Variables influencing the elementary education IDEB in public municipal networks of São Paulo in 2017*

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Abstract

Considering the continuous need to improve the condition of Brazilian education and the moment of renewal of the main Law on financing education in municipalities in 2020, this article aims to identify the variables of the context of elementary education networks in São Paulo municipalities, which have a significant correlation with the IDEB, in 2017. Among those indicated in the literature, 33 variables are used, which have data available on official government websites, and analyzed using the Ordinary Least Squares (OLS) method and the stepwise procedure. The regression equation obtained in the study shows that the average expenditure per student on staff of the municipal networks, teaching effort, school dropout, as well as the development index of the income dimension explain, with a statistical significance of 5%, more than 66% of IDEB of municipal networks in the state of São Paulo in 2017. The results corroborate the national and international literature regarding the figure of the teacher, his remuneration, and the management of the school process as the key elements for the development of education. The moment calls for a posture of better investments, with coherent planning and execution in the social and economic context, specific to the development of educational activity, with attention to school spaces, financial resources and the professionals who work there.

Keywords

IDEB – Municipal networks – Elementary education – Quality in education.

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Introduction

Since the IDEB - *Índice de Desenvolvimento da Educação Básica* (Basic Education Development Index) (BRASIL, 2019b) was established as a potential indicator of the quality of basic education (BRASIL, 2007), it is not difficult to accept the idea that one of the information desired by managers and citizens is to know in which programs to apply resources, to improve performance in this indicator. The bibliography in the area suggests that it cannot be said that programs contemplating a component (variable) (WOOLDRIDGE, 2016, p. 23) or even a factor (combination of variables) (HAIR *et al*., 2009, p. 101) would have the primacy in explaining student performance in general assessment systems and expected progression to the following years. Analysts have long suggested that there is a considerable combination of components, with distinct associations for each context and moment, making the issue complex (OLIVEIRA, 2010; DITTRICH, 2010). One may see that the term quality, when attributed to education, becomes polysemic, given that it can be interpreted from different perspectives (GUSMÃO, 2013; ALVEZ; SILVA, 2013).

Factors related to personal and family characteristics of students, from macroeconomic and social structures to those that can be identified with the structures of public service provision, present in the locations where the activities are developed, are among the most indicated as influencing the results of educational systems (OLIVEIRA, 2010). The latter characterize the conditions for effective production of public policy in a territory (MORAES, 2018), results of public choices made by political actors responsible for managing public services in localities (SECHI, 2015).

There is considerable academic interest in studies on IDEB as an indicator of quality, with the evaluation of expenditure efficiency as the most frequent focus. Few published studies try to explain IDEB influencers in municipal elementary education networks. This finding indicates a gap to be filled by studies capable of supporting citizen assessments and decisions by those responsible for managing educational programs and policies in the municipalities.

Given this context, this article aims to identify and evaluate variables with a higher level of association with the IDEB of elementary education students, initial and final years, enrolled in public municipal networks in São Paulo, in 2017. Based on the literature visited and referred to in the following topic, the study uses variables obtained from official databases of the Union and the State of São Paulo, applying simple and multivariate analysis techniques by Ordinary Least Squares (WOOLDRIGE, 2016, p. 70) to identify those that influenced, with a higher level of statistical significance (HAIR *et al*., 2009), the IDEB of fundamental education, of the municipal networks of the State of São Paulo, in 2017.

With the increasing availability on official government websites of educational databases, this study uses data from the TCE - State Audit Court (SÃO PAULO, 2019), from IBGE - Brazilian Institute of Geography and Statistics (BRASIL, 2020a), from STN – National Treasury Secretariat (BRASIL, 2020b), IDEB – Basic Education Development Index (BRASIL, 2019a), INEP – Institute of Studies and Research Anísio Teixeira (BRASIL, 2019b) as well as MS – Brazilian Ministry of Health (BRASIL, 2019e).

In the regression model, there are 33 variables indicated in the literature, which had data available at the municipal level in the cited sources for 2017. The stepswise procedure (FAVERO, 2015, p. 44) defined the variables that represent the most statistically significant influence (*p-value > 0.05*) on the 2017 IDEB of elementary education municipal networks in São Paulo. The previous result of IDEB, from 2015, human development index, income dimension of the year 2010, teacher effort rate, student dropout rate and average remuneration per student of the staff of municipal networks, point out as the most explanatory influencers for more than 66% of the IDEB of the municipalities.

The novelty of this study refers to the low availability of publications with similar objectives. The study opportune due to the renewal, in 2020, of the Law of the Fund for the Maintenance and Development of Basic Education and the Valorization of Education Professionals – Fundeb (BRASIL, 2019d), which placed educational policies and their financing on the public agenda. One should consider that federal transfers are the most relevant in the financing of education in Brazilian municipalities, aggravating the care taken in the renewal of the aforementioned Law. Another point concerns the assessment of the quality of primary education from the perspective of quality management of public spending (BOUERI *et al*., 2015).

In addition to this introduction, this article visits studies published on IDEB and the quality of education, contextualizing and supporting the findings. Next, it presents the methodological choices, results and conclusions.

The IDEB, publications, and the quality of public education

IDEB – Basic Education Development Index

According to INEP:

> The IDEB is an educational quality indicator that combines performance information on standardized exams (Prova Brasil or Saeb) – obtained by students at the end of the teaching stages (4th and 8th grades of elementary school and 3rd grade of high school) – with information on academic performance (approval). (BRASIL, 2019b, p. 1).

Created in 2007, based on the "application of an assessment mechanism with sensitive characteristics, called Prova Brasil" in 2005 (DITTRICH, 2010, p. 1), IDEB was instituted by INEP after the phase of inclusion of Brazilian children in social education networks in the mid-1990s, "when Elementary Education was finally virtually universalized" (OLIVEIRA, 2010, p. 12). In 2007, through Decree No. 6,094 of April 24, 2007 (BRASIL, 2007), the then President of the Republic, Mr. Luiz Inácio Lula da Silva, instituted this indicator with the determination that:

> Art. 3 The quality of basic education will be objectively measured based onthe IDEB, calculated and published periodically by INEP, based on data on school performance, combined with student performance, contained in the school census and the Basic Education Assessment System - SAEB,

> composed of the National Evaluation of Basic Education - ANEB and the National Evaluation of School Performance (Prova Brasil). (BRASIL, 2007).

IDEB combines progression in the education system with the necessary learning of the appropriate content for each grade (REZENDE; JANUZZI, 2008, p. 121; BRASIL, 2019b), since "it is calculated from data on school approval obtained from the Census School, and performance averages in Inep evaluations" (BRASIL, 2019b, p. 1). Its implementation "represents a paradigm shift, since our tradition in developing educational indicators for use in educational policy is small or, at most, located in some technical sectors" (VIDAL and VIEIRA, 2011, p. 426) and it constitutes a fertile field for the evaluation of Brazilian education aiming at reducing educational inequalities (FRANKLIN, 2011, p. 232).

Studies on IDEB

The SCIELO (www.scielo.br) and SPELL (www.spell.org.br) databases include 123 QUALIS/CAPES national journals in the field of education in "developing countries and, particularly, in Latin America and the Caribbean" (SCIELO, 2019 , p. 1) and administration (SPELL, 2019). With the term IDEB in the search tools, 65 articles were found (29 in Spell and 37 in Scielo, 1 repeated), published in 45 different journals of Brazilian institutions. The oldest is from 2007 and 5 were published until August, 2019. The journal that published the most articles (9) was Ensaio: Evaluation and Public Policies in Education (http://revistas.cesgranrio.org.br/index.php/ensaio). Another 4 journals published 4 or 5 articles; 24 journals have the publication of a single article. In 2013, 2016 and 2018, there were more publications (11, 11 and 10, respectively). From 2013 to date, there are a minimum of five articles published per year in these 45 journals, showing the relative novelty of the topic. We highlight four articles among those that are similar to the objective of this study.

Rezende and Januzzi (2008), when analyzing the conditions for formalizing the IDEB, validated that "The IDEB was built with a consistent methodology that uses two similar dimensions, composed of result indicators that affect each other in opposite directions" (REZENDE; JANUZZI, 2008, p. 144) proposing the inclusion of the "school dropout dimension" as one of the important dimensions of educational development in the last 10 years (REZENDE; JANUZZI, 2008, p. 144).

The study by Alves and Soares (2013) addressed:

> [...] the complex relationship between the value of the school's IDEB and its contextual characteristics defined by the profile of its students and the conditions of the school offer. To do so, it makes use of data from Prova Brasil, the School Census and Ideb, referring to public elementary schools throughout Brazil that have this information disclosed by Inep. (ALVES; SOARES, 2013, p. 179).

They consider that "School's infrastructure and complexity conditions – measured with data from the School Census – also have a significant relationship with the IDEB" (ALVES; SOARES, 2013, p. 191).

Lourenço *et al*. (2016) assess whether the IDEB grade distinction between Brazilian municipalities may be a consequence of social, economic-financial and social control aspects, in addition to pedagogical and structural aspects, and concluded that:

> [...] social and pedagogical aspects are decisive for the probability of obtaining regular grades or good grades in IDEB 2013; and that municipalities belonging to states with a greater concentration of wealth, with less access to knowledge and low life expectancy have a relevant increase in the probability of obtaining bad grades in the IDEB. The research contributes with evidence that contextual, contingent and local factors, including those related to family and housing conditions, have a greater impact on school performance than factors related to public spending on basic education. (LOURENÇO *et al*., 2016, p. 28-29).

Thus, this shows how teaching performance is influenced by several contextual factors.

The work by Gomes *et al*. (2016) "aimed to study the social development policies of three municipalities in São Paulo: Americana, Cajuru and São Caetano do Sul, based on social and economic indicators, combining them with educational results." (GOMES *et al*., 2016, p. 36). They combined the view of managers, teachers and parents or caregivers of the supply and demand of education services with secondary data from IBGE, Fundação Seade and EducaCenso/Ideb in the years 2007, 2009, 2011 and 2013. They assessed that: "... wealth and development indices are not directly correlated to the performance of local public education, just as a full-time school is not by itself a representative of better quality of education" (GOMES *et al*., 2016, p. 36). They conclude that:

> [...] there is evidence that improving the quality of teaching is more related to management, commitment, responsibility, training and evaluation than to the volume of resources applied. To the improvements in the salary conditions of educators, a set of measures and structural (sic) management must be added, leaving behind the diffuse commitment of political discourses. There was also a high sensitivity of educators in relation to changes, especially those resulting from electoral processes and the executive management of the municipality. (GOMES *et al*., 2016, p. 48).

Sanches (2017) carried out a rich survey of theses and dissertations from the base of CAPES - Coordination for the Improvement of Higher Education Personnel with the "general objective of analyzing master's and doctoral theses that make reference to IDEB completed in Brazil between 2007 and 2015, identifying modalities of appropriation of the Index in these productions". After analyzing the 383 works found, he evaluated:

> Five predominant ways of incorporating the theme: reference to IDEB as an inductor of policies and programs; investigation of factors for obtaining high or low IDEB by schools or public education networks; reference to IDEB as a program/policy/management outcome indicator; use of IDEB data in research design and/or data analysis, usually treated as one of the explanatory variables of the study results; and mention of IDEB as one of the selection criteria for states, municipalities and/or schools to be researched or as an element to characterize the context in which the study was carried out. (SANCHES, 2017, p. 151).

This study shows that the IDEB is valued by society as an "inducing element" of policies, used at different levels of the educational process, which include the management of networks and the classroom, since it is associated with the notion of educational quality.

Given the above, due to the breadth of uses of the indicator, it can be considered that the academic community has focused on the topic with a profusion of analyses, representing a well-paved path in terms of the management of public policies in Brazilian basic education.

In the international literature, studies on school performance are related to spending on service provision structures to analyze resource efficiency, using the Data Envelopment Analysis (DEA) tool. Moraes (2018) mapped these studies published in the ERIC (Educational Resources Information Center) and WOS (Web of Science) databases, from 1978 to 2016. The factors mentioned are linked to the scope of the student, family or educational institution, which can be described as: psychological and behavioral, demographic, economic needs, family structure, parental education, school attendance rate, educational resources, number of students, proportion of professors per student, teaching experience and public expenses/expenses per se, which are more related to variables such as teacher salary, staff (academic staff, administrators and support staff) and school resources (books, computers, buildings etc.) (MORAES, 2018, p. 48-68).

In his study, Moraes (2018, p. 139) concluded that the efficiency of Brazilian municipalities in public primary education policy can be analyzed by variables that qualify the functioning structure of the municipal primary education network (teacher adequacy, management complexity, teaching effort , teacher turnover, teacher remuneration and school infrastructure), which define five "Typologies" of municipalities. These typologies and the results of the networks support his assertion that "to improve the quality of any indicators, it is necessary to take into account the profile of the municipality in question for better accuracy in diagnosing which actions should be formulated and implemented." (MORAES, 2018, p. 140). These influencing factors are translated into the variables used in this study.

Methodological aspects

This study can be classified as descriptive, explanatory and exploratory, given the objective of identifying the variables with significant correlation with the IDEB, in 2017, of municipal elementary education networks in the State of São Paulo, as it analyzes "if and how two or more variables are related to each other in a population" (STEVENSON, 1981, p. 341). To do so, it uses the technique of multivariate regression analysis (HAIR *et al*., 2009, p. 149-220) by Ordinary Least Squares (WOOLDRIDGE, 2016) and the *stepwise* procedure that "presents the property of automatically excluding explanatory variables whose parameters are not show statistically different from zero" (FÁVERO, 2015, p. 44).

The city of São Paulo was excluded, considering its population equivalent to 42% of the others and a public budget, for 2017, equivalent to 49.4% of the sum of the budget of all municipalities in the state (BRASIL, 2020b). The remaining 644 were grouped by their population estimated by IBGE 2017, into five bands, as disclosed by the National Treasury Secretariat (BRASIL, 2020b):

Range 1 – up to 30,000 inhabitants
Range 2 – between 30,001 and 50,000 inhabitants
Range 3 – between 50,001 and 300,000 inhabitants
Range 4 – between 300,001 and 1,000,000 inhabitants
Range 5 – above 1,000,000 inhabitants

The variables used, indicated in the literature and with available data, are described in Table 1 below, regarding the denotation used in the regression, description and source.

Table 1 – Variables used in the multiple regression model with *stepwise* procedure: model denotation (acronym), description and source

Variable	Description	Source
ideb17	Basic Education Development Index of schools in the São Paulo municipal elementary education networks for 2017.	BRASIL, 2019c
ideb15	Basic Education Development Index of schools in the São Paulo municipal elementary education networks for 2015.	BRASIL, 2019c
tdi17	Year Age Distortion Rate. It refers to the gap rate between the student's age and the year the student should be enrolled in, if he followed the regular flow in elementary education, when started at five or six years of age.	BRASIL, 2019c
abd17	Student dropout rate, identified by comparing enrollments between the beginning and end of 2017.	BRASIL, 2019c
inse17	Index of the socio-economic level of students enrolled in the municipal primary education network, in 2017.	BRASIL, 2019c
tnr17	Non-response rate. Represents the proportion of students with no data in INEP databases.	BRASIL, 2019c
afd17	Adequacy of Teacher Training. Percentage of teachers in Elementary School, in municipal schools, by group of training adequacy to the subject taught, in 2017. They refer to: Group 1 - Faculty with higher education degree (or bachelor's degree with pedagogical complementation) in the same area of the subject taught; and Group 2 - Faculty with bachelor's degree or higher education (without pedagogical complementation), in the same area of the subject taught.	BRASIL, 2019c
dsu17	Percentage of Teachers in Elementary School of the municipal network with higher education, in 2017.	BRASIL, 2019c
had17	Average Hours/Classes per day. There is no technical note on the INEP website about this variable. The information reported by the municipalities to INEP was considered.	BRASIL, 2019c
ied17	Teaching effort index. Classifies each teacher in levels from 1 to 6, according to the effort made in the exercise of the profession. High levels indicate greater effort, as they are related to the following teaching characteristics: number of schools worked, number of work shifts, number of students served, and number of stages in which they teach. The percentages of teachers working at levels 1 and 2 were taken, i.e., the proportion of teachers in each network that, in general, have up to 25 or between 25 and 150 students and work in a single shift, school and stage, levels considered of less effort.	BRASIL, 2019c
ird17	Faculty Regularity Rate. Evaluates the regularity of the teaching staff in basic education schools, based on the observation of the permanence of teachers in schools in the last five years (2013 to 2017). It ranges from 0 to 5, the closer to 0, the more irregular the teacher's relationship with the school. Schools were classified by the following ranges of the regularity indicator: low regularity (mean IRD equal to or less than 2); medium-low (average IRD greater than 2 to 3); medium-high (average IRD greater than 3 to 4); high (average IRD greater than 4 to 5). For this study, the proportions of teachers in the medium-high and high IRD were taken.	BRASIL, 2019c

rmd17	Average remuneration of teachers. It refers to the standardized gross remuneration for 40 hours of teachers working in basic education by municipality and level of education, in 2014.	BRASIL, 2019c
atu17	Students by class: "division of enrollment by the number of classes" (INEP, 2019b).	BRASIL, 2019c
Conedu	Existence of Municipal Council of Education, 0 for no, 1 for yes.	BRASIL, 2019c
Confund	Existence of a Municipal Management Council of FUNDEB – Basic Education Development Fund, 0 for no, 1 for yes.	BRASIL, 2019c
Gestrec	Existence of the Education Revenue Management Council in the municipality, 0 for no, 1 for yes.	BRASIL, 2019c
Sme	Existence of an autonomous administrative structure of the Municipal Department of Education, 0 for no, 1 for yes.	BRASIL, 2019c
Plano	Existence of Municipal Council of Education, 0 for no, 1 for yes.	BRASIL, 2019c
rc17	Total Current Revenue collected by the municipality in 2017.	BRASIL, 2020b
rcc17	Current Municipal Revenue per capita in 2017.	Based on BRASIL, 2020a and BRASIL, 2020b.
fundb17	Total amount received from Fundeb in 2017.	BRASIL, 2020b
fundeba17	Average value per student, of the FUNDEB amount received by the municipality, in 2017.	Based on BRASIL, 2019b and BRASIL, 2020b.
gini10	Indicator of the degree of concentration of municipal income, between the richest and the poorest. The closer to 1, the greater the level of income distribution in this group.	BRASIL, 2019e
idhm10	Municipal Global Human Development Index for the year 2010.	BRASIL, 2020 a
idhe10	Human Development Index, education dimension, for 2010.	BRASIL, 2020 a
idhl10	Human Development Index, longevity dimension, in 2010.	BRASIL, 2020 a
idhr10	Human Development Index, education dimension, for the year 2010.	BRASIL, 2020 a
pibt16	Total Gross Domestic Product of the municipality in 2016	BRASIL, 2020 a
pibc16	Inter-Gross Product per capita of the municipality, in 2016.	BRASIL, 2020 a
ma17	Average budget expenditure per student, with remuneration and/or benefits paid to municipal elementary education professionals.	Based on SÃO PAULO, 2019
mb17	Average budget expenditure per student on trips and stays in municipal elementary education.	Based on SÃO PAULO, 2019
mc17	Average budget expenditure per student, with interest and financial charges for municipal elementary education.	Based on SÃO PAULO, 2019
md17	Average budget expenditure per student, with purchases of materials and services.	Based on SÃO PAULO, 2019
me17	Average expenditure per student, with permanent materials and fixed investments in municipal elementary education.	Based on SÃO PAULO, 2019

Source: Elaborated by the author.

The requirements of normality, homoscedasticity and linearity (HAIR *et al*., 2009, p. 82-88; CORRAR, PAULO; DIAS FILHO, 2014, p. 40-46) and the absence of multicollinearity (HAIR *et al*., 2009, p. 160; FÁVERO *et al*., 2014, p. 131; FÁVERO, 2015, p. 45-62) of the variables of the final regression, were verified and found adequate by the visual histogram test, by the White, Shapiro-Wilk and linear correlation tests and the variance inflation factor or VIF (*variance inflation factor*) (HAIR *et al*., 2009, p. 190-191; FÁVERO *et al*., 2014, p. 131-142; FÁVERO, 2015, p. 45-62). Data, charts, graphs and statistical analyzes were developed using Microsof Excel (2010) and STATA (14) [Computer Programs].

Results and analyses

The resident population, enrolled students and the respective IDEB for the year 2017 (average, lowest and highest value and standard deviation) in the municipal primary education network of the 644 municipalities, are contained in Table 2 below, in the population groups already identified.

Table 2 – Population, enrolled students, mean, lowest and highest value and standard deviation of the 2017 IDEB, of the municipal network in the State of São Paulo, by population group

Population Range	Quantity of Municipalities.	Population	Rate	Total enrollment in basic educ.	Rate	2017 IDEB			
						Average	Lowest	Highest	Standard Deviation
1	268	1,367,587	4%	99,069	5%	6.37	4.40	7.80	0.68
2	240	5,617,178	17%	393,281	22%	6.18	4.35	7.80	0.65
3	112	13,107,592	40%	796,449	44%	6.19	4.85	7.40	0.55
4	22	10,362,941	31%	461,851	25%	6.10	4.95	7.10	0.60
5	2	2,531,542	8%	71,186	4%	5.90	5.60	6.20	0.42
Total	644	32,986,840	100%	1,821,837	100%	6.25	4.35	7.80	0.65

Source: Elaborated by the author.
Caption: Range 1: up to 30,000 inhabitants; Range 2: between 30,001 and 50,000 inhabitants; Range 3: between 50,001 and 300,000 inhabitants; Range 4: between 300,001 and 1,000,000: Range 5: above 1,000,000 inhabitants.

In Table 2 above, one can see that 21% of São Paulo residents, except for the capital, live in municipalities with up to 50,000 inhabitants. These municipalities are home to more than 27% of students enrolled in elementary education schools managed by local municipalities. They also have the lowest and highest IDEB value in 2017 in the municipal primary education network in the state. It is observed that, while there are municipalities with IDEB at levels higher (7.80) than the state average (6.25), in these cities there is also the lowest IDEB (4.35).

Table 3, below, presents the variables that were excluded from the multivariate regression by the stepwise procedure (FÁVERO, 2015, p. 44) for having low statistical significance (*p-value* > 0.05), with the dependent variable in the regression model.

Table 3 – Variables removed by the application of the regression model, with the *stepwise* procedure, for having a statistical significance lower than 5% (*p-value* > 0.05)

Variable	p-value	Variable	p-value	Variable	p-value
me17	0.9528	mb17	0.6568	atu17	0.3800
inse17	0.9406	idhm10	0.5690	gini10	0.2051
fundb17	0.9208	rcc17	0.5415	md17	0.1823
sme	0.9045	rc17	0.5224	gestrec	0.1707
pibt16	0.8970	ird17	0.5032	plano	0.1347
confund	0.8521	dsu17	0.4256	tdi17	0.0887
had17	0.8496	afd17	0.4084	tnr17	0.0688
mc17	0.8445	idhe10	0.4049	conedu	0.0519
pibc16	0.7241	fundeba17	0.4005	-	-
rmd17	0.6819	idhl10	0.3862	-	-

Source: Elaborated by the author.
Caption: the variables were identified in Table 1.

Twenty-eight of the 33 initial variables were removed from the regression model. The existence, or not, of the Municipal Council of Education (conedu: *p-value* = 0.0519), the non-response rate (tnr17: *p-value* = 0.0688) and the age-grade distortion rate (tnr17: *p -value* = 0.0887). These variables would have been included in the equation if the significance level was set at 10% (*p-value* < 0.1). In this regard, the explanatory power of the final regression equation would have a R2 (*R-squared*) = 0.7037.

In Table 4, below, the data from the regression equation offered by the STATA application are shown, explaining the variables that influence IDEB, of São Paulo municipalities in the year 2017.

Table 4 - Regression data

Source	SS	Df	MS	Number of obs = 574		
				F(5,568) = 222.87		
Model	157.732617	5	31.55	Prob > F = 0.0000		
Residual	80.398463	568	0.14154659	R-squared = 0.6624		
				Adj R-squared = 0.6594		
Total	238,13108	573	0.41558652	Root MSE = 0.37623		
ideb17	Coeff	Std. ERR	t	P>|t|	[95% Conf. Interval	
idhr10	1.161345	.3992458	2.91	0.004	.3771669	1.945524
ied17	.0053112	.0010288	5.16	0.000	.0032905	.0073319
abd17	-.3499537	071097	4.92	0.000	-.4895987	-.2103086
ideb15	.6819201	.029358	23.23	0.000	.6242566	.7395836
ma17	.0000164	6.48e-06	2.53	0.012	3.63e-06	.0000291
_Cons	.9990193	.3153371	3.17	0.002	.3796502	1.618388

Source: Elaborated by the author.
Caption: the variables were identified in Table 1.

Table 4 shows that the econometric model obtained as multivariate regression has considerable statistical significance (*Prob. F*> 0.0000) and that can explain 66.24% (*R-squared* = 0.6624) of the behavior of the dependent variable, that is, the 2017 IDEB of the municipal networks in São Paulo. As these variables individually have statistical significance at 5%, they indicate an excellent combination of focus on managing the improvement of the IDEB in fundamental education in each municipality.

The regression equation for estimating the IDEB of the municipal elementary education network in 2017 in the municipalities of São Paulo, considering the variables with statistical significance, is defined as follows:

IDEB2017 = 1.161345 idhr10 + 0.0053112 ied17 - 0.3499537 abd17 + 0.6819201 ldeb15 + 0.0000164 ma17

Note: The variables were described in Table 1 and are analyzed individually below.

Table 5 – Income dimension Human Development Index (idhr10) of São Paulo municipalities in 2010

population range	IDHR2010			
	Average	Minor vlr.	Greater value	Standard Deviation
1	0.70	0.60	0.85	0.03
2	0.72	0.59	0.82	0.03
3	0.75	0.66	0.89	0.04
4	0.77	0.67	0.86	0.05
5	0.79	0.75	0.83	0.06
Everyone:	0.72	0.59	0.89	0.04

Source: Elaborated by the author.
Caption: population range according to Table 2.

The HDI Income dimension (idhr10) is positively related to the IDEB of São Paulo municipalities. It is estimated that the 1.16-point increase in the IDHR will reflect the 1-point increase in the respective municipality's IDEB. Families that are better equipped with economic resources have better conditions of access to schools in which their children perform better in IDEB. This result is in line with the discovery by Gomes *et al.* (2016) and Dittrichi (2007). Overcoming the antagonistic dichotomy between income and learning is a challenge for the Brazilian state that was not even overcome by the NGP (LOURENÇO, *et al.*, 2016, p. 40). Evidence contrary to the statement by Oliveira (2010) for whom "student performance is not directly related to the economic and social differences of the municipalities." (OLIVEIRA, 2010, p. 129).

Table 6 – Teaching Effort Index (ied17) of those working in municipal elementary education networks in the State of São Paulo in 2017, by population group

population range	Teaching Effort Rate			
	Average	Minor vlr.	Greater value	Standard Deviation
1	56.66	8.30	100.00	19.73
2	50.41	12.80	100.00	15.80
3	49.84	18.70	89.60	14.44
4	47.26	18.80	86.00	19.06
5	57.20	50.10	64.30	10.04
Everyone:	52.80	8.30	100.00	17.68

Source: Elaborated by the author.
Caption: population range according to Table 2.

Variable ied17 reflects the proportions of professors who develop a lower level of effort in the function. It shows that the greater the proportion of professors with less effort, the better (or higher) IDEB in the municipality. It is possible to assess the level of influence of physical and intellectual impairment for the necessary adaptation to the challenge of being a primary school teacher in the analyzed networks. Teachers with up to 150 students per shift have students with better performances in the Prova Brasil.

As municipalities with more than 1 million inhabitants and those with up to 30,000 inhabitants have better financial capacity to hire a greater number of teachers (more than 1 million inhabitants) and by the smaller number of students and fewer displacements (up to 30,000 inhabitants), these present the best performance in this indicator. These results corroborate the findings of Oliveira (2010), Dittrich (2010) and Vidal and Vieira (2011), who stated that "The Physical Infrastructure and Pedagogical Resources dimension is a critical field in Rio de Janeiro municipalities, demanding a closer look of political managers." (VIDAL; VIEIRA, 2011, p. 128).

Table 7 – Dropout rate (abd17) of elementary school students in Brazilian municipalities in 2017

population range	Elementary school dropout rate				
	Average	Minor vlr.	Greater value	Standard Deviation	Estimate
1	.0839552	0	1.5	.2446507	143
2	.15	0	1.6	.2754493	683
3	.1508929	0	.7	.1750138	1,519
4	.2681818	0	1	.2732283	1,204
5	.15	.1	2.	.0707107	89
Everyone:	.1265625	0	1.6	.2499090	3,638

*Estimate of the number of students who dropped out of elementary school in 2017 based on the number of students enrolled and the dropout rate in each municipality.
Source: Elaborated by the author.
Caption: population range according to Table 2.

The dropout rate by elementary school students is negatively correlated with the 2017 IDEB, as expected. The coefficient in the estimated regression equation (-0.349953) indicates that the IDEB of São Paulo municipalities can improve 1 point for every 3% decrease in the dropout rate. The estimated column in table 7 shows that just over 3,600 students dropped out of elementary school in 2017, in these education networks. Of these, municipalities in ranges 1 to 4, with a high standard deviation, show that this is not a problem at all. This finding corroborates the statement by Rezende and Januzzi (2008, p. 144) that the reduction in school dropout is still one of the relevant dimensions of the development of education in the country and by Dittrichi (2010) for whom managers should:

> [...] commit to part of the solution of the problems detected by the evaluations, implementing policies that aim to guarantee to the group of schools with the lowest performances, especially when this performance is linked to the socioeconomic level, that there is an effective policy for differentiated improvement of these schools, so that such privileged conditions can compensate part of the unfavorable structure of the students of these schools. (DITTRICHI, 2010, p. 267).

Thus, there is potential for improvement in IDEB in municipalities with higher school dropout rates, that is, programs that induce students to stay in schools have the right address.

Table 8 – Average expenditure on remuneration of education professionals per student enrolled (MA17) in municipal elementary education networks in São Paulo municipalities in 2017, categorized by population group

population range	Average expenditure per enrolled student			
	Average	Lowest value	Highest value	Standard Deviation
1	8,456.74	1,574.02	46,744.79	5,140.79
2	6,193.08	532.55	21,004.93	2,222.50
3	6,029.19	1,458.62	13,232.57	2,039.93
4	5,537.45	7,096.93	9,724.32	2,348.73
5	6,661.15	5,442.45	7,879.86	1,723.51
Everyone:	7,083.66	532.55	46,744.79	3,879.85

Source: Elaborated by the author.
Caption: population range according to Table 2.

One may observe that municipalities with up to 30,000 inhabitants have an average of 8,400 reais; however, the highest value is 5 times higher than the average and almost 30 times higher than the lowest value for this category of municipality. Municipalities with a population between 50 thousand and 300 thousand inhabitants have the lowest average value of 6.0 thousand reais, which shows a gain in scale in the educational networks. The lowest value of average expenditure per student is 532 reais, representing 8.5% of the average and the highest value is 39 times higher than this, in the same range of municipality. These same cities, on the other hand, according to additional analyses, have

a high average budget expenditure per student with purchases of materials and services (md17), an indication that they may be hired by outsourcers of educational services. In the other population groups, the mean, highest and lowest values are relatively stable, given that the standard deviation is much lower in relation to the first two population groups.

In a complementary analysis, it was found that the average expenditure on staff of the municipal primary education networks (ma17) has high statistical significance with the adequacy of teacher training (afd17), with the teacher effort index (ied17), with the proportion of faculty with higher education (dsu17), with the teacher regularity index (ird17), with the average remuneration of the professor (rmd17), with the number of students per class (atu17) and with the average amount per student received by the municipality transfers to FUNDEB (fundebal7). Adequate training for the contents (afd17) at the level of higher education (dsu17) of teachers is combined to enhance the efforts of municipal education systems, with the learning processes of students. This finding emphasizes the role of total expenditure on education, which should be directed primarily to teacher remuneration and how these are related to complementary aspects of the teacher's performance, relevant to the education system. This finding corroborates the considerations by Gomes *et al.* (2016), and Jacomini and Pena (2016), Lourenço *et al.* (2016) and Gomes *et al.* (2019), for whom programs, materials and educational spaces work together for quality when well managed (GOMES, *et al.*, 2019, p. 292-293).

Table 9 – Correlation matrix of the variables that make up the IDEB multiple regression for the year 2017, of the elementary education networks of the São Paulo municipalities

	ideb17	ideb15	idhr10	ied17	abd17	ma17
ideb17	1.0000					
sig	0.0000					
ideb15	0.3695	1.0000				
sig	0.0000					
idhr10	0.0813	0.1137	1.0000			
sig	0.0449	0.0050				
ied17	0.3871	0.1791	-0.1828	1.0000		
sig	0.0000	0.0000	0.0000			
abd17	-0.4449	-0.1630	0.0885	-0.2994	1.0000	
sig	0.0000	0.0001	0.0256	0.0000		
ma17	0.2224	-0.0376	-0.0604	0.1748	-0.1592	1.0000
sig	0.0000	0.3549	0.1284	0.0000	0.0001	

Source: Elaborated by the author.

As shown in Table 9 above, the level of univariate correlation between the variables that make up the regression model is low to weak; on the other hand, the level of statistical

significance of this correlation is high (*p-value* < 0.05) for most of the correlations. This analysis consolidates these variables as the main causes of the variation in the IDEB in the year 2017, of elementary education networks in São Paulo municipalities that combine to produce an event or phenomenon (FÁVERO, 2015, p. 44 ; HAIR *et al.*, 2009, p. 100).

Discussion

Public policies are complex phenomena and their analysis requires technical training, knowledge with a scientific basis, as well as dedication to their proper understanding. As stated by Sechi (2015, p. 1):

> The analysis of public problems aims to improve the public decision-making process with the use of methods and techniques of problem analysis (*problem analysis*) and solution analysis (*soution analysis*) to assist in decisions and in the structuring of policies, laws, programs, campaigns , projects or public actions.

The results of this study show that the result of the elementary education policy in São Paulo municipalities measured by IDEB is influenced by an interesting and small combination of variables. The pre-existing condition, measured by the IDEB of the previous evaluation (2015), with strong explanatory power of the current score, represents the strength of the educational context present in each municipal network, as the main aspect of change in the quality of fundamental education in these realities. The biggest challenge is to break the inertia in the quality of education observed.

The results showed that the educational policy of considering structural variables such as the Human Development Index (HDI), income component of municipalities, is non-discretionary for network managers, and cannot be directly transformed by direct actions. This implies analyzing the socioeconomic and cultural condition of families in order to integrate them into the process of stimulation and development of students.

On the other hand, the average expenditure on the remuneration of public servants in education (teachers, employees and managers of the local network) is one of the variables with a strong impact and consequences in the 2017 IDEB of the networks. It must be appreciated that this is a consolidated concern in the management of fundamental education policies, given the inclusion of aspects of valuing education professionals when the FUNDEF is renewed for FUNDEB (BRASIL, 2019d) and also identified by Gomes *et al.* (2016) and Lourenço *et al.* (2016). Equalizing remuneration for the set of municipalities, as well as valuing the teacher for a fair remuneration consistent with their social role, is the first step.

The data consistently show that the teaching effort influences the 2017 IDEB results of these municipal networks. Decreasing the number of classes, teacher displacements and the number of students per class are evidences that the quality of educational services in environments that are easier to manage and teaching performance are key aspects for the quality of learning and the student's permanence in the network. Teachers' remuneration and their performance in the classroom are crucial for the quality of teaching, which will be observed with their own programs and actions to reduce the teacher's effort, in

fulfilling their noble mission of educating. Structuring teaching careers that encourage the permanence of the teacher with a bond in a single municipality is a good way to go.

The dropout rate is also a condition that can be worked on with specific programs. The identification of dropout conditions, their motivations and the student's profile can be established by specific programs. The 644 municipal networks that consume more than 17.6 billion reais a year have the potential to establish teams of monitoring abandonment, as a concrete action for the improvement of IDEB, since "one could observe the reception or association of IDEB with the notion of educational quality." (SANCHES, 2017, p. 151).

Conclusion

This study sought to identify which variables influenced, with statistical significance, the 2017 IDEB of São Paulo municipalities. With the use of 33 variables and the Ordinary Least Squares (MQO) method with the *stepwise* procedure, unprecedented knowledge of interest to managers and those responsible for implementing educational policies in the municipalities was produced.

The results show that the initial condition of teaching in the evaluation cycle (IDEB 2015), the average expenditure per student with the remuneration of education professionals, the level of teaching effort, the dropout rate in municipal networks and the development index human dimension income (IDHR) form the set of variables that can explain more than 66% of the variation of the IDEB in the year 2017.

Evaluating the intrinsic relationships as well as the details of how these variables are operationalized and implementing actions in plans, programs and projects to strengthen the dimensions reflected by these variables has the potential to bring improvements to education in the State's municipalities with a higher level of effectiveness , if compared to the others that were not included in the regression model. These considerations are strengthened by the studies referred to and the results of this work, pointing to the improvement of the management of education systems as a relevant step towards the quality of education. The decrease in the number of students per class and/or the number of teacher work shifts are clear examples that are achievable by managers who managed public expenditures in the order of 16 billion reais in 2017, to serve a population of more than 1.8 million students. The implementation of programs to reduce school dropout in municipalities where this problem is relevant is a desirable action with significant results.

The smallest but present significant influence ($0.05 < p\text{-}value > 0.10$) of variables such as the age-grade distortion rate, the non-response rate (tnr17) as well as the existence or not , of the Municipal Council of Education (in 8 municipalities there is no such Council, according to data from this research), as variables with the potential to influence the IDEB of São Paulo municipalities in 2017.

The studies published, as well as the results of this work, corroborate the implementation of actions with a strong potential to change the not-so-adequate conditions of fundamental education in municipal public networks, in the state of São Paulo. In this sense, new studies with primary data of a qualitative and quantitative nature can be developed to deepen the assessment of the best paths for education in São

Paulo and Brazil. As the teacher component of elementary education in the municipalities appeared insistently in the results of this study and in others indicated in the literature, a first investigation into how the careers of professionals in elementary education are structured, developed and operationalized seems to be the most urgent. Aspects of the definition and development of the teaching career are the most pressing.

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