

# The school environment and its performance: analysis of the scores obtained by schools from the state of Espírito Santo in the nationwide exam Prova Brasil, using multiple linear regression

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This article describes the relationship between the school environment and its performance. The study observed the score obtained in the nationwide school evaluation exam called *Prova Brasil* (2013) by the schools that are part of Espírito Santo's educational system, analyzing them through multiple linear regression. The sample consisted of 244 schools and 10 environmental variables were analyzed, of which 3 formed the regression model by the stepwise method: Index of Teacher Regularity, Indicator of Teacher Stress and Abandonment Rate. The variables obtained 47.9% of association with the score obtained in *Prova Brasil* and explained 22% of the score's variation. In addition, the variables are subject to management from civil servants working in the state's educational system. The findings reinforce the importance of the school environment, as well as of the teacher, as a way to reduce — through the school — the effects of the unfavorable family and social background.

**Keywords:** public administration; educational policies; school management; school context; school performance.

## Contexto e desempenho escolar: análise das notas na Prova Brasil das escolas capixabas por meio de regressão linear múltipla

O presente estudo descreve a relação entre o “contexto” e o “desempenho” escolar mensurado por meio das notas mais recentes (2013) da Prova Brasil das escolas do sistema estadual de ensino do Espírito Santo, por meio de regressão linear múltipla. A amostra foi composta por 244 escolas e foram analisadas 10 variáveis contextuais, das quais três compuseram o modelo de regressão pelo o método *stepwise*: Índice de Regularidade Docente, Indicador de Esforço Docente e Taxa de Abandono. Essas variáveis obtiveram um grau de associação de 47,9% com a nota na Prova Brasil e explicaram 22% da sua variação; e estão sob a gerência dos gestores públicos da rede estadual de educação do Espírito Santo. Os achados do estudo reforçam a importância do “contexto” escolar, bem como do “professor”, como forma de reduzir os efeitos da conjuntura familiar e social desfavorável por meio da atuação da organização escolar.

**Palavras-chave:** administração pública; políticas educacionais; gestão escolar; contexto escolar; desempenho escolar.

## Contexto y rendimiento escolar: análisis de las notas en el Examen Brasil de escuelas del estado de Espírito Santo por medio de regresión lineal múltiple

El presente estudio describe la relación entre el “contexto” y el “rendimiento” escolar mensurado por las notas más recientes del Examen Brasil (2013) de las escuelas del sistema de educación del estado de *Espírito Santo*, a través de regresión lineal múltiple. La muestra consistió en 244 escuelas y se analizaron 10 variables contextuales, de las cuales tres han compuesto el modelo de regresión por el método *stepwise*: Índice de Regularidad del Maestro, Indicador de estrés del Maestro y Tasa de Abandono. Estas variables obtienen un grado de pertenencia a un 47,9% con la nota del Examen Brasil y explican el 22% de la variación; y están bajo la gestión de los gestores públicos del estado de la educación de *Espírito Santo*. Los resultados del estudio reforzar la importancia del “contexto” de la escuela, así como del “profesor”, como un modo de reducir los efectos desfavorables de la conjuntura familiar y social por medio de la actuación de la organización escolar.

**Palabras clave:** administración pública; políticas educativas; gestión escolar; contexto escolar; rendimiento escolar.



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## 1. INTRODUCTION

The present article analyzes the performance of students from the final years of public elementary schools in the state *Espírito Santo* (ES),<sup>1</sup> in the national test *Prova Brasil*<sup>2</sup> of 2013, in relation to the “context” in which each school performed the teaching and learning process, aiming at contributing to the public education network of ES.

Ministerial Order No. 931, of March 21, 2005, established the *Prova Brasil*, which is part of the discursive worldwide concern around large-scale national assessments that measure quality in education around the globe — in addition to quantity and expansion. *Prova Brasil* evaluates students from rural and urban areas in the initial (4th and 5th years) and final years (8th and 9th years) of public primary education in Portuguese and mathematics. This is a census evaluation, in which students of Brazilian schools with more than 20 students enrolled in the initial and final years of elementary school take the test. This evaluation, carried out every two years, presents nominally the results of schools and municipalities.

*Prova Brasil* can be understood as a strategy that allows the Brazilian government to evaluate the quality of public school education and, at the same time, to hold each of these organizations, as well as leaders and teachers, responsible for the students’ results (Fernandes and Gremaud, 2009). This movement, which in the world of management is conventionally called accountability, is structured around the notion that society has the right to hold public employees accountable for the service rendered quality. Nevertheless, the accountability carried out by *Prova Brasil* focuses on the dissemination of results and setting of goals. Good practices are not rewarded, just as schools, principals and teachers with low performance are not penalized (Bonamino and Sousa, 2012; Hanushek and Raymond, 2005).

The political discourse claims that *Prova Brasil* indicates where resources should be spent, as well as points out pedagogical and management practices capable of improving students’ performance and teaching quality. However, scholars argue that the average improvement in the quality of education is based on inequity between students and student groups (Lee and Bryk, 1989; Fuller and Clarke, 1994; Franco et al., 2007; Soares and Alves, 2003). According to Soares and Alves (2003), large-scale educational evaluations allow not only the production of efficacy of Brazilian education networks, but also the production of educational equity. For these authors, efficiency is not performed homogeneously in the national education system, because this system favors school performance of “white people”, who are mostly part of more privileged social strata. To that end, school organization produces, through large-scale evaluations, efficacy and inequality in the same movement, increasing the difference between social and racial groups. According to Oliveira (2011), *Prova Brasil* can lead to the redefinition of the programmatic content around the subjects required by this evaluation. In this correlation, for Bonamino and Sousa (2012), the “preparatory” for the accomplishment of standardized evaluations applied in large scale can entail the narrowing of the school curriculum.

The issue presented by the present research concerns a controversial topic, the *Prova Brasil*, which, as few other questions, manages to be part of the public interest and specialized knowledge

<sup>1</sup> Brazilian state usually refereed as *Capixaba* (TN: translator’s note).

<sup>2</sup> Brazil Test (TN).

areas (Psychology, Sociology, Anthropology, Didactics, Education, Philosophy, Public and Private Management), as well as politics and society. In particular, multiple relationships are investigated between the *Prova Brasil* grades of 2013 of the students of the final years of public elementary schools in *Espírito Santo* and the contextual indicators of these schools. Following is the theoretical basis on which the discussion will be founded.

## 2. THEORETICAL GROUNDING

Different civilizations, empires, dynasties, countries and blocks of countries have understood the role of school institutions very differently from time to time. According to Nogueira and Nogueira (2004), until the middle of the twentieth century, the school had as its central role to overcome the economic backwardness, authoritarianism and privileges attached to traditional societies. At that time, the school was understood as a means to build a just, modern and democratic society (Nogueira and Nogueira, 2004). The optimistic assumption that a free public school offered to all would guarantee equal opportunities was gradually challenged in the 1960s by studies that began to recognize the impact of factors that extrapolate school institutions, such as social and cultural origins of the students (e.g. Bourdieu and Passeron, 1964; Stone, 1965; Coleman et al., 1966; Karmel, 1966).

Despite the studies, the accumulated statistics, and the growing speculations about educational systems in the 1960s and 1970s, research undertaken since the 1980s has sought to discredit the idea that the school would have no effect on the performance of its students (e.g. Rutter et al., 1979; Brookover, 1979; Mortimore et al., 1988; Ribeiro, 1991; Lee, Bryk and Smith, 1993; Sammons, Hillman and Mortimore, 1995). Among the studies that have attempted to question Coleman Report's pessimism and social, cultural, and economic determinism, *Fifteen Thousand Hours*, Rutter and partners (1979) may represent the most compelling statement that the school "makes a difference". The study, developed in twelve high schools in London, had its name inspired by the question that

[...] is almost a dozen years during a formative period of their development children spend almost as much of their waking life at school as Home. Altogether, this works out at some 15,000 hours [...] during which schools and teachers may have an impact on the development of the children in their care. [Rutter et al., 1979:1]

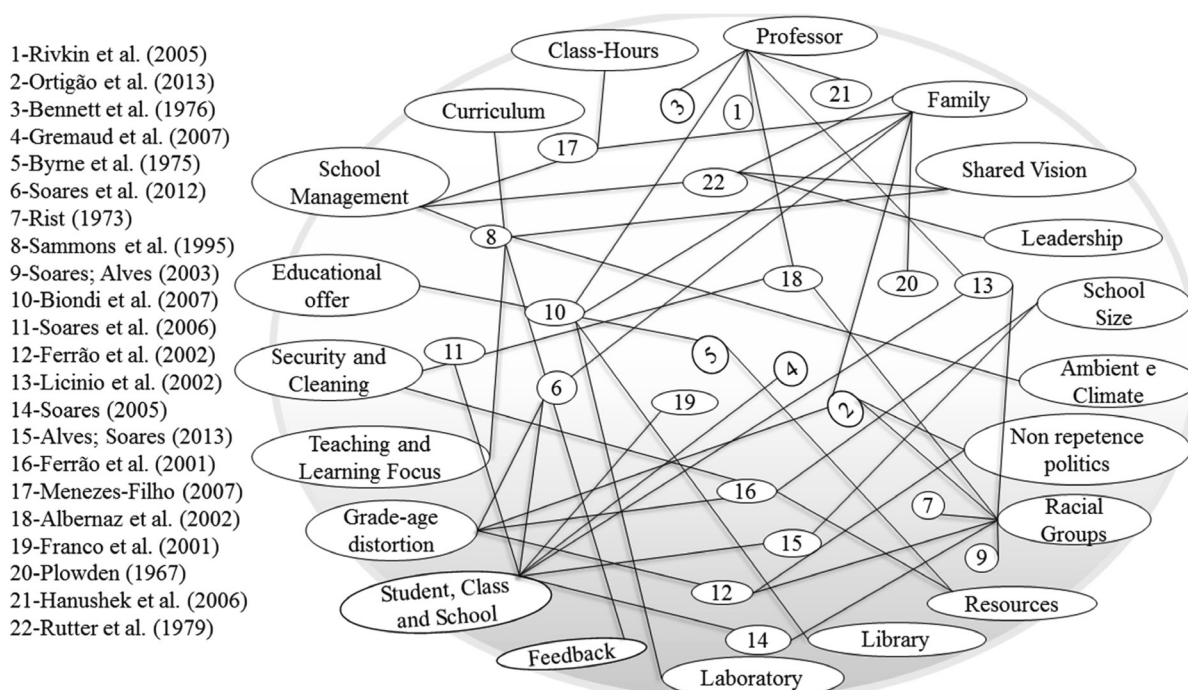
These authors, in order to demonstrate that among the variables that explain and influence the performance of the students, the participation of the school is emphasized, elaborated a response to the questions raised by the studies developed by Coleman (1966) and Jencks (1972), namely: "[...] do a child's experiences at school have any effect; does it matter which schools he goes to; and which are the features of school that matters?" (Rutter et al., 1979:1). Such investigations do not deny schools' inability to provide fair-quality education and the implication of social, cultural, and economic origin in school outcomes, but rather discuss the likely impact of "factors" and "variables" on school success and performance (e.g. Plowden, 1967; Woodhall, 1967; Jensen, 1969; Bernstein, 1970; Jencks, 1972). In

this sense, the school came to be understood not as a place that reproduces the social and cultural origin of the student, but as an institution where cultures, customs, practices, debates, polemics, curricula, policies, and subjectivities are (re)invented (e.g. Anyon, 1981; Hall and Sandler, 1982; Apple, 1982; Everhart, 1983; Weis, 1988; Fine, 1991).

In the midst of this worldwide movement around the management, function, quality, equity, and performance of the school institution, currently academics from Brazil and elsewhere sought to empirically encompass elements that are likely to collaborate with greater emphasis on building more effective schools and adequate to modernity (e.g. Willms and Somers, 2001; Albernaz, Ferreira and Franco, 2002; Soares, 2002; Soares, 2005; Rivkin, Hanushek and Kain, 2005; Soares and Andrade, 2006; Sobreira and Campos, 2008; Alves and Soares, 2013).

Based on the analysis of research and literature reviews, classified as relevant by Google Scholar, we summarize in figure 1 variables related to schools capable of promoting a teaching-learning process of quality and equitable for its students. Figure 1 does not distinguish between “schooling”, “unit of analysis” or “studied population”, since it aims only to map factors, as pointed out in the literature, associated with school success. In spite of this, consideration of the method, results, and discussion around these variables should be considered if the investigations and revisions of figure 1 are used to formulate conclusions as well as to compare results and analyses.

**FIGURE 1** STUDIES AND EXPLANATORY VARIABLES OF STUDENT PERFORMANCE



Source: Elaborated by the authors.

The *Prova Brasil* provides information on the school’s “context” — (1) socioeconomic level and (2) teacher training — of the educational units which carried out the assessment, together with its grades. However, the scores of the *Prova Brasil* are presented (nominally by school) together with indicators about the school context without the likely relations between “performance” and “school” circumstance being described. Thus, based on figure 1, the present study sought in the National Institute of Studies and Educational Research (Inep) other variables on the school “context” to enrich the proposed analysis, which are: (1) average pupils per class; (2) average daily class hours; (3) age-series distortion rates; (4) yield rates; (5) teacher regularity; (6) teacher effort; (7) complexity of school management.

Thus, the general objective of this article is to analyze and describe the relationship between the scores of the *Prova Brasil* of 2013 of the final year’s students of the state elementary schools of *Espírito Santo* and the contextual indicators of these schools presented by INEP. This objective is pursued, since it is imperative to analyze the extent to which this “context” is associated with the “performance” of the schools of the *Espírito Santo*’s state network.

### 3. METHODOLOGICAL PROCEDURES

In order to analyze the grades obtained in the *Prova Brasil* of the year 2013 of the students of the final years of the public elementary schools of *Espírito Santo*, a descriptive cross-sectional study was developed using quantitative strategies (Creswell, 2010).

To estimate possible determinants of the grades obtained in the *Prova Brasil* of 2013, indicators were selected from the “context” in which each educational entity developed their teaching process, which emerged from theoretical foundation (section 2). Chart 1 shows the constitutive and operational definitions (grade obtained from the applied scale) of the variables.

**CHART 1 DESCRIPTION OF THE VARIABLES OF THE INITIAL RESEARCH MODEL**

Variables		Description		
Dependent	Grades of the <i>Prova Brasil</i> of 2013	GPB	Interval (0 to 10)	Proficiency average in Portuguese and standardized mathematics for a range of 0 to 10. The grade of the school corresponds to the average of the students’ grades.
	Students per class	SPC	Ratio	Average number that corresponds to the division of the number of enrollments by the number of classes of the school.
Independent (school context for the <i>Prova Brasil</i> of 2013)	Class hours per day	CHD	Ratio	Average number of class hours per day.
	Age-series distortion rate	ASD	Ratio	Age-series distortion rates.
	Approval rate	APR	Ratio	Approved students rate.

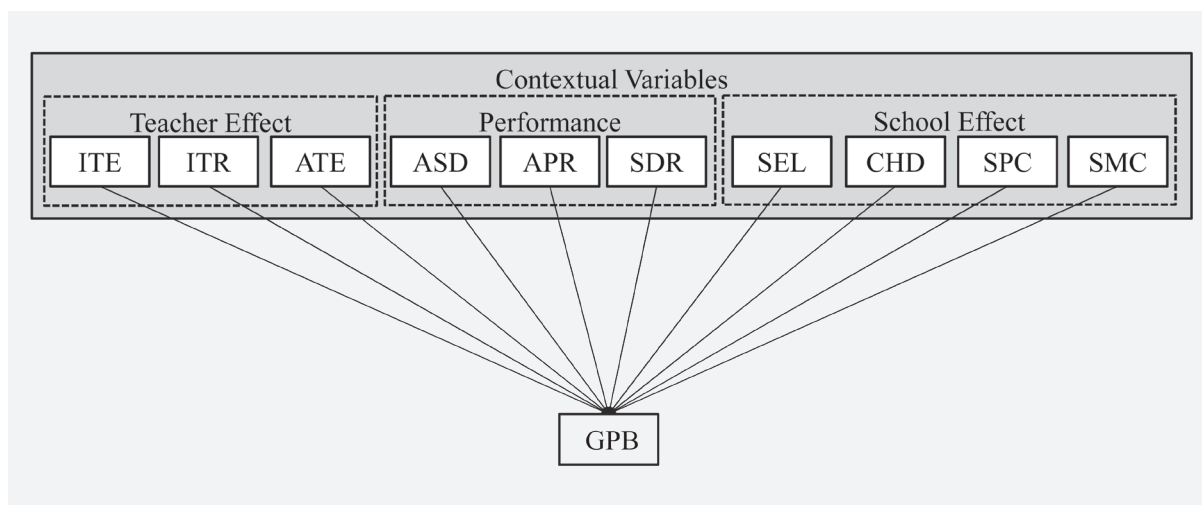
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Variables		Description		
<b>Independent (school context for the Prova Brasil of 2013)</b>	Students per class	SPC	Ratio	Average number that corresponds to the division of the number of enrollments by the number of classes of the school.
	Class hours per day	CHD	Ratio	Average number of class hours per day.
	Age-series distortion rate	ASD	Ratio	Age-series distortion rates.
	Approval rate	APR	Ratio	Approved students rate.
	Dropout rate	SDR	Ratio	Student's dropout rate.
	Index of Teacher Regularity	ITR	Interval (0 to 5)	Observation of teachers' permanence in schools. The closer to 0, the more irregular is the teacher's attachment to the school, the closer to 5, the more regular.
	Indicator of the teacher effort	ITE	Ratio	Percentage of teachers per level of effort. The characteristics considered to measure the level of effort are: number of schools, shifts, students and periods that the teacher imparts. Schools are classified as level 1 (up to 25 students, a single shift, school, and stage) to level 6 (more than 400 students, in three shifts, in two/three schools and periods). The sum of the percentages of levels 4, 5 and 6 is used as the explanatory variable.
	Indicator of school management complexity	SMC	Interval (1 to 6)	Characteristics to measure the SMC: school size; number of shifts, stages and modalities offered. Level 1 represents the least complexity of school management, while level 6 is the largest.
Socioeconomic level of students	SEL	Ratio	Simple arithmetic mean of the SEL of students, within a defined range based on household goods, income, utilities services and family education level, in order to provide an overview of the standard of living of the students.	
Adequacy of teacher education	ATE	Ratio	It goes from group 1 (undergraduate or baccalaureate with a pedagogic complementation in the subject that teaches) to group 5 (without superior education). The percentage of disciplines is considered as an explanatory variable, in each period, given by teachers of level 1.	

Source: Elaborated by the authors.

In order to clarify the research problem, the schematic design of the study is shown in figure 2.

**FIGURE 2** INITIAL RESEARCH MODEL



**Source:** Elaborated by the authors.

The research population is composed of 497 public schools, urban and rural, of the 78 municipalities in the state of *Espírito Santo*. In Brazil, the Federal Constitution of 1988, and the Law of Guidelines and Basis for National Education<sup>3</sup> of 1996, provide that national education must be organized through “educational systems”, according to political and administrative dependence. Therefore, the present research offers useful information so that public managers of the state education network of ES, can elaborate, implement and evaluate laws, policies and educational plans.

Likewise, our research was motivated by the intensification of policies that promote closing classes and schools in ES, on the grounds that there is a growing demographic decline and school dropout (Arpini, 2016). However, the economic and demographic approach employed to close classes and schools, due to the low density of students, does not make sense in the presence of school dropouts. In the absence of massive educational public policies to reduce dropout and reintegration of graduates, closing classes and schools means accepting the failure of the ES public education system.

Consulting the online platform to access Brazilian educational data (QEdu),<sup>4</sup> it was verified that in 2010 there were 552 public schools in ES (QEdu, 2016a) and in 2014 only 492 schools (QEdu, 2016b). The closure of public schools intensified in 2015, leading to protests, reports, studies and opinions from experts and policymakers. In 2016, a Public Civil Action of the Public Prosecutor’s Office of *Espírito Santo*<sup>5</sup> questioned the closure of public schools, with a request of anticipation of guardianship, against the state of *Espírito Santo*.

Also, the low performance in the *Prova Brasil* of 2013 of the students of the final years of public elementary schools (14% in mathematics and 26% in Portuguese in the 9th year) compared to the initial years (39% in mathematics and 46% in 5th year), led to the reduction of the research by excluding

<sup>3</sup> Law of Guidelines and Bases of National Education (LDB).

<sup>4</sup> Check out the site at: <[www.qedu.org.br](http://www.qedu.org.br)>.

<sup>5</sup> Public Ministry of *Espírito Santo* (MPES).

the results of 9th grade students. In addition, the same phenomenon occurs nationally; while 12% of the 9<sup>th</sup> grade students learned the “adequate” mathematics and 25% Portuguese, 42% of the 5<sup>th</sup> grade students learned math and 47% Portuguese in the *Prova Brasil* of 2013. In the final years the average grade of public schools in the state of *Espírito Santo* has remained below the national average. For all this, the question arises about possible determinants of this underperformance in the *Prova Brasil* of 2013 of the students of the final years of public elementary schools in the ES education system.

Data collection was carried out on the Inep website between September and December of 2015. The most recent data at the time of the collection corresponded to the year 2013. It is clarified that the public consultation of the grades of *Prova Brasil*, unlike the data of the independent variables, had to be consulted school by school. The procedure was done manually based on the code of the 497 public schools in the state of *Espírito Santo*.

In order to understand the relationship between the “contextual” variables and the “performance” in the *Prova Brasil* of 2013 of the students of the final years of public elementary schools in the state of *Espírito Santo*, multiple linear regressions were used. Additionally, for the regression model variables, the stepwise method was used; a strategy usually selected for descriptive studies, in which the aim is only to describe little-known relationships among variables, not to explain them, due to the absence of a consistent theory about the studied phenomena and of empirical support; or when there is a high number of possible independent variables, being convenient to know which are the relevant variables.

In the stepwise method, only variables that significantly contribute to the adjustment of the regression model are incorporated. The contribution of each variable is established by contrasting, from the partial correlations, the hypothesis of independence between this variable and the dependent variable. In the present study, the rule for entry and removal of variables to the model was thus established: input *p-value* <0.05 and output *p-value* > 0.10.

It should be emphasized that the assumptions made by the multiple linear regression model were validated by applying tests on: the independence of the stochastic perturbation term (Durbin-Watson test), homoscedasticity of the stochastic perturbation term (Breusch-Pagan), normal distribution of the stochastic perturbation term (Kolmogorov-Smirnov test) and absence of multicollinearity between independent variables (variance inflation factor — VIF and condition index). Also, the size of the multiple regression effect was verified by Cohen’s *f*<sup>2</sup> index.

In the data processing, the software SPSS 20 (tests of assumption<sup>6</sup> validation and multiple linear regression) and GPower 3.1 (statistical power of the test and Cohen’s *f*<sup>2</sup>) were used.

The data collected through the Inep website revealed that of the 497 schools in the state of *Espírito Santo*, 249 (located in 71 of the 78 municipalities) had data related to the grades in the *Prova Brasil* of the students of the final years of elementary. Of these, 244 schools had data for all the independent variables considered in this study (figure 2). A sample was then selected based on this criterion, rather than engaging into techniques for the treatment of missing values, since the sample represents 98% of the total number of schools that were reduced from the study (final years of elementary school).

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<sup>6</sup> It is clarified that in the processing of the Breusch-Pagan test, a macro written by Ahmad Daryanto was used specifically for syntax of the program SPSS.



#### 4. RESULTS

Before starting the procedures to extract measures, the study undertakes the characterization of the variables, in order to broaden the understanding of the results (table 1).

**TABLE 1** DESCRIPTIVE STATISTICS OF THE VARIABLES OF THE INITIAL RESEARCH MODEL

Variables	Mean	Standard Deviation
GPB	4.92	0.61
ASD	30.08	9.70
ITE	2.57	0.50
SMC	5.09	0.95
ITE	76.54	12.87
APR	82.24	10.33
SDR	3.23	3.26
ATE	37.79	13.96
CHD	5.10	0.42
SPC	26.67	4.48
SEL	47.21	2.73

Source: Elaborated by the authors.

The *Prova Brasil* grades (GPB) of the students from the final years of public elementary schools that make up the sample are slightly dispersed (CV = 12.4%). The dispersion around the mean of the 10 independent variables can be considered low to moderate, except for the variable SDR, whose dispersion is quite high (CV = 100.9%), denoting a highly heterogeneous profile of schools in relation to the school dropout rate.

Otherwise, the correlation analysis presented in table 2 showed that of the 10 studied independent variables, 5 did not have statistically significant correlations, at the 0.05 level with the dependent variable.

**TABLE 2** CORRELATIONS

Variables	GPB	ASD	ITE	SMC	ITE	APR	SDR	ATE	CHD	SPC	SEL
GPB	1										
ASD	-0.331**	1									
ITE	0.392**	-0.329**	1								

Continue

Variables	GPB	ASD	ITE	SMC	ITE	APR	SDR	ATE	CHD	SPC	SEL
SMC	-0.019	<b>0.167**</b>	0.040	1							
ITE	0.099	0.047	-0.068	<b>0.184**</b>	1						
APR	<b>0.225**</b>	<b>-0.483**</b>	0.039	<b>-0.181**</b>	<b>-0.149*</b>	1					
SDR	-0.259*	0.460**	-0.074	0.079	<b>0.112*</b>	<b>-0.502**</b>	1				
ATE	0.035	-0.057	-0.032	0.034	0.012	0.021	-0.020	1			
CHD	0.005	-0.029	-0.013	<b>-0.260**</b>	<b>-0.433**</b>	0.101	-0.037	-0.001	1		
SPC	<b>-0.153**</b>	0.003	<b>-0.172**</b>	<b>0.127*</b>	-0.035	-0.091	-0.011	0.022	-0.042	1	
SEL	0.013	<b>0.111*</b>	<b>-0.217**</b>	-0.097	-0.049	-0.054	<b>-0.125*</b>	0.016	<b>0.139*</b>	<b>0.322**</b>	1

\* Significant at the 0.01 level.

\*\* Significant at the 0.05 level.

Source: Elaborated by the authors.

The correlation test leads to the identification of five independent variables as candidates for the regression model: ASD ( $r = 0.331, p\text{-value} < 0.05$ ), ITR ( $r = 0.392, p\text{-value} < 0.05$ ), APR ( $r = 0.225, p\text{-value} < 0.05$ ), SDR ( $r = -0.259, p\text{-value} < 0.05$ ), and SPC ( $r = -0.153, p\text{-value} < 0.05$ ), since the others do not have statistically significant correlations with the dependent variable (GPB). This considerable reduction reinforces the decision to use the stepwise estimation procedure. In addition, there are few statistically significant correlations between independent variables, and all of them (except for the relationship between APR and SDR) can be classified as low ( $0.1 < r \leq 0.3$ ) or moderate ( $0.3 < r \leq 0.5$ ), by the criterion of Miles and Shevlin (2001), which reinforces the choice of this set of predictors.

Additionally, there was no statistically significant correlation between the Socioeconomic Level of the Students (SEL) and the *Prova Brasil* grades (GPB), as initially expected, due to other findings (e.g. Alves and Soares, 2013). Perhaps the way in which this variable was operationalized (by Inep itself), in a range of clusters defined on the basis of a multiple scale from different attributes (household goods, income, utilities services and family education level), did not allow capturing a statistically significant association from the data used by the present research, which represent the hierarchical level “school”. Studies have suggested that indicators, linked to the SEL construct, impact (positively/negatively) on the student performance in large-scale national evaluations, but perhaps the construct itself, just as it was operationalized, it did not allow to capture associations present between its indicators and the selected dependent variable (GPB). Due to the link of this study with Organizational Studies, the data related to school organization was privileged, and the hierarchical level “students” was not analyzed. When working with the average grade of the school in the *Prova Brasil*, in relation to the contextual and organizational variables, and not with the individual grades of students identified by “gender”, “color” and/or “race”, it was not possible to analyze the differences between the school’s “social” groups in relation to the performance in large-scale educational evaluations (e.g. Soares and Alves, 2003). However, by emphasizing the “organizational” hierarchical level, it was possible to highlight new correlations between the independent variables of “school” and “school context” (especially with regard to “teacher”) with the performance of these educational organizations in the *Prova Brasil* of 2013.

The independent variable with the highest relation intensity to the dependent variable is ITR. In fact, among the eight schools with the best ITR, six scored higher than average in the *Prova Brasil* of 2013, while from the eight schools with the worst teacher regularity index, six had below-average grades in the same evaluation. However, no strong correlation was observed in any variable ( $r > 0.5$ ).

Among the independent variables, only the statistically significant association between the APR and SDR variables was classified as strong ( $r = -0.502, p\text{-value} < 0.05$ ). This is an expected relationship, since both of them compose, in association with failure statistics (which was not integrated into the list of independent variables due to their perfect negative correlation with the APR variable), the school performance rate (figure 2). For the construction of the best regression model, the stepwise method was used. As shown in table 3, four models were suggested through this method, being model 4 the one with the greatest explanatory power (adjusted  $R^2 = 0.233$ ).

**TABLE 3** SUMMARY OF MULTIPLE LINEAR REGRESSION MODELS — STEPWISE METHOD

Model	Predictors	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	Std. Error of the Estimate
1	(constant), ITR	0.392	0.153	0.150	0.563
2	(constant), ITR, SDR	0.454	0.207	0.200	0.546
3	(constant), ITR, SDR, ITE	0.479	0.229	0.220	0.539
4	(constant), ITR, SDR, ITE, APR	0.495	0.245	0.233	0.535

Source: Elaborated by the authors.

To evaluate the results in a better way, the assumptions made by the multiple linear regression model are verified. Table 4 presents the results of VIF, to validate the absence of multicollinearity among the regressors; and the condition index, for the evaluation of joint collinearity problems.

**TABLE 4** VALIDATION OF ASSUMPTIONS — REGRESSORS

Model	Multicollinearity			
	Variables	VIF	Dimension	Condition Index
1	(constant)		1	1.000
	ITR	1.000	2	10.316

Continue

Model	Multicollinearity			
	Variables	VIF	Dimension	Condition Index
2	(constant)		1	1.000
	ITR	1.006	2	2.559
	SDR	1.006	3	11.964
3	(constant)		1	1.000
	ITR	1.009	2	2.889
	SDR	1.017	3	10.208
	ITE	1.016	4	18.977
4	(constant)		1	1.000
	ITR	1.009	2	3.119
	SDR	1.345	3	11.458
	ITE	1.028	4	14.822
	APR	1.353	5	33.636

Source: Elaborated by the authors.

The VIF denotes absence of multicollinearity ( $VIF < 5$ ), according to a criterion suggested by Gujarati (2000). However, the condition index indicated that in model 4 the variables would present collinearity problems if they stay together, also as proposed by Gujarati (2000), so values above 30 imply severe multicollinearity. This can be explained by the strong statistically significant correlation between the APR and SDR variables (table 2), which composes the performance construct (figure 2), so that the introduction of the APR variable amplifies the effects of multicollinearity, reducing the contribution of the variable SDR to the regression model.

For this reason, it is understood that the most efficient model is model 3, because the adjusted  $R^2$  value increases, reducing the standard error of the estimate (table 3), without increasing the joint collinearity above the accepted level (table 4). In addition, the incremental predictive effect of the APR variable on the dependent variable (controlling the other independent variables of model 3) is only 1.6%. That is, model 4 increased  $R^2$  in relation to model 3 by only 1.6%.

Following the verification of the presumed assumptions by the multiple linear regression model, as summarized in table 5, considering model 3, the tests of Breusch-Pagan for validation of homoscedasticity of the stochastic perturbation term; the Durbin-Watson, to validate the independence of the stochastic perturbation term; and Kolmogorov-Smirnov, for the validation of the normal distribution of the stochastic perturbation term.

**TABLE 5** VALIDATION OF ASSUMPTIONS — STOCHASTIC DISRUPTION TERM

Homocedasticity		Independence	Normality	
Breusch-Pagan		Durbin-Watson	Kolmogorov-Smirnov	
LM	Sig.	D	Estatística	Sig.
0.662	0.882	1.965	0.031	0.2

Source: Elaborated by the authors.

The value was 1.965 for the Durbin-Watson statistic. In the table of critical values  $d_L$  e  $d_U$  of the Durbin-Watson test, there were no values for  $n = 244$ , considering then the approximate values for  $n = 240$ , with a significance level of 0.05. As  $d_U \cong 1.8053 < 1.965 < 2.1947 \cong 4 - d_U$ , there is no evidence to reject the null hypothesis. Thus, it is assumed that the stochastic perturbation term is independent. However, in relation to table 5, the Kolmogorov-Smirnov test does not allow rejection of the null hypothesis of the normal distribution of the stochastic term ( $p\text{-value} = 0.2$ ), which can assume the normality assumption; and the Breusch-Pagan test does not allow rejection of the null hypothesis of the stochastic perturbation term ( $p\text{-value} = 0.882$ ).

Regarding table 3, the variables Index of Teacher Regularity (ITR), dropout rate (SDR) and index of teacher effort (ITE) (model 3), obtained a degree of association of 47.9% with the variable *Prova Brasil* grades (GPB) — that is, the multiple correlation between the dependent variable and the predictor score. In turn, the adjusted coefficient of determination (adjusted  $R^2$ ) of 0.22 shows that 22% of the variations in the *Prova Brasil* grades are explained by the joint variation of the variables chosen by model 3. Thus, by comparing the suggested models, it is noted that model 4 has a greater predictive effect, presenting an adjusted coefficient of determination higher than the other models; nonetheless, for the joint collinearity problem (table 4), model 3 was chosen.

Although the adjusted coefficient of determination may seem low (adjusted  $R^2 = 0.22$ ), it is common to apply values of this order in practical applications of multiple regression analysis in the social sciences. For example, the studies of Mazulo (2015) and Alves and Soares (2013), which respectively obtained adjusted  $R^2 = 0.219$  and 0.31. In addition, considering there are other unpredicted variables in the initial research model that could interfere with the results, it can be argued that the findings of the study are important elements for understanding the question of the present research and for its contribution to future studies. By means of the Anova analysis (table 6), which provides the statistical test for the general adjustment of the model in terms of the F ratio, it is verified the evidence that allows rejecting the null hypothesis that claims the coefficient of determination is equal to zero. Thus, at least one of the independent variables influences the grades of the *Prova Brasil* ( $\exists \beta_j \neq 0 E$ ). Consequently, the statistical significance of the model is attested. In other words, the use of the ITR, SDR and ITE variables reduces the square error that would occur if only the mean of the variable GPB was used to predict the dependent variable by  $23\% \left( \frac{20,776}{90,537} \right)$ , and such reduction is considered statistically significant with an F ratio of 23.825 and a significance level of 0.000.

**TABLE 6 ANOVA**

Model			Sum of squares	df	Mean square	F	Sig.
1	(constant), ITR	Regression	13.890	1	13.890	43.856	0.000
		Residual	76.647	242	0.317		
		Total	90.537	243			
2	(constant), ITR, SDR	Regression	18.699	2	9.350	31.365	0.000
		Residual	71.838	241	0.298		
		Total	90.537	243			
3	(constant), ITR, SDR, ITE	Regression	20.776	3	6.925	23.825	0.000
		Residual	69.761	240	0.291		
		Total	90.537	243			
4	(constant), ITR, SDR, ITE, APR	Regression	22.226	4	5.556	19.440	0.000
		Residual	68.312	239	0.286		
		Total	90.537	243			

Source: Elaborated by the authors.

In table 7 we can verify the standardized coefficients (Beta) of the variables present in the construction of the multiple linear regression model.

**TABLE 7 COEFFICIENTS**

Model		Coefficients			Significance	
		B	Std. Error	Beta	t	Sig.
1	(constant)	3.704	0.188		19.746	0.000
	ITR	0.474	0.072	0.392	6.622	0.000
2	(constant)	3.897	0.188		20.705	0.000
	ITR	0.454	0.070	0.375	6.510	0.000
	SDR	-0.043	0.011	-0.231	-4.017	0.000
3	(constant)	3.324	0.284		11.715	0.000
	ITR	0.465	0.069	0.384	6.742	0.000
	SDR	-0.046	0.011	-0.248	-4.331	0.000
	ITE	0.007	0.003	0.153	2.673	0.008

Continue

Model		Coefficients			Significance	
		B	Std. Error	Beta	t	Sig.
4	(constant)	2.513	0.457		5.500	0.000
	ITR	0.466	0.068	0.384	6.808	0.000
	SDR	-0.033	0.012	-0.175	-2.688	0.008
	ITE	0.008	0.003	0.167	2.923	0.004
	APR	0.009	0.004	0.147	2.252	0.025

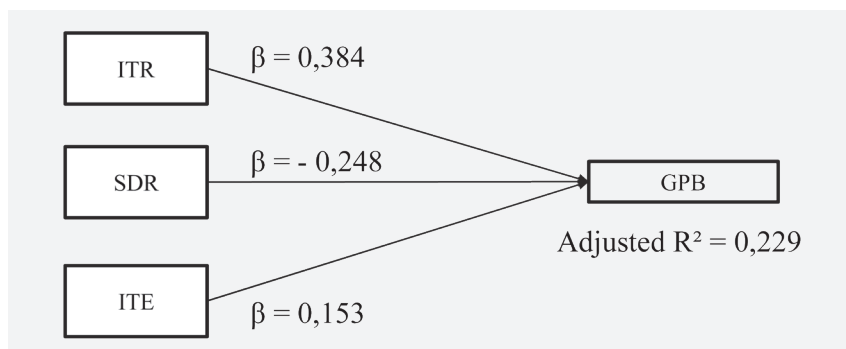
Source: Elaborated by the authors.

Analyzing the beta weights of the variables (standardized regression coefficients), it is of particular interest the inverted signal of the SDR variable, suggesting that an increase over this variable has a negative impact on the *Prova Brasil* grades, which was already observed when analyzing the bivariate correlation (table 2), and the positive sign of the ITE variable, since it is intuitively expected that the lower the teaching effort, the higher the grades of the *Prova Brasil*. Although the combined collinearity could be classified as moderate ( $10 \leq \text{condition index} \leq 30$ ), the inclusion of the ITE variable in model 3 increased the condition index from 10,208 to 18,977 (table 4), so that an inversion of the sign can be attributed to the ITE variable to multicollinearity.

It is also observed (table 7) that the beta weights of the variables, although not large, have a substantial impact on the general regression model and are statistically significant, since through the t test it is possible to reject the hypothesis that the coefficients are equal to zero.

The beta weights (expressed in a standardized scale) represent a means to evaluate the relative importance of the individual variables in the general grade of *Prova Brasil*. The most relevant variable was ITR, followed by SDR and ITE. It is difficult to classify the variables as high or low; however, the observation of the relative magnitude indicates Index of Teacher Regularity (ITR) has a more visible effect (2.5 times more) than teacher effort (ITE). Thus, once the regularity of the faculty members can be increased, solely by the permanence of the teachers in the same school, it represents the most direct, *coeteris paribus*, to increase the *Prova Brasil* grades. A cause and effect relationship cannot be assumed, but schools with higher presence regularity of its faculty members had higher grades in the *Prova Brasil*. One can also present the results of multiple linear regression diagrammatically (figure 3).

FIGURE 3 FINAL RESEARCH MODEL



Source: Elaborated by the authors.

The effect size was calculated in order to verify the statistical power of the multiple regression.

Through the classification criterion proposed by Cohen (1988) for regression, the size of the effect is considered average ( $f^2 = 0.30$ ). The statistical power of the test was then calculated. Assuming a level of significance of 0.05, the statistical power was approximately 1.00, indicating very low probability of type II error. As explained by Hair and colleagues (2009), in multiple regression, statistical power refers to the probability of detecting as statistically significant a specific level of coefficient of determination or regression for a given sample size and level of significance. For example, considering a statistical significance level of 5% and 80% of power, a sample of 250 observations would detect  $R^2$  values greater than or equal to 6% (Hair et al., 2009).

Finally, regarding the generalization of the results, the adjusted  $R^2$  test reveals little loss in predictive power when compared to  $R^2$  (0.229 and 0.220, respectively — see table 3), which suggests a lack of over-adjustment. In addition, with three variables in the model, the minimum number of sample sizes is given according to the proportion of 50 observations per variable in the statistical variable ( $n = 244$ ). According to the criterion proposed by Hair and partners (2009), the recommended level, by the proportion between observations and independent variables in the statistical variable, for the generalization of results in multiple regression, using stepwise procedure, is at least 50 to 1, because this technique only selects the strongest relationships within the dataset and is more likely to become a specificity of the sample.

Therefore, it is assumed that the results are not specific to the sample used in the estimation, but generalizable to the population — although it was not admissible, due to limitation in the data set, to carry out a direct validation by the evaluation of the correspondence of the results of another sample of the population, since partitioning the sample into analysis and test samples would not allow to meet the minimum proportions of number of observations per independent variable, being possible to advocate in its favor, given that this model is established from the sample that represents 98% of the schools where there were data referring to the *Prova Brasil* grades of the final years of public elementary schools.

## 5. DISCUSSION

The Index of Teacher Regularity (ITR), which refers to the permanence of teachers in schools, is the most relevant explanatory variable of our model. The Indicator of Teacher Effort (ITE), another independent variable of the model, can also be associated to the “teacher effect” in the performance of the ES state schools in the Brazil Test 2013.

For Rivkin, Hanushek and Kain (2005) the teacher effect matters even more when these professionals have more than three years of experience. Hanushek and Rivkin (2006) similarly point out that teachers have the potential to contribute to student learning. For Albernaz, Ferreira and Franco (2002), teacher training impacts student learning. Soares (2005) identified that a large part of the variability of the results of his study on proficiency is due to the class, which covers the “teacher effect” as well as the school. Santos (2002), based on the work of Paiva, Junqueira and Muls (1997), points out that many teachers should be considered apathetic and disinterested, since they cannot afford their own bus tickets, have declining authority, and Trafficker in the region where the school is located. For this author, it is imperative that an evaluation be performed not only quantitatively, but that it considers local social relations — which would give meaning to the construction of public policies.



A counterpoint to the results of the present study is offered by Menezes-Filho (2007:15), who states “[...] neither the time in school nor the fact of teaching in more than one school affects student performance”. On the other hand, Felicio and Biondi (2007) have identified that the absence of rotation and the experience in the classroom affect positively, in research on the determinants of student performance in Mathematics of the initial years of the fundamental of the public network.

Regarding the explanatory variable Dropout Rate (SDR), there is also a literature dedicated to analyzing the school flow, the population’s access to school, to evidence the “pedagogy of repetition” and to question educational indicators (Teixeira de Freitas, 1947; Fletcher, Ribeiro and Costa, 1988; Klein and Ribeiro, 1991, 1995; Fletcher and Castro, 1993). According to Fernandes and Natenzon (2003), who analyze the association between the drop in school performance, observed through the System of Evaluation of Basic Education (Saeb) 1995-1999, and the reduction of repetition / dropout rates in the period, the performance of students in the 4th year of elementary school has declined, while the performance of those of the appropriate age for the 4th year has increased. For these authors, this fact shows that correction in the school flow, for the period, is associated with a worse performance of the students.

For Menezes-Filho (2007), social programs against abandonment worsen the performance of schools and those against repetition positively influence student learning. In contrast, Ferrão, Beltrão and Santos (2002), when applying multilevel regression models to the Saeb results, suggest that: there is no derogative quality effect attributable to non-repetition policies; Students with a low socioeconomic level with automatic promotion does not perform inferior; And students with age-grade mismatch learn less than students of adequate age. These authors indicate, in consonance with the results of the present research, that abandonment, which leads to school backwardness, has the potential to impair student performance. Ferrão, Beltrão and Santos (2002) also study the impact of non-repetition policies on the quality of education. These authors, based on a review of the seminal works of the 1950s on the harmful effects of repetition for the student and the school, and the proposals for continuing education in the 1980s, are dedicated to investigating the occurrence (or not) of a “different” performance of those students who take advantage of non-repetition policies: “[...] the results of the models suggest that, with regard to public schools, the existence of a substantially derogatory effect on the quality of education attributable to policies of non-repetition was not found” (Ferrão, Beltrão and Santos, 2002:47-48).

Klein and Ribeiro (1991, 1995) also refute the idea that higher approval rates may undermine educational performance. On the contrary, these authors suggest that the main deficiency of Brazilian Basic Education is the quality of education and the pedagogy of repetition. Nevertheless, if the student should be held responsible for the poor quality of the educational system with repetition, occupying possible “new open places” in elementary education, or if he should be benefited by “continuing education” policies, generating a probable “victimization” of the A student who may feel free to learn/respect the teachers and the school, continues as an open theme for future work. What should be prioritized? Quality or continuity? As Souza and colleagues (2012) demonstrate, it may not be an option or an opposition, but rather a recognition that the quality of the school can effectively be understood as a factor that impacts the (continued) study. Quality of the school does not boil down to the teacher, well it’s true. However, policy actions on the improvement of these two

significant independent variables of our model (ITR and ITE) have the potential to positively impact students' approval (motivation, non-abandonment, performance). In other words, the present study suggests the importance of massive public educational policies of continuity based on the quality of the teaching of the network. For, according to their research, even if non-approval loses force in explaining school dropout, it can still be understood as a barrier to the ideal progression of students and to their insertion in high school.

## 6. FINAL CONSIDERATIONS

In the Brazilian literature, numerous other studies have been carried out to identify the relationship between factors and variables linked to the school, students, families and the notes of *Prova Brasil*. Some studies, based on data from this exam, were fostered by organizations such as INEP and the Ministry of Education (e.g. Felício and Biondi, 2007), Inep and the World Bank (e.g. Parandekar, Oliveira and Amorim, 2008) and by the United Nations Educational, Scientific and Cultural Organization (Unesco) (e.g. Soares et al., 2012). Empirically demonstrating that the practices of “schools” are exploited by political, economic, cultural, social, scientific and culture interests and processes associated with educational merits (Aggleton and Whitty, 1985; Gillborn, 1997; McCarthy, 1990).

The present study collaborates with this research network around large-scale national educational evaluations by providing empirical evidence for the ES statewide network on the impact of the Index of Teacher Regularity (ITR), the Indicator of Teacher Effort (ITE) and the Dropout Rate (SDR) in the *Prova Brasil* of 2013 performance. There is statistical evidence that the permanence of the teacher in a same school has a positive impact on students' scores in the Brazil Test and that a higher (still) dropout rate of the state schools in Produce an opposite effect.

Therefore, we understand that the state school closure policy undertaken by the State Government of *Espírito Santo* has the potential to negatively affect the dropout rate, in addition to violating constitutional and infraconstitutional principles and norms, as stated in the Public Civil Action of January 29 2016 that was referred to in the third section. This action came from the undersigned, filed with the MPES by the students themselves (Civil Inquiry No. 2015.0034.7269-57). It is important to note that the MPES makes its representation based on the “process” of closing schools and not possible impact of the closure of schools.

Thus, there is an educational backwardness and a disregard for the state government with the reversal of the increasing dropout rate — 61,702 “students” aged four to 17 remained out of school in the ES in 2014, according to the National Household Sample Survey (PNAD). Although this number extrapolated the home of 100,000 children out of school in 2005, in 2014 there was a worsening in this situation, since in 2013 there were 51,000 “students” out of the classroom. Students “out” of the school are scholars who “dropped out” of school. Therefore, the data collected by the PNAD corroborate the present research, since they demonstrate the passivity of the State of *Espírito Santo* in relation to the current high rates of school dropout. Instead of creating means to bring the student back to school, it is assumed very naturally that if there are fewer students there should be fewer classes and schools; Which can be observed in the words of the Secretary of State for Education, Mr. Haroldo Rocha:

There is no school closure, what exists is an enrollment organization that happens every year, according to the demand that is identified in each region [...]. We have 500 schools in the state network, we have 4,000 classrooms to serve 370,000 schools and we only serve 260,000. [Arpini, 2016]

However, the dropout rate (QEdu, 2016c), which implies promoting strategies to contain school dropout, balancing supply and demand, to use the terms of Exmo. Mr. Secretary of State for Education, and not the closure of schools.

Therefore, instead of limiting our contribution to the indication of the impact of explanatory variables on the performance of students from the state schools of the ES in the *Prova Brasil* of 2013, we present the results of the study to Exma. Ms. Maria Cristina Rocha Pimentel, Attorney General who filed a Public Civil Action that questioned the closure of state schools against the State of *Espírito Santo*. In this way, we offer significant quantitative inputs to support the Public Civil Action filed by MPES against the closure of classes, shifts and schools of the state public network. This because the state school closure policy undertaken by the State Government of *Espírito Santo* has the Potential of negatively impacting the abandonment rate, and, consequently, the performance of the *Prova Brasil* of the state network of the ES. The present work contributes to the argument of the MPES that, in itself, was not referenced as a kind of “substitute” for the empirical analysis undertaken by this research.

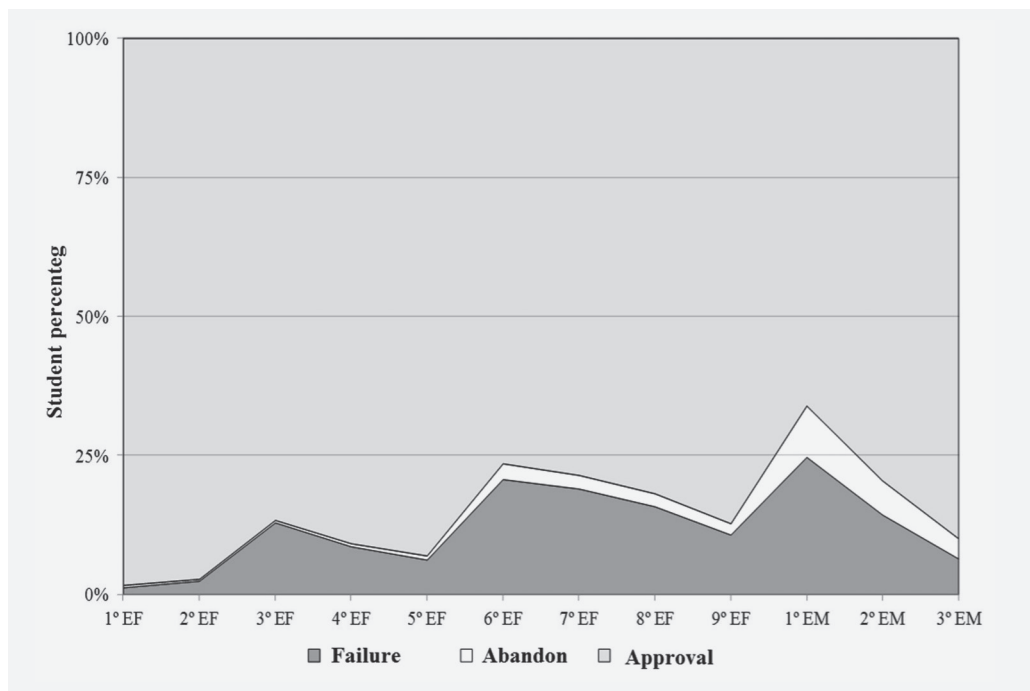
Otherwise, the indicator of school management complexity, even if not included in the model, is widely recognized in the literature as a factor that impacts school performance (e.g. Lee, Bryk and Smith, 1993; 2007; Alves and Soares, 2013). For future studies, it may be relevant to better describe and specify the components that shape the management complexity indicator, relating the performance of the students of a school with the existence or not of: full time enrollment; Multi classes (students of different series and stages); assistants/monitors/translators.

It is also worth noting that there are results that oppose our observation that the number of class hours does not affect student performance, as is the case of Menezes-Filho (2007). This author, however, came to a similar result to ours, that the size of the class does not influence — a finding that does not justify the closure of schools.

Finally, despite the incontrovertible impact of students’ socioeconomic status on school performance, as previously explained in sections 1, 2 and 4, the observation of the sample of this study, which only includes schools with SEL of 2 to 4 (out of a total of levels from 1 to 7) and with data dispersion very concentrated around the mean (CV = 5.8%) — see table 1 —, suggests that this explanatory variable does not significantly impact the results of the students of the state network of *Espírito Santo* in *Prova Brasil* of 2013, opening space for future research to find other ways to operationalize this dimension, as we have already suggested in topic 4. Brazilian education offers countless data, not only at the hierarchical level of the school, but also of its students. The “micro data” of Brazilian education offer a way out of the inequalities of school performance among students (from different social classes, colors, races), as well as to work together data at the hierarchical levels of “students” and “schools”. However, the present study opted to offer an overview of the data in the hierarchical organizational level, which is unusual, making it possible to problematize contextual variables of the school in relation to the teacher and the abandonment in the state education network of *Espírito Santo*.

Likewise, in this section, we decided to expand the contribution of this study by mapping and presenting educational public policies of the *Espírito Santo's* state-level network that contribute to: (1) the homogenization of the data on the age-grade distortion rate, the dropout rate and the adequacy of the teacher training of the school population of the studied ES state network (table 1); and (2) improvement of regularity and teacher effort indexes, as well as reduction of dropout (relevant explanatory variables). One of these state educational policies is *Escola Viva*, which proposes a new model for high school, aiming, among other educational objectives, to reduce the rate of distortion of the high school age, which is even worse than in elementary school, as it is possible to understand by graph 1.

**GRAPH 1** RATE OF PERFORMANCE OF THE STATE NETWORK SCHOOLS OF ES IN 2014



Source: From QEdU (2016c).

It is important to note that *Escola Viva* does not represent a massive public educational policy, but a pilot project linked to a campaign promise, with the goal of having 30 schools by the end of the Hartung (PMDB) government. Because it is a pilot project that serves a restricted educational audience, it is possible to question the potential of the Living School in reducing the rate of age-grade distortion in the state education network of the ES. As argued in topic 5, it is the improvement in the “quality” of the network that could lead to “continuity” of the students, not the improvement in a few schools of the network that were chosen. The irony, of the dichotomous relationship, has been given since the birth of this pilot project: if some schools are “alive”; are the others “dead”?

Looking for other educational public policies of the state of Espírito Santo with potential to revert the increase of the age-school distortion, the present study identified: (1) reform and construction of 56 state schools, which are paralyzed, and in progress; (2) quarterly evaluations of the state education network (*Paebes TRI, Alfa 1ª e 2ª onda*) to promote quality education; (3) Future Youth; (4) new measures in the selection and training of directors of the state public network; (5) partnership with 78 ES municipalities to guarantee literacy for children up to eight years of age; (6) “school portfolios”, which aims to recover and relocate furniture, as well as modernize and standardize the purchase of furniture for the whole State; (7) integrated school maintenance system; (8) State Direct Money in School Program (Pedde); (9) Public Private Partnership, aiming at the construction and operation of non-pedagogical services. There are also the following projects, actions and state programs in progress for the *Capixaba* elementary education: (1) Acceleration of Learning, which aims at the continuous training of teams of the State Secretariat of Education (Sedu) and elementary schools ES to reduce the age-grade distortion rate of students in grades 2-4 of elementary school, with emphasis on recurrent cases; (2) Country Coordinators; (3) Learning Support; (4) Read, Write and Count; (5) More Time in School; (6) Read, Holy Spirit; (7) Culture in School; (8) Sport at School; (9) Teaching to Learn; (10) Urban Youth; (11) Science in School; (12) Justice in school. With respect to the teacher (regularity, effort and adequacy), the following policies, programs and projects were found: (1) New policy of progression and functional ascension; (2) Internship Program Teacher Training; (3) Continuing Education Program (Freire platform); (4) Permanent State Forum to Support Teacher Training; (5) Sedu Award — good practices in Education; (6) Institutional Scholarship Program. Before mentioning the extent to which “new studies” can evaluate the investment made by the programs and policies punctuated in the previous paragraphs, the effects of the “academic” findings of this research are discussed on the “practice”. The present study pointed out that 3 contextual variables have the potential to impact the performance of students in educational evaluations applied on a large scale in the state education network of *Espírito Santo*, namely: Index of Teacher Regularity (ITR), Indicator of Teacher Effort (ITE) and Dropout Rate (SDR). These variables reinforce the importance of the school context as well as the teacher as a way to reduce the effects of the unfavorable family and social environment through the performance of the school organization; And, are under the management of the public managers of the state education network of *Espírito Santo*. Therefore, in an empirical way, new/future research can analyze whether the financial investment expended by such programs, projects and policies (and others not identified) contributed to the rates of age-grade, adequacy, effort and teacher regularity, as well as with the production of equity and educational quality by the ES web. Thus, it would be possible to indicate initiatives with a greater impact on the “quality” and “quantity” of education in the ES, favoring the decision-making process around the strategic task of allocating public resources.

In reference to methodological aspects, the present study analyzed the impact of student and school factors on the Brazil 2013 test of state schools in the state of *Espírito Santo*, using averages, rates, and school indexes that conceal the variation of the results of these covariables between the Students and teachers of the schools. In this sense, there is the possibility of having a bias in this study for having used the school as a unit of analysis, as Alves and Soares (2013) warn.

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