) principal, b) teachers or members of the school management team, c) school governing board, d) local or municipal authority, e) regional or state authority, f) national or federal authority.

Quality Assurance System Survey (QASS)

QASS consists of 11 items coded Q17 to measure whether quality assurance systems are in place in schools. The answer options are as follows: i) Yes, this is mandatory, based on district or ministry policies, ii) Yes, based on school initiatives, iii) No. The existence of quality assurance systems reflects expectations regarding the school's ability to provide quality education; in this survey, a total "yes" responses score (both mandatory and school-initiated) of 7 or more out of 11 items (> 63.6) of yes responses can be considered an indicator of the school's commitment to quality assurance systems.

Instruction Hindrances Scale (IHS)

IHS is a 4-point Likert scale that aims to describe the physical and human resources that hinder the achievement of educational goals in schools. The response options are: i) Not at all, ii) Very little, iii) To some extent, and iv) A lot. A high score on this scale indicates a higher level of learning hindrances in schools. It consists of 10 questions coded as Q25 in the PISA school survey guide and data set. Exploratory factor analysis conducted on the scale showed that all items were valid, and the scale explained 63.35% of the variance in two dimensions. Accordingly, the first dimension consists of items related to physical resources (05, 06, 07, 08, 09, 10) and explains 48.35% of the variance; the second dimension consists of items related to human resources (01, 02, 03, 04) and explains 15% of the variance. The factor loadings of the items in the scale range from .82 to .73; the item-total correlation values range from .65 to .51, and the Cronbach Alpha coefficient is .87. After modifying items SC017Q07JA and SC017Q08JA in the scale, improvements were achieved in the fit indices of confirmatory factor analysis (CFA). In the CFA results for IHS, the standardized factor load values are

between .84 and .57 for the first dimension and between .75 and .66 for the second dimension. In the IHS model, the fit indices were, $\chi^2/df = 29,68$; CFI: 0.86; GFI: 0.945; AGFI: 0.887; IFI: 0.86; SRMR: 0.052; RMSEA: 0.160, indicating mixed model fit: GFI and SRMR are within acceptable ranges, whereas χ^2/df , CFI, IFI and RMSEA fall outside conventional cut-offs (the high χ^2/df partly reflects the large sample size).

Data Analysis Procedures

The analysis of the variables in the study and the calculation of scores were obtained as follows:

School autonomy was measured using 12 items coded as Q13. Table 3 shows the percentages calculated for each item in the school autonomy survey. The variable named “school autonomy” was obtained by summing the percentages related to i) principal, ii) teachers or members of the school management team, and iii) school governing board, which are indicators of school autonomy. The variable named “centralized administration” was obtained by summing the options i) local or municipal authority, ii) regional or state authority, and iii) national or federal authority. A high score in the school autonomy variable indicates that schools are autonomous and make their own decisions, while a high score in the centralized administration variable indicates that decisions regarding the school are made by the central administration and that school autonomy is low. In the 12-item SAS, the sum of school autonomy and centralized administration is 12 points, and correlation analyses were performed on the total scores.

QASS, was measured using 11 items coded as Q17 and three response options. Total scores were obtained for the response options “yes, this is mandatory, based on district or ministry policies” and “yes, based on school initiatives,” and these were included in the correlation analysis as two different variables. Since the survey consisted of 11 items, the two defined variables and the sum of the “no” options amounted to 11 points.

The IHS consists of 10 items on a 4-point Likert scale. Accordingly, instruction hindrances were calculated for each school on a scale of 10 to 40, and correlation analyses were performed on the total scores obtained from the scale.

School location is question Q1, which describes the geographical location of schools. Table 1 provides descriptive statistics for the countries included in the study regarding the geographical location of schools. In this variable, which measures the size of the city where the schools are located, the larger the city, the higher the score. The smallest location, “a village, hamlet or rural area (fewer than 3,000 people),” is scored as 1, while the largest location, “a megacity (with over 10,000,000 people),” is scored as 6.

School funding is question Q4 and consists of four options. Each option asks what percentage of school funding for an academic year is covered by the relevant option. The percentage is asked for each option, and the sum of these percentages is 100. Accordingly, the first option (SC016Q01TA) is government (includes departments, local, regional, state, and national), and the second option (SC016Q02TA) is student fees or school charges paid by parents or guardians. The responses to these options were analyzed as two different variables in the correlation analysis.

Findings

The autonomy level of schools in the Singapore education system was collected with the SAS and descriptive statistics are given in Table 2.

Table 2

Descriptive Statistics on School Autonomy in the Singapore Education System (N=164)

At your school, who is responsible for	Principal %	Teachers or members of sch. mang. Team %	School governing board %	Local or municipal authority %	Regional or state authority %	National or federal authority %
1) Appointing or hiring teachers	18.9	3				77.4
2) Dismissing or suspending teachers from employment	17.1	1.8	1.8			78.7
3) Establishing teachers' starting salaries, including setting pay scales	6.7	2.4	7.9			82.3
4) Determining teachers' salary increases	7.3	4.9	6.7			80.5
5) Formulating the school budget	32.3	27.4	7.3			32.3
6) Deciding on budget allocations	71.3	23.8	3			1.2
7) Establishing student disciplinary policies and procedures	35.4	59.8	0.6			3.7
8) Establishing student assessments policies, including [national / regional] assessments	15.2	35.4				48.8
9) Approving students for admission to the school	52.4	6.7				39.6
10) Choosing which learning materials are used	12.8	76.7				10.4
11) Determining course content, including [national / regional] curricula	4.3	29.9				65.6
12) Deciding which courses are offered	27.4	45.1	1.2			25.6
Total (Average)	25.12	26.41	2.73			45.53
Autonomy	School Level: % 54.26			Centralized Adm.: % 45.53		

Table 2 shows that 163 of the 164 school principals in Singapore responded to the questionnaire. As Singapore consists of one large city and one administration, it has become apparent that local administrations have no influence over decisions made in schools. It was found that schools in Singapore have a reasonable level of autonomy (more than half of the decisions (54.26%)). It has been found that school principals have the most influence over student admissions, teachers or members of the school management team have the most influence over the selection of learning materials, and national or federal authorities have the most influence over teachers' starting salaries. Teachers' employment, dismissal and salary increases are largely determined by the central government. Descriptive statistics regarding the level of autonomy that schools have in the Estonian education system are given in Table 3.

Table 3

Descriptive Statistics on School Autonomy in the Estonian Education System (N=196)

At your school, who is responsible for	Principal %	Teachers or members of sch. mang. Team %	School governing board %	Local or municipal authority %	Regional or state authority %	National or federal authority %
1) Appointing or hiring teachers	92.3	6.1		.5		1
2) Dismissing or suspending teachers from employment	96.9	3.1				
3) Establishing teachers' starting salaries, including setting pay scales	35.2	2.6		19.4		42.9
4) Determining teachers' salary increases	35.2	3.6		19.4		41.8
5) Formulating the school budget	65.8	9.7	1.5	21.4		1.5
6) Deciding on budget allocations	48	10.2	1	37.8		2
7) Establishing student disciplinary policies and procedures	15.3	80.1	4.6			
8) Establishing student assessments policies, including [national / regional] assessments	16.3	77.6	1			5.1
9) Approving students for admission to the school	75	10.2	5.1	9.7		
10) Choosing which learning materials are used	2	97.4				.5
11) Determining course content, including [national / regional] curricula	3.6	95.4				1
12) Deciding which courses are offered	11.2	84.7	2			1.5
Total	41.37	40.05	1.27	9.01		8.11
Autonomy	School Level: % 82.72			Centralized Adm.: % 17.12		

Table 3 shows that one of the 196 school principals included in the study in Estonia did not answer question 12, while all other principals answered all questions. Schools in Estonia are quite autonomous, with decisions regarding school operations largely made by the principal or management team, while the central administration has the most influence in determining teacher salaries. School principals in Estonia have a high degree of authority in the employment and dismissal of teachers, and as a result, it can be said that decisions regarding teacher employment are made at the school level. The school principal has influence in determining learning materials, course content, and courses to be offered in a small number of schools, while in the remaining schools, these decisions were made by the management team. Descriptive statistics regarding the level of autonomy that schools have in the Canadian education system have been provided in Table 4.

Table 4

Descriptive Statistics on School Autonomy in the Canadian Education System (N=863)

At your school, who is responsible for	Principal %	Teachers or members of sch. mang. Team %	School governing board %	Local or municipal authority %	Regional or state authority %	National or federal authority %
1) Appointing or hiring teachers	46.3	3	41.4		.2	
2) Dismissing or suspending teachers from employment	11.7	.6	70.7	.1	7.6	.1
3) Establishing teachers' starting salaries, including setting pay scales	1.6	.7	27.6	.6	59	1.4
4) Determining teachers' salary increases	1.6	.6	23.2	1.3	62.3	1.6
5) Formulating the school budget	17.5	1.7	61.4	.3	9.5	.3
6) Deciding on budget allocations	49.9	4.5	32		4.2	.1
7) Establishing student disciplinary policies and procedures	35.1	18.8	31.4	.1	5.3	.2
8) Establishing student assessments policies, including [national / regional] assessments	5.2	7.9	26.8	1.2	49.1	.7
9) Approving students for admission to the school	53.8	8.9	25.6		2.3	.1
10) Choosing which learning materials are used	13.2	53.3	10.7	.7	12.9	.2
11) Determining course content, including [national / regional] curricula	2.8	11	5.2	2.2	68.7	1
12) Deciding which courses are offered	46.1	26.4	7.8	.2	10.2	
Total	23.73	11.45	30.32	.56	24.28	.4
Autonomy	School Level: % 65.5			Centralized Adm.: % 25.24		

Table 4 shows that of the 863 school principals included in the study in Canada, between 78 and 80 did not respond to the questions, while the rest did respond. It can be stated that schools in Canada have a high degree of autonomy, with very few decisions being made at the provincial or national level. In Canada, the school principal is responsible for teacher employment, the use of the school budget, and student enrolment; the school governing board is responsible for teacher employment, teacher dismissals, and the determination of the school budget; the school management team has a high degree of influence on the learning materials to be used in schools, and the regional or state authority has a high degree of influence on determining teachers' starting salaries, salary increases and course content. Descriptive statistics on the level of autonomy of schools in the education systems of countries with below-average and average performance in PISA were given in Table 5.

Table 5

Descriptive Statistics on School Autonomy in Education Systems of Other PISA Countries (N=14,066)

At your school, who is responsible for	Principal %	Teachers or members of sch. mang. Team %	School governing board %	Local or municipal authority %	Regional or state authority %	National or federal authority %
1) Appointing or hiring teachers	37.3	5.9	5.9	7.2	16	21.3
2) Dismissing or suspending teachers from employment	36.6	5	8.7	6.8	15.9	20.5
3) Establishing teachers' starting salaries, including setting pay scales	12.6	4.1	7.3	5.9	14.6	49
4) Determining teachers' salary increases	11.4	4.5	7.1	4.4	13.7	52.3
5) Formulating the school budget	23.1	11.7	17.4	10	12.5	18.7
6) Deciding on budget allocations	22.1	11.3	22.1	11.3	11.9	14.5
7) Establishing student disciplinary policies and procedures	19.9	37.3	18.6	.9	4.1	12.5
8) Establishing student assessments policies, including [national / regional] assessments	8.8	21.8	5.4	2	11.5	43.8
9) Approving students for admission to the school	44.8	16.6	7	3.4	10.9	10.4
10) Choosing which learning materials are used	8.3	56.6	5.4	1	3.3	18.7
11) Determining course content, including [national / regional] curricula	5.3	22.4	3.4	1.8	11.2	49.4
12) Deciding which courses are offered	10.7	22	7.6	1.8	11	40.4
Total	20.08	18.27	9.66	4.71	11.38	28.46
Autonomy	School Level: % 48.01			Centralized Adm.: % 44.55		

Table 5 shows that 14,060 school principals from countries with average and below-average performance in the PISA test were included in the study, and between 894 and 961 principals did not respond to the questions, although this varied depending on the question. In countries with average and below-average PISA performance, it can be said that school autonomy and centralized management levels are similar. In countries participating in PISA, it has been revealed that school principals have high levels of authority in the employment and dismissal of teachers; the school management team has high levels of authority in student discipline policies and teaching materials used in schools; and national or federal authorities have high levels of authority in teachers' starting salaries, salary increases, assessment and evaluation policies, course content, and course selection. Descriptive statistics obtained from the QASS, which describes the existence of quality assurance and improvement systems in schools, have been presented in Table 6.

Table 6

Descriptive Statistics on Quality Assurance and Improvements Systems in Schools

Exist at your school	Singapore (N= 164)		Estonia (N= 196)		Canada (N=863)		Other Countries (N=14.066)	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
1) Internal evaluation / self-evaluation	99.4	0.6	99	.5	76.2	12.1	90	3.1
2) External evaluation	98.8	1.2	79.6	19.9	60.4	27.7	78.6	14.2
3) Written specific of the school's curricular profile and educational goals	100	0	97	2	82.3	6	88.3	4.4
4) Written specification of student performance standards	97.6	2.4	77.1	22.4	74.2	14.1	84.4	8.3
5) Systematic recording of data such as Teacher or student attendance and professional dev.	100	0	93.4	5.6	81.4	7.4	90.6	2.5
6) Systematic recording of students test results and graduation rates	100	0	96.5	2.6	85.1	3.9	89.5	3.7
7) Seeking written feedback from students (e. g. regarding lessons, teachers or resources)	91.5	8.5	75.5	23.5	55.4	33	72.9	20.1
8) Teacher mentoring	100	0	94.9	4.6	75.7	13.2	76.9	16.1
9) Regular consultation aimed at school improvement with one or more experts over a period of at least six months	67.1	32.9	51.1	46.9	65.4	23.2	60.6	32.5
10) Implementation of a standardized policy for mathematics subjects (i.e. school curriculum with shared instructional materials accompanied by staff development and training)	98.8	1.2	72	26.5	71.8	17.1	70	23.1

As Table 6 shows, quality assurance and improvement systems are in place in the vast majority of schools in Singapore and Estonia. Singapore has more schools with quality assurance and improvement systems than Estonia, Canada and other countries around the world, whereas Estonia has more schools with such systems than Canada and other countries around the world. It was found that other countries participating in PISA most frequently had records of student test results and graduation rates, whereas consulting with experts on school development was the least common practice. Teaching resources that hinder teaching activities were examined using IHS, and descriptive statistics on this are given in Table 7.

Table 7

Statistics on Instructional Resources Hindering Teaching Activities

Is your school's capacity to provide instruction hindered by any of the following issues?	Singapore (N= 164)		Estonia (N= 195)		Canada (N=761)		Other Countries (N=13,099)	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
1) A lack of teaching staff	1.94	.81	2.79	.90	2.31	1.00	2.07	1.04
2) Inadequate or poorly qualified teaching staff	1.53	.69	2.39	.89	1.88	.86	1.80	.91
3) A lack of assisting staff	1.48	.66	2.20	.96	2.18	.91	2.11	1.10
4) Inadequate or poorly qualified assisting staff	1.24	.49	1.78	.84	1.83	.88	1.69	.95
5) A lack of educational material (e.g. textbooks, IT equipment, library or laboratory material)	1.10	.33	1.83	.84	1.52	.74	2.18	1.10
6) Inadequate or poor quality educational material (e.g. textbooks, IT equipment, library or laboratory material)	1.12	.37	1.79	.82	1.50	.73	2.10	1.05
7) A lack of physical infrastructure (e.g. building, grounds, heating/cooling, lighting and acoustic systems)	1.27	.62	1.97	1.08	1.56	.83	2.13	1.13
8) Inadequate or poor quality physical infrastructure (e.g. building, grounds, heating/cooling, lighting and acoustic systems)	1.30	.68	1.92	1.02	1.49	.79	2.09	1.10
9) A lack of [digital resources] (e.g. desktop or laptop computers, internet access, learning management systems or school learning platforms)	1.09	.32	1.61	.76	1.52	.76	2.32	1.13
10) Inadequate or poor quality [digital resources] (e.g. desktop or laptop computers, internet access, learning management systems or school learning platforms)	1.15	.45	1.68	.83	1.55	.76	2.30	1.11
Total	1.32	.36	1.99	.56	1.73	.57	2.07	.77

As can be seen in Table 7, in countries with high performance in PISA, the resources that hinder teaching activities appear to be, from least to most, Singapore, Canada and Estonia. With regard to resources that hinder teaching activities, Singapore and Canada experienced resource problems at the 'not at all' level, whereas Estonia and other countries experienced problems at the 'very little' level. In high-performing countries in PISA, the lowest problem was found to be 'a lack of digital resources', while the highest problem was 'a lack of teaching staff'. It is noteworthy that in other countries participating in PISA, the lowest resource problem was 'inadequate or poorly qualified assisting staff' and the highest problem was 'a lack of digital resources'.

A One-Way ANOVA was conducted to compare the resource issues of high-performing countries in PISA, and a significant difference was found [$F_{(2,1117)} = 69.49$; $p < 0.000$]. According to this result, schools in Singapore experience lower resource issues compared to schools in Canada and Estonia, while schools in Canada experience lower resource issues compared to schools in Estonia. In Singapore, the relationships between the variables described in the findings section and the school's funding sources and geographical location were analyzed using Pearson's correlation, and the results were presented in Table 8.

Table 8

Relationships between Variables for Singapore

Variable	n	M	SD	1	2	3	4	5	6	7
1.SA	162	6.52	2.78							
2.CA	162	5.48	2.78	-1.00**						
3.MQAS	164	4.40	2.26	-.290**	.290**					
4.SIQAS	164	5.13	2.42	.309**	-.309**	-.963**				
5.IH	164	13.21	3.57	-.013	.013	-.003	.005			
6.SL	159	5.00	.000	NC	NC	NC	NC	NC		
7.SFcfG	162	74.74	27.30	-.543**	.543**	.109	-.125	.038	NC	
8.SFcfSaP	162	22.21	26.59	.538**	-.538**	-.107	.128	-.036	NC	-.972**

* Correlation is significant at the 0.01 level (2-tailed)

NC= Not computed: Due to school location is same for whole school

1: School Autonomy, 2: Centralized Administration, 3: Mandatory Quality Assurance System, 4: School Initiatives Quality Assurance System, 5: Instruction Hindrances, 6: School Location, 7: School Funding comes from Government, 8: School Funding comes from Students and Parents

As can be seen in Table 8, there is a low-level negative significant relationship between variables 1 and 3 [$r(162) = -.290, p < .001$]; while there is a low-level positive significant relationship between variables 1 and 4 [$r(162) = .309, p < .001$]. According to this result, if school autonomy scores increase, the mandatory quality assurance system decreases, whereas the school initiatives quality assurance system increases. There was a moderate negative significant relationship between variables 1 and 7 [$r(160) = -.543, p < .001$]; whereas there was a positive significant relationship between variables 1 and 8 [$r(160) = .538, p < .001$]. According to this result, if school funding comes from the government, school autonomy decreases; if school funding comes from students and parents, school autonomy scores increase. Centralized administration and school autonomy have a correlation value of -1 due to the calculation algorithm. Therefore, the relationships between centralized administration and variables 3, 4, 7, and 8 are inversely proportional to those between school autonomy and variables 3, 4, 7, and 8. According to this result, in Singapore, when centralized administration increases in a school, the mandatory quality assurance system and school funding comes from the government increase, whereas school initiatives quality assurance system and school funding comes from students and parents decrease. The relationships between the variables included in the study in Estonia were analyzed using Pearson correlation, and the results are presented in Table 9.

Table 9

Relationships between Variables for Estonia

Variable	n	M	SD	1	2	3	4	5	6	7
1.SA	194	9.96	1.40							
2.CA	194	2.04	1.40	-						
				1.00**						
3.MQAS	191	3.66	1.93	-.120	.120					
4.SIQAS	191	4.77	2.03	.099	-.099	-.753**				
5.IH	195	19.91	5.62	-.029	.029	-.214**	.127			
6.SL	196	2.47	1.16	.050	-.050	.094	.085	.109		
7.SFcfG	195	96.88	9.97	-	.194**	.038	-.040	.050	-	
				.194**					.199**	
8.SFcfSaP	195	2.11	9.05	.195**	-	-.019	.009	-.052	.184*	-
					.195**					.958**

* Correlation is significant at the 0.01 level (2-tailed)

1: School Autonomy, 2: Centralized Administration, 3: Mandatory Quality Assurance System, 4: School Initiatives Quality Assurance System, 5: Instruction Hindrances, 6: School Location, 7: School Funding comes from Government, 8: School Funding comes from Students and Parents

As can be seen in Table 9, in Estonia, there is a low-level negative significant relationship between variables 1 and 7 [$r(193) = -.194, p = .007$]; and a low-level positive significant relationship between variables 1 and 8 [$r(193) = .195, p = .007$]. According to this result, if school autonomy increases, school funding comes from students and parents increases, whereas school funding comes from the government decreases. It is expected that there is a high level of negative correlation between variables 3 and 4 [$r(191) = -.753, p < .001$]. According to this result, if the mandatory quality assurance system increases, school initiatives quality assurance system decreases. A low level of negative significant relationship emerged between variables three and five [$r(190) = -.194, p = .003$]. According to this result, in Estonia, if the mandatory quality assurance system increases in a school, instruction hindrances decrease. A low-level positive significant relationship was found between variables two and seven [$r(193) = .194, p = .007$]; a low-level negative significant relationship was found between variables two and eight [$r(193) = -.195, p = .007$]. According to this result, if the influence of centralized administration increases in the decisions made in a school, school funding comes from the government, whereas school funding comes from students and parents decreases. Finally, a low-level negative significant relationship was calculated between variables six and seven [$r(195) = -.199, p = .005$]; whereas a low-level positive significant relationship was calculated between variables six and eight [$r(195) = .184, p = .010$]. Accordingly, as the geographical location of the school increases (as the city grows), school funding comes from students and parents increases, whereas school funding comes from government decreases. The relationships between the variables included in the study in Canada were analyzed using Pearson correlation, and the results were presented in Table 10.

Table 10

Relationships between Variables for Canada

Variable	n	M	SD	1	2	3	4	5	6	7
1.SA	772	8.65	1.76							
2.CA	772	3.35	1.76	-						
				1.00**						
3.MQAS	738	5.37	2.45	-	.145**					
				.145**						
4.SIQAS	738	2.84	2.15	.226**	-	-.689**				
					.226**					
5.IH	761	17.33	5.66	-	.103**	.002	-.086*			
				.103**						
6.SL	807	3.09	1.31	.104**	-	-.027	.030	-.097**		
					.104**					
7.SFcfG	789	89.69	19.38	-	.245**	.220**	-	.096**	-.134**	
				.245**			.260**			
8.SFcfSaP	767	7.77	16.76	.287**	-	-.241**	.272**	-.128**	.190**	-
					.287**					.925**

* Correlation is significant at the 0.01 level (2-tailed)

1: School Autonomy, 2: Centralized Administration, 3: Mandatory Quality Assurance System, 4: School Initiatives Quality Assurance System, 5: Instruction Hindrances, 6: School Location, 7: School Funding comes from Government, 8: School Funding comes from Students and Parents

As can be seen in Table 10, there is a low-level negative significant relationship between variables 1 and 3 [$r(726) = -.145, p < .001$]; between variables 1 and 4, there is a low-level positive significant relationship [$r(726) = .226, p = .000$]. According to this result, in Canada, if school autonomy scores increase, the mandatory quality assurance system decreases, whereas the school initiatives quality assurance system increases. A low-level negative significant relationship emerged between variables 1 and 5 [$r(747) = -.103, p = .005$]. Accordingly, as school autonomy increases, instructional hindrances decrease. A low-level positive significant relationship was found between variables 1 and 6 [$r(771) = .104, p = .004$]. Accordingly, as the geographical location of the school (city size) increases, school autonomy increases. A low-level negative significant relationship was found between variables 1 and 7 [$r(760) = -.245, p < .001$]; whereas a low-level positive significant relationship was found between

variables 1 and 8 [$r(738) = .287, p = .000$]. According to this result, school funding comes from students and parents increases school autonomy, whereas school funding comes from government decreases it. Centralized administration and school autonomy have a correlation value of -1 according to the calculation algorithm. Therefore, the relationships between centralized administration and variables numbered three, four, five, six, seven and eight are inversely proportional to those between school autonomy and variables numbered three, four, five, six, seven and eight. According to this result, in Canada, when centralized administration increases in a school, mandatory quality assurance system, school funding comes from government and instruction hindrances increase; whereas school initiatives quality assurance system and school funding comes from students and parents decrease. Another result is the low-level negative significant relationship between variables two and six [$r(771) = -.104, p = .004$]. According to this, as the geographical location of the school (size of the city) increases, centralized administration decreases.

As can be seen in Table 10, there is a low-level positive significant relationship between variables 3 and 7 [$r(727) = .220, p < .001$]; while there is a low-level negative significant relationship between variables 3 and 8 [$r(706) = -.241, p < .001$]. Accordingly, in Canada, if school funding comes from the government, the mandatory quality assurance system increases; if school funding comes from students and parents, the mandatory quality assurance system decreases. A low-level negative significant relationship was found between variables 4 and 5 [$r(727) = -.086, p = .020$]. Accordingly, school initiatives quality assurance system reduces instruction hindrances.

As can be seen in Table 10, low-level significant relationships have emerged between variable number five and variables six [$r(759) = -.097, p = .007$], seven [$r(748) = .096, p = .009$] and eight [$r(727) = -.128, p = .001$]. Accordingly, as the geographical location of the school increases (as the city grows) and school funding comes from students and parents, instructional hindrances decrease. Finally, for Canada, a low-level positive significant relationship was found between variables six and eight [$r(766) = .190, p < .001$]. Accordingly, as the geographical location of the school increases (as the city grows), school funding comes from students and parents.

Results and Discussion

In the countries included in the study, school autonomy ranges from high to low in Estonia, Canada and Singapore (Cheng et al., 2016). In all three countries and in other countries of the world participating in the PISA exam, the proportion of decisions made within the school is higher than the proportion of decisions made by local and central governments. According to this result, it can be stated that schools have a reasonable level of autonomy, in other words, a relatively high level of autonomy on a global scale (Honig & Rainey, 2012). Compared to Singapore and Canada, school principals in Estonia were found to have a high level of authority and a high level of influence in teacher recruitment and school budget determination (Kukemelk & Ginter, 2016; Mehisto & Kitsing, 2022).

In Singapore, unlike in Estonia and Canada, teacher recruitment, termination, teacher salaries and raises are decided by the government (Schleicher, 2012). In Canada, it was concluded that the federal or central government had no influence on schools, whereas regional or state authorities had influence on determining teacher salaries, salary increases, and course content (Council of Ministers of Education, Canada, 2022). The political structure of countries, their geographical and cultural locations, and the autonomy of schools are factors that influence whether decisions are made at the central or school level. Therefore, it is possible to consider it as a normal situation that there are differences between countries in terms of school autonomy.

In Singapore and Estonia, quality assurance and improvement systems are in place in the vast majority of schools; in these two countries, quality assurance systems are present in a greater number of schools than in Canada and other countries participating in PISA (Boman, 2020). However, in the three countries included in the study and other countries participating in PISA, the existence of quality assurance and improvement systems in the vast majority of schools is a positive development. Quality assurance systems contribute to the implementation of learning and teaching activities that meet qualified and anticipated standards in schools (Révai, 2018).

In this study, factors that hinder teaching activities were among the variables examined. According to the study, Singapore was found to be the country with the lowest teaching hindrances compared to Estonia, Canada and other countries around the world. Singapore, Estonia and Canada, which were high-performing education systems in PISA, encountered lower teaching barriers compared to other countries with average and below-average performance (Greatbatch & Tate, 2019). This result can be evaluated as an indication of the relationship between the learning resources available to a school and the academic achievement of its students (Savasci & Tomul, 2013). It was concluded that the most common hindrance in the three high-performing education systems included in the sample was a shortage of teaching staff, whereas the least common hindrance was a lack of digital resources. In European countries, the United States and other developed countries around the world, teacher shortages were widespread and striking (Ladd, 2007; Sutch et al., 2019). In other countries participating in PISA, it was found that the least common hindrance was a shortage of qualified support staff, whereas the most common hindrance was a lack of digital resources. In other countries participating in PISA, it is expected that there will be a hindrance due to the financial burden of digital resources. With the increase in national income in other countries, it will be possible to provide easier access to the greater number of digital resources needed by schools.

In each of the three high-performing countries in PISA, a single relationship pattern emerged for all three education systems among all variables examined. According to this pattern, there was a negative relationship between school autonomy and school funding coming from the government, and a positive relationship between school autonomy and school funding coming from students and parents (moderate in Singapore and low-level in Estonia and Canada). Accordingly, if school funding comes from students and parents, school autonomy will also increase (Gunnarsson et al., 2009). A relationship pattern valid for Singapore and Canada is a negative relationship between school autonomy and mandatory quality assurance system, whereas there is a positive relationship with school initiatives quality assurance system. Accordingly, school autonomy increases school-based quality assurance systems and reduces mandatory quality assurance systems. Hanushek et al. (2013) also found that schools can develop more effective quality assurance systems with strong local decision-making mechanisms that reduce centralized control and allow schools to set their own quality standards. Another relationship pattern applicable to Estonia and Canada is the relationship between school location and funding from students and parents. As the population of the city where the school is located increases, the amount of funding from students and parents decreases. Some studies and research reports highlight the funding differences between rural and urban schools in OECD countries (OECD, 2018). Especially in highly urbanized areas, the diversity of funding and the advantages of employing more qualified teachers, as well as the frequent teacher turnover in rural areas (Monk, 2007) may be reflected as negative outcomes for rural areas. It is possible to generalize this situation for Estonia and Canada in terms of research findings.

In Estonia, there is a negative and significant relationship between mandatory quality assurance systems and instructional hindrances. The presence of mandatory quality assurance systems reduces instructional hindrances in schools. Estonia's centralized quality assurance system (national curriculum, standardized assessments and school inspections) has been effective in reducing learning inequalities. It has contributed to minimizing barriers to teaching (e.g. lack of resources, teacher quality), especially in disadvantaged schools. External evaluations identified pedagogical and managerial weaknesses of schools, contributing to the elimination of instructional barriers (e.g. language barriers, special educational needs) (OECD, 2020). These findings suggest that centralized quality assurance systems and standards are contributory for Estonia.

In Canada, a negative correlation was found between school autonomy and instruction hindrances, while a positive correlation was found between school location and instruction hindrances. Accordingly, it was found that instruction hindrances have an effect on school autonomy. In Canada, school autonomy increases as the size of the city where the school is located increases. Accordingly, it is possible to conclude that school autonomy needs to be supported in small settlements as well. A negative significant relationship was found between instruction hindrances and school location and funding comes from students and parents. Accordingly, in Canada, the size of the city where the school

is located and the type of school funding (from the central government or from parents/students) affect the learning obstacles that arise in schools.

When evaluating the results on school autonomy, country conditions and how the basic components of education, public school structure and institutional culture are structured become very important. In countries such as Canada and Estonia, where education components and basic governance culture and processes are standardized through quality assurance systems, the results are very good, whereas in countries with low quality in education, the results are not of the same quality (Hanushek et al., 2013; OECD, 2011b). In contrast, both international and Canadian and Estonian PISA results and experiences show that academic outcomes can be improved with more pedagogical autonomy (Bédard, 2015).

Implications

In order to increase school autonomy, in addition to securing financial support from parents and students, policy regulations are needed to prevent the central government budget allocated to education from reducing school autonomy, based on the importance of public resources in education. Quality assurance systems contribute to the quality of education provided by schools. In order to increase school-based quality assurance systems, which are an indicator of the school's commitment to providing quality education, there is a need to increase school autonomy. As the population of the city where the school is located increases, the amount of funding for schools from students and parents decreases. Therefore, it is recommended that policy regulations be made to provide parental support to schools in large cities in order to ensure school autonomy.

In Estonia, it is recommended to increase the number of school-based quality assurance systems to reduce instruction hindrances, whereas in Canada, it is recommended to increase school autonomy. In Canada, it is also recommended that regulations be implemented to reduce learning barriers in schools in large cities, based on the fact that instruction hindrances increase as the city where the school is located grows. For Canada, it is also important to maintain financial support from parents and students in terms of school funding in order to reduce instruction hindrances.

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Credit Author Statement:

Abdurrahman Ilgan: Conceptualization, Methodology, Formal Analysis, Data Curation, Writing – Original Draft Preparation, Writing – Review & Editing.

Abdurrahman Ekinci: Conceptualization, Methodology, Formal Analysis, Data Curation, Writing – Original Draft Preparation, Writing – Review & Editing.

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