Teacher expectations and math proficiency: evidence from SAEB 2017 in public schools*[1]

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Abstract

High school remains one of the main bottlenecks in the Brazilian educational system, especially for students from lower socioeconomic backgrounds. Student proficiency, used as a proxy for educational quality, is associated with different school factors, among which teacher expectations stand out. This study analyzes the relationship between teacher expectations and the mathematics performance of 11th-grade students in Brazilian public schools, using microdata from the 2017 Basic Education Assessment System (Sistema de Avaliação da Educação Básica - SAEB). For this purpose, a three-level multilevel model (students, classes, and schools) was estimated, including a set of control variables related to the school and family context. The results indicate that very high teacher expectations are positively associated with student performance in mathematics, even after controlling for socioeconomic characteristics and school processes. This result highlights the importance of teacher expectations as one of the mechanisms capable of mitigating educational inequalities and contributing to school effectiveness. In addition, the study shows that the impact of expectations is not limited to motivational aspects, but translates into measurable learning gains, which broadens the understanding of the school factors that influence educational quality. Thus, the results provide support for policies aimed at teacher training and capacity building, highlighting the relevance of teacher expectations for building a more equitable and promising school environment.

Keywords

Teacher expectations – Math proficiency – Multilevel model – High school.

***** English version by Lucas Parenti Nero. The authors take full responsibility for the translation of the text, including title of books/articles and the quotations originally published in Portuguese.

1- Data availability: The entire dataset supporting the results of this study has been made available in the official repository of INEP (Anísio Teixeira National Institute for Educational Studies and Research) and can be accessed at: https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos/microdados

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Introduction

In recent decades, Brazilian education has made significant progress in terms of enrollment expansion, but the low quality of elementary and secondary education remains one of the obstacles to the nation's economic development. Following this perspective, Senkevics and Carvalho (2020) highlight that, despite the growth of higher education, secondary education still functions as a selective filter, meaning that a significant portion of young people remain retained at this stage of basic education.

This situation stems from several factors that characterize secondary education as a real "bottleneck" in the educational system. Among these factors, the high failure and dropout rates, socioeconomic inequalities that affect retention and learning, and the gaps accumulated throughout elementary school, which are reflected in low academic performance, stand out (Mendes, 2015). Combined, these elements limit students' progress and compromise the effectiveness of this stage of education.

The pursuit for improving educational quality indicators entails the analysis of multiple factors related to student performance. Among them, teacher expectations stand out, whose relevance was initially demonstrated by Rosenthal and Jacobson's (1968) experimental study, known as *Pygmalion in the Classroom*. Based on this seminal work, several studies have sought to replicate or deepen the analysis, with varying results, but which in general reinforce the importance of the relationship between teachers' expectations and students' academic performance (Wang; Rubie-Davies; Meissel, 2018).

Studies such as those by Gregory and Huang (2013) and Papageorge, Gershenson; and Kang (2018) show that teachers' expectations can significantly influence school trajectories, including by mitigating sociodemographic inequalities. In Brazil, however, research on the theme is still scarce, with the works of Soares *et al*. (2010) and Xavier and Oliveira (2020) standing out.

In view of this gap, the present study seeks to specifically analyze the relationship between teachers' expectations and the mathematics performance of 11th grade students in Brazilian public schools, based on microdata from the SAEB 2017. The objective is to contribute to the understanding of how this school process can directly affect learning in a subject that is central to cognitive development and the continuity of educational training. To achieve this objective, the study is divided into four sections, in addition to this introduction. The next section presents the theoretical framework based on Attribution Theory of Causality, followed by the methodological section, the results, and finally, the concluding remarks.

Attributional Theory of Causality

An important reference for understanding how perceptions and expectations relate to school performance is the Attribution Theory of Causality, developed by Bernard Weiner in the 1980s, based on earlier contributions by Fritz Heider (1958) and Harold Kelley (1967). Weiner (1985, 1986) is considered one of the leading exponents of educational psychology, having structured a theory that seeks to explain how individuals interpret the causes of their successes and failures. In his formulation, events can be attributed to

internal or external factors, stable or unstable, controllable or uncontrollable, influencing emotions, future expectations, and behaviors.

In its initial version, the theory focused on attributions made by students themselves, and was later expanded to the theory entitled Interpersonal Attribution Theory (Weiner, 2004, 2010), in which parents, teachers, and other significant agents also play a central role in shaping expectations. In this sense, the classroom is perceived as a space in which the teacher, when interpreting the causes of student performance, expresses emotions and behaviors that can reinforce or limit student motivation. When poor performance is attributed to lack of effort, for instance, negative reactions such as reprimands or punishment tend to occur. In contrast, when associated with uncontrollable factors, such as cognitive limitations or socioeconomic conditions, it can elicit attitudes of support and encouragement.

This approach is directly related to the problem under study, which concerns teachers' expectations of their students. Attribution theory suggests that, when forming expectations, teachers interpret causes, express emotions, and modulate behaviors that influence students' self-perception of ability, motivation, and, consequently, academic performance. Thus, high expectations can create an environment that is more conducive to learning, while low expectations tend to reproduce stigmas and self-fulfilling prophecies (Rosenthal; Jacobson, 1968).

Empirical literature reinforces this association. Rosenthal and Jacobson (1968) experimentally showed that teacher expectations affect students' future performance. Gregory and Huang (2013) found a positive relationship between high teacher expectations and high school completion, while Papageorge, Gershenson, and Kang (2018) identified the effects of expectations on reducing educational inequalities. In Brazil, Soares *et al.* (2010) found that high expectations were associated with better proficiency results in schools in Minas Gerais, and Xavier and Oliveira (2020) highlighted the importance of the link between expectations and teacher-student relationships.

The present study differs from these works in that it uses data from SAEB 2017, which is nationwide in scope, focusing on mathematics proficiency and applying a multilevel model. Thus, it can contribute to filling a gap in Brazilian literature, in which quantitative research on the theme is still rare.

Methodology

Data

The microdata used in the present study stem from the National Assessment of School Performance/Anresc (Prova Brasil) and the National Assessment of Basic Education (*Avaliação Nacional da Educação Básica* - ANEB), both of which are part of the Basic Education Assessment System (*Sistema de Avaliação da Educação Básica* - SAEB). SAEB is the main standardized database on school performance in Brazil, covering students, teachers, and principals in all states.

The analysis exclusively covers 12th grade students evaluated by SAEB in 2017[4]. Private and federal schools were excluded in order to focus the research on state and municipal networks, which are responsible for most public high school enrollments and are the focus of key policies aimed at reducing educational inequalities. After applying these criteria, the final sample consisted of 90,652 students, distributed across 6,002 classes and 3,554 schools.

Although SAEB is recognized as the most comprehensive database on Brazilian basic education, it has limitations. Some of the contextual information is self-reported by students, which can lead to measurement errors. However, the specialized literature considers such data sufficiently valid for large-scale analyses (Soares; Collares, 2006).

Specification of the econometric model

Educational data have a hierarchical structure: students are grouped into classes, which in turn are grouped into schools. This configuration vilates the presumption of independence of observations in traditional linear regressions. To deal with this characteristic, multilevel models are used, which allow variables at different levels to be analyzed, the variance between them to be partitioned, and consistent standard errors to be obtained (Goldstein, 1987; Gelman; Hill, 2007).

The model adopted in this study has three levels: students (level 1), classes (level 2), and schools (level 3). The choice of random intercept is related to the objective of capturing the variability in mean performance between classes and schools, without the need for random slopes. This decision also ensures comparability with previous national studies in the field of school effectiveness (Soares, 2004; Silva, 2017).

The dependent variable corresponds to mathematics proficiency as measured by SAEB in 2017. The use of proficiency as a proxy variable for educational quality is justified by the fact that it directly reflects the results of the teaching-learning process, in contrast to input or school flow indicators, such as infrastructure or repetition rates, which capture only indirect dimensions of the phenomenon (Hanushek; Woessmann, 2011). In addition, large-scale evaluations in Brazil and other countries have consolidated proficiency as a measure of educational output, as it is standardized, comparable across networks and schools, and suitable for analyzing school effectiveness (Alves, 2006; Soares; Alves, 2003).

The choice of mathematics, specifically, is due to three factors: it is widely used in national and international studies as a proxy for educational quality (Teddlie; Reynolds, 2000); it shows greater variability among students and greater sensitivity to socioeconomic inequalities compared to proficiency in Portuguese, which increases its discriminatory power (Soares, 2004); and it is highlighted in the literature on school effectiveness as a robust indicator of learning and teaching quality (Silva, 2017). Thus, mathematics proficiency is treated in this study as a synthetic measure of educational quality.

4- The SAEB 2017 microdata used in the present study are available for public access in the official INEP repository: https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos/microdados.

Following Raudenbush and Bryk's notation (2002), in the three-level hierarchical model, each student is represented by the subscript *i* (first level), the subscript *j* represents the class (second level), and the subscript *k* represents each school (third level). Thus, the estimated model for the 11th grade is as follows:

(1) $y_{ijk}^{3EM} = \pi_{fs0} + \beta_{fjk} X_{fijk} + \gamma_{fsk} W_{sjk} + \pi_{fst} Z_{tk} + e_{ijk} + u_{fjk} + r_{fsk}$

It can be verified from (1) that: β_{fjk} represents the impact of the explanatory variables considered in vector *X* of level 1 on student performance, γ_{fsk} represents the impact of the explanatory variables considered in the vector *W* of level 2 in student performance, π_{fst} represents the impact of the explanatory variables considered in the vector *Z* of level 3 in student performance.

Thus, the model specification allows the analysis of the influence of teachers' expectations on student performance, alongside other school processes and socioeconomic characteristics of students and their families, to be conducted while respecting the hierarchical structure of the data.

It should also be noted that, in this type of analysis, where data are structured at varying levels, it is crucial to identify how much of the variation seen in performance is due to students belonging to different classes and/or schools. One mechanism that allows variance based on these differences to be measured is the calculation of the intraclass correlation coefficient.

As the intraclass coefficient approaches zero (on a scale from zero to one), a student's performance would be fully explained by the variations or differences between the students themselves. In this case, there would be no need to estimate a model at more than one level. On the other hand, as the intraclass coefficient approaches one, differences in performance between students become more significant due to differences between classes and schools, highlighting the importance of considering the hierarchical structure of the data when estimating models.

Formally, the intraclass correlation coefficient is designated by the following equations:

$$\frac{\sigma_e^2}{\sigma_e^2 + \sigma_{u_0}^2 + \sigma_{r_{00}}^2} \quad \text{(level 1)} \quad (2)$$

$$\frac{\sigma_{u_0}^2}{\sigma_e^2 + \sigma_{u_0}^2 + \sigma_{r_{00}}^2} \quad \text{(level 2)} \quad (3)$$

$$\frac{\sigma_{r_{00}}^2}{\sigma_e^2 + \sigma_{u_0}^2 + \sigma_{r_{00}}^2} \quad \text{(level 3)} \quad (4)$$

Where σ_e^2 is the variance at level 1, $\sigma_{u_0}^2$ the variance at level 2, and $\sigma_{r_{00}}^2$ the variance at level 3.

In addition to the intraclass coefficient, a test X^2 (LR test) can be performed to identify whether it is really necessary to perform the analysis, respecting the hierarchical structure established at more than one level or not. The LR test has as its null hypothesis that the random effects are equal to zero. Therefore, if it is statistically significant, it is inferred in favor of using a hierarchical model.

In turn, the explanatory variables considered in the vectors of levels 1 (*X*), 2 (*W*), and 3 (*Z*), presented in Table 1 below were selected based on the literature on school effectiveness. (Teddlie; Reynolds, 2000; Silva, 2017). In these studies, it is understood that the quality of a school's performance is entirely associated with processes considered effective that form the school context. These school processes can be represented by several variables, which collectively dictate the profile of educational institutions.

Based on the processes identified by Teddlie and Reynolds (2000) and compatibilized with the socioeconomic questionnaires applied by SAEB (Prova Brasil and Prova Aneb) in 2017, 73 control variables were selected. Of this set, 57 variables were used to construct 13 indicators that summarize aspects of school processes and the socioeconomic and family conditions of students. These indicators were generated using the HOMALS multivariate statistical technique[5].

Table 1 - Description of the explanatory variables used in the composition of the estimated model

Data	Variable	Description	Components	Q[b]	Type
	1st level (students)				
Gender	Male	Assumes a value of 1 if the gender is male and 0 if otherwise.	Question 1-1	St	Dummy
Race	Black	Assumes a value of 1 if the race is black and 0 if otherwise.	Question 2-2	St	Dummies
	Brown	Assumes a value of 1 if the race is brown and 0 if otherwise.			
	Asian	Assumes a value of 1 if the race is Asian and 0 if otherwise.			
	Indigenous	Assumes a value of 1 if the race is indigenous and 0 if otherwise.			
Early years education	Preschool	Assumes a value of 1 if the student attended preschool (ages 4 to 5) and 0 if otherwise.	Question 46-39	St	Dummies
	Daycare	Assumes a value of 1 if the student attended daycare (0 to 3 years old) and 0 if otherwise.			
Retention	Retained once	Assumes a value of 1 if the student has already been retained once, and 0 if otherwise.	Question 48-41	St	Dummies
	Retained 2 or more times	Assumes a value of 1 if the student has already been retained twice or more, and 0 if otherwise.			

5- *Homogeneity Analysis by Means of Least Squares* (HOMALS) is a type of Multiple Correspondence Analysis (MCA) that reduces the dimensionality of a system composed of n individuals and j categories associated with the variables that describe them. In addition, through mathematical manipulation, the indexes generated were used on scales ranging from 0 to 10.

Data	Variable	Description	Components	Q[b]	Type
Student capital	Parents' education	Index on a scale of 0 to 10 based on the level of education and reading habits of the mother and father. The higher the index, the higher the level of education and the more frequent the parents' reading habits.	Combination of questions 19-19, 23-23, 21-21, and 25-25	St	Index
	Socioeconomic level	Index on a scale of 0 to 10 based on ownership of material goods (color TV, refrigerator, freezer, washing machine, computer, and car), bathroom, and domestic help in the studen"s home. The higher the index, the higher the socioeconomic level.	Combination of questions 5-5,8-8, 10-10, 11-11, 12-12, 13-13, 14-14, and 17-17	St	Index
Focus on academics	Parental engagement	Index on a scale of 0 to 10 based on parental monitoring and encouragement of their children's studies. The higher the index, the greater the parental engagement.	Combination of questions 26-26, 28-28, 30-30, 27-27, 29-29, and 31-31	St	Index
	Consistency of homework	Index on a scale of 0 to 10 based on the frequency of completion and correction of homework. The higher the index, the better the consistency of homework.	Combination of questions 54/53, and 55/59	St	Index
2nd level (class)					
Teacher training	Teaching	Assumes a value of 1 if the teacher has a higher education degree in teaching and 0 if otherwise.	Question 4	T	Dummies
	Bachelor's degree (languages or other fields)	Assumes a value of 1 if the teacher has a bachelor's degree in languages or other areas and 0 if otherwise.			
	Bachelor's degree (mathematics)	Assumes a value of 1 if the teacher has a bachelor's degree in mathematics and 0 if otherwise.			
Teacher compensation	1 and 3 times the minimum wage	Assumes a value of 1 if the teacher's gross salary is between 1 and 3 times the minimum wage (BRL 937 to BRL 2,811) and 0 if otherwise.	Question 10	T	Dummies
	3 and 4 times the minimum wage	Assumes a value of 1 if the teacher's gross salary is between 3 and 4 times the minimum wage (BRL 2,811 to BRL 3,748) and 0 if otherwise.			
	4 to 7 times the minimum wage	Assumes a value of 1 if the teacher's gross salary is between 4 and 7 times the minimum wage (BRL 3,748 to BRL 6,559) and 0 if otherwise.			
	More than 7 times the minimum wage	Assumes a value of 1 if the teacher's gross salary is more than 7 times the minimum wage (> BRL 6,559) and 0 if otherwise.			
Stability	Teacher and principal time working at the school	Index on a scale of 0 to 10 based on the number of years the teacher and principal have worked at the school. The higher the index, the greater the stability of the teacher and principal at the school.	Combination of questions 14 and 17	T/P	Index
Educational leadership	Teacher engagement in decision-making	Index on a scale of 0 to 10 based on the frequency with which teachers participate in decisions related to their work. The higher the index, the greater the engagement of teachers.	Combination of questions 68 and 69	T	Index
	Teacher/principal relationship	Index on a scale of 0 to 10 based on the quality of the relationship between the teacher and the principal and the frequency with which the principal's proactivity/commitment is perceived. The higher the index, the better the quality of the teacher/principal relationship.	Combination of questions 61, 62, 63, 64, 65, 66, and 67	T	Index

Data	Variable	Description	Components	Q[b]	Type
Teaching	Teaching processes	Index on a scale of 0 to 10 based on the frequency with which certain teaching practices are conducted and the efficiency of the planned content development. The higher the index, the better the teaching processes.	Combination of questions 106, 113, 121 and 122	T	Index
Teacher" expectations	Low expectations	Assumes a value of 1 if the teacher believes that slightly less than half of the students will enter university. Value 0, if otherwise.	Question 95-96	T	Dummies
	High expectations	Assumes a value of 1 if the teacher believes that slightly more than half of the students will enter university. Value 0, if otherwise.			
	Very high expectations	Assumes a value of 1 if the teacher believes that almost all students will enter university. Value 0, if otherwise.			
3rd level (school)					
Administrative dependence	State	Assumes a value of 1 if the school is state-run and 0 if it is municipal.	-	Sc	Dummy
Location	Urban area	Assumes a value of 1 if the school is located in an urban area and 0 if it is located in a rural area.	-	Sc	Dummy
Leadership	School participation	Index on a scale of 0 to 10 based on the frequency of meetings with the Class Council and School Board. The higher the index, the greater the participation in the school.	Combination of questions 52 and 29	T/P	Index
Educational leadership	Frequency control	Index on a scale of 0 to 10 based on the school's internal policies aimed at minimizing student absences. The higher the index, the greater the control over attendance.	Combination of questions 45, 47, 49, 46, 48	P	Index
School culture	Management support	Index on a scale of 0 to 10 based on external support for the position of school principal. The higher the index, the greater the support for management.	Combination of questions 77, 79, 78, 80	P	Index
	Absence of violence	Index on a scale of 0 to 10 based on the absence of certain events indicative of violent climate. The higher the index, the greater the level of absence of violence.	Combination of questions 99, 98, 90, 91, 93	P	Index
	Safety measures	Index on a scale of 0 to 10 based on the assessment of certain aspects related to school and student safety. The higher the index, the greater the adoption of safety measures.	Combination of questions 26, 35, and 27	Sc	Index
	Infrastructure	Index on a scale of 0 to 10 based on an assessment of the state of repair of certain items/equipment at the school and aspects of vandalism. The higher the index, the better the quality of the infrastructure.	Combination of questions 13, 16, 31, and 36.	Sc	Index
	Shortage of teachers	cAssumes a value of 1 if the school's operation was hampered by a high rate of teacher absences and 0 if otherwise.	Question 73	P	Dummy
Monitoring	Programs to reduce retention rates	Assumes a value of 1 if there are any actions to reduce retention rates in school and 0 if otherwise.	Question 42	P	Dummy
	Tutoring programs	Assumes a value of 1 if there are any measures in place to reinforce students' learning (tutoring, remedial classes, catch-up classes, etc.) and 0 if not.	Question 43	P	Dummy
	Teacher training at school	Assumes a value of 1 if the principal organizes some form of continuing education (refresher courses, training, capacity building, etc.) and 0 if otherwise.	Question 26	P	Dummy

[a] The "components" column indicates the number of questions used in the SAEB questionnaires in 2017 for the 11th grade.

[b] The column "Q" refers to the source of the questionnaire responses (St=student, T=Teacher, P=Principal, and Sc=School). Only the pupil questionnaires show some variations in numbering.

Source: Prepared by the authors based on the reconciliation of contextual variables from Prova Brasil and the processes listed by Teddlie and Reynolds (2000) and Silva (2017).

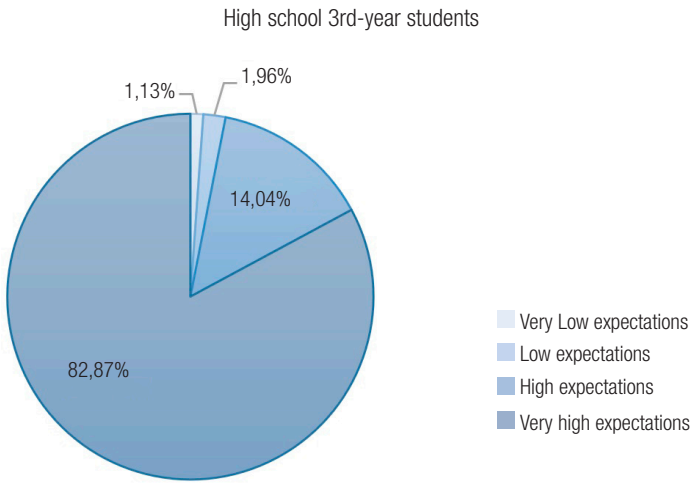
Results

Descriptive analysis

Based on the total number of observations relating to 11th grade students, Figure 1 shows the sample distribution by teachers' expectations regarding the number of students who will enter university. It is possible to note that the vast majority of expectations are very high, corresponding to 82.87% of the total. In turn, Table 2, presented below, shows the ratio/mean of the variables and indicators for the total sample and separately for the four levels of expectations: very low expectations, low expectations, high expectations, and very high expectations.

At first glance, it is possible to confirm the prevalence of a majority of female students and students who are not white. Furthermore, it is clear that as teacher expectations are higher, the ratio of female students also increases, while the ratio of non-white students decreases. In other words, higher levels of expectations are associated with a higher ratio of female students in relation to male students and among white students. Soares *et al*. (2010) found similar results when considering data from schools in Minas Gerais participating in PROEB/2006 (Basic Education Public Network Assessment Program).

Figure 1 - Distribution of the sample of 11th grade students by teachers' expectations (very low, low, high, and very high expectations)



Source: Prepared by the authors based on microdata from SAEB 2017.

Table 2 - Mean of analytical sample variables for 11th grade students by expectation levels

VARIABLES	11th grade					Min	Max
	T	VLE	LE	HE	VHE		
Female (ref)	0.56 (0.49)	0.53 (0.49)	0.55 (0.49)	0.55 (0.49)	0.56 (0.49)	0	1
Male	0.44 (0.49)	0.47 (0.49)	0.45 (0.49)	0.45 (0.49)	0.44 (0.49)	0	1
White (ref)	0.30 (0.45)	0.29 (0.45)	0.28 (0.44)	0.26 (0.44)	0.30 (0.46)	0	1
Brown	0.51 (0.49)	0.49 (0.50)	0.55 (0.49)	0.52 (0.49)	0.50 (0.49)	0	1
Black	0.14 (0.34)	0.16 (0.36)	0.13 (0.33)	0.16 (0.36)	0.14 (0.34)	0	1
Asian	0.03 (0.18)	0.03 (0.18)	0.03 (0.16)	0.03 (0.17)	0.03 (0.18)	0	1
Indigenous	0.02 (0.12)	0.02 (0.15)	0.01 (0.12)	0.02 (0.13)	0.01 (0.12)	0	1
9th grade (ref)	0.27 (0.44)	0.32 (0.46)	0.27 (0.44)	0.28 (0.44)	0.27 (0.44)	0	1
Preschool	0.37 (0.48)	0.32 (0.46)	0.34 (0.47)	0.35 (0.47)	0.37 (0.48)	0	1
Daycare	0.36 (0.47)	0.36 (0.47)	0.39 (0.48)	0.37 (0.48)	0.36 (0.47)	0	1
Never retained (ref)	0.67 (0.47)	0.53 (0.49)	0.61 (0.48)	0.60 (0.48)	0.68 (0.46)	0	1
Once	0.18 (0.38)	0.23 (0.41)	0.21 (0.41)	0.21 (0.40)	0.17 (0.37)	0	1
Twice or more	0.16 (0.36)	0.24 (0.42)	0.17 (0.37)	0.18 (0.38)	0.15 (0.35)	0	1
Parents' education	5.79 (2.49)	5.52 (2.45)	5.66 (2.52)	5.69 (2.52)	5.81 (2.49)	0	10
Socioeconomic level	7.89 (1.39)	7.77 (1.52)	7.80 (1.33)	7.81 (1.40)	7.91 (1.38)	0	10
Teaching degree	0.03 (0.16)	0.03 (0.17)	0.07 (0.25)	0.03 (0.17)	0.03 (0.16)	0	1
Bachelor's degree (other fields)	0.14 (0.34)	0.24 (0.42)	0.26 (0.43)	0.17 (0.37)	0.13 (0.33)	0	1
Bachelor's degree (mathematics)	0.81 (0.38)	0.71 (0.45)	0.60 (0.48)	0.79 (0.40)	0.82 (0.38)	0	1
Lower than 1 minimum wage (ref)	0.02 (0.14)	0.01 (0.11)	0.04 (0.18)	0.02 (0.15)	0.02 (0.14)	0	1
Between 1 and 3 minimum wages.	0.36 (0.47)	0.45 (0.49)	0.33 (0.46)	0.37 (0.48)	0.36 (0.47)	0	1
Between 3 and 4 minimum wages.	0.20 (0.40)	0.23 (0.42)	0.29 (0.45)	0.19 (0.38)	0.20 (0.40)	0	1
Between 4 and 7 minimum wages.	0.32 (0.46)	0.24 (0.42)	0.29 (0.45)	0.32 (0.46)	0.32 (0.46)	0	1
Higher than 7 minimum wages.	0.10 (0.30)	0.07 (0.26)	0.05 (0.21)	0.10 (0.29)	0.10 (0.30)	0	1

VARIABLES	11th grade					Min	Max
	T	VLE	LE	HE	VHE		
Principal and teacher time working at the school	3.79 (2.13)	4.05 (2.23)	4.08 (2.15)	3.80 (2.10)	3.78 (2.14)	0	10
State-run	0.998 (0.04)	1 (0)	1 (0)	1 (0)	0.998 (0.04)	0	1
Municipal (ref)	0.002 (0.04)	0 (0)	0 (0)	0 (0)	0.002 (0.04)	0	1
Urban	0.95 (0.21)	0.99 (0.11)	0.94 (0.24)	0.96 (0.18)	0.95 (0.22)	0	1
Rural (ref)	0.05 (0.21)	0.01 (0.11)	0.06 (0.24)	0.04 (0.18)	0.05 (0.22)	0	1
Consistency of homework	9.50 (1.91)	9.28 (2.31)	9.49 (1.89)	9.46 (1.99)	9.51 (1.89)	0	10
Parents' engagement	8.98 (1.54)	8.84 (1.71)	8.97 (1.56)	8.94 (1.58)	8.98 (1.53)	0	10
Teacher engagement in decision-making	8.70 (2.11)	7.93 (2.70)	8.05 (2.73)	8.41 (2.32)	8.78 (2.03)	0	10
Director/teacher relationship	9.00 (1.75)	8.38 (2.43)	8.59 (2.25)	8.83 (1.79)	9.04 (1.71)	0	10
Teaching Processes	9.24 (1.41)	8.38 (2.07)	9.09 (1.59)	9.00 (1.56)	9.29 (1.36)	0	10
Engaging others (school participation)	8.29 (2.19)	7.27 (2.70)	7.93 (2.55)	8.00 (2.31)	8.36 (2.15)	0	10
Frequency control	9.86 (0.70)	9.89 (0.33)	9.88 (0.45)	9.89 (0.53)	9.86 (0.74)	0	10
Management support	8.98 (1.86)	9.20 (1.73)	8.55 (2.27)	8.93 (1.93)	8.99 (1.84)	0	10
Absence of violence	6.43 (2.29)	6.37 (2.20)	6.23 (2.34)	6.36 (2.23)	6.45 (2.30)	0	10
Safety measures	5.63 (3.41)	5.48 (3.77)	5.37 (3.41)	5.70 (3.39)	5.62 (3.41)	0	10
Infrastructure	5.70 (2.88)	5.43 (2.78)	4.79 (3.02)	5.33 (2.88)	5.78 (2.87)	0	10
Shortage of teachers	0.68 (0.46)	0.72 (0.45)	0.69 (0.46)	0.68 (0.46)	0.68 (0.46)	0	1
Retention reduction programs	0.97 (0.17)	0.98 (0.15)	0.96 (0.19)	0.96 (0.19)	0.97 (0.16)	0	1
Tutoring programs	0.78 (0.41)	0.75 (0.43)	0.76 (0.42)	0.77 (0.42)	0.79 (0.41)	0	1
Teacher training at school	0.64 (0.47)	0.61 (0.48)	0.58 (0.49)	0.61 (0.48)	0.65 (0.47)	0	1
N	90.652 (100%)	1.025 (1.13%)	1.775 (1.96%)	12.727 (14.04%)	75.125 (82.87%)	-	-

Source: Prepared by the authors based on microdata from SAEB 2017.
Note: 1) T=Total; VLE=Very low expectations; LE=Low expectations; HE=High expectations; VHE=Very high expectations. 2) (ref) = notation used to indicate which variables were considered as reference and omitted in the estimation of the model. 3) Standard error in parentheses.

In addition to gender and race, one of the most notable control variables is the fact that the ratio of students retained once or twice decreases substantially as expectations increase. Additionally, it seems that the mean of indicators related to students' socioeconomic and family conditions—such as parents' education and socioeconomic level—increases as the level of expectations rises.

This same decreasing ratio was also noted for the variables 9th grade and bachelor's degree (other areas), indicating that students who start school later in life are not regarded with expectations as high as students who started studying in daycare or preschool. In addition, teachers who teach mathematics or Portuguese but do not have a degree in these areas have lower expectations of their students than teachers with a degree in mathematics. This is an important indicator, as it highlights the relevance of specific training for teaching.

With regard to school processes, in general, all (with the exception of *safety measures* and *teacher shortages*) had higher means at each higher level of expectations. These school processes constitute practices recognized by the literature on school effectiveness as positive factors, creating conditions for teachers to develop higher expectations of their students (Silva, 2017). Furthermore, with regard to the indicator of *principal and teacher time working at the school*, this declines as expectations increase. In addition, teacher shortages and the lack of tutoring programs are frequently encountered problems.

Econometric results

Before presenting the estimated coefficients, model adequacy tests were performed. The null model (M0) indicated that approximately 21.06% of the variance in mathematics proficiency is explained by differences between classes and schools, according to the intraclass correlation coefficient (ICC). This result highlights the relevance of the hierarchical structure of the data. The likelihood ratio test (LR test) rejected the null hypothesis of no random effects at the 1% significance level, confirming the relevance of multilevel modeling (Gelman; Hill, 2007).

Table 3 presents the results of the progressive estimates of the multilevel model. Model 1 includes only student-level variables; model 2 adds class-level variables, including teacher expectations; and model 3 incorporates school-level variables. This strategy allows assessing the robustness of the estimates as new sets of variables are added. In the complete model (M3), the intraclass coefficient decreased to 15.22%, highlighting the importance of student-level variables, but also the significant weight of class and school characteristics. The LR test remained statistically significant at 1%, validating the use of the multilevel model for the analysis.

Table 3 - Model estimated to explain the performance of 11th grade students in relation to teacher expectations

VARIABLE	11th GRADE		
	M1 (Students)	M2 (Class)	M3 (School)
Male sex	10.91*** (0.29)	10.92*** (0.29)	10.93*** (0.28)
Brown color	-4.48*** (0.35)	-4.50*** (0.34)	-4.30*** (0.35)
Black color	-7.33*** (0.48)	-7.35*** (0.48)	-7.30*** (0.47)
Asian	-4.46*** (0.81)	-4.49*** (0.81)	-4.30*** (0.81)
Indigenous	-9.43*** (1.18)	-9.35*** (1.18)	-8.62*** (1.18)
Early childhood education (preschool)	2.23*** (0.38)	2.25*** (0.39)	1.94*** (0.38)
Early childhood education (daycare)	-2.31*** (0.38)	-2.29*** (0.38)	-2.53*** (0.37)
Retained once	-18.49*** (0.39)	-18.39*** (0.39)	-18.42*** (0.39)
Retained twice or more times	-18.05*** (0.42)	-17.96*** (0.42)	-17.68*** (0.42)
Social capital: Parents' level of education	1.21*** (0.06)	1.20*** (0.06)	1.20*** (0.06)
Social capital: Socioeconomic level	1.22*** (0.12)	1.21*** (0.12)	1.02*** (0.12)
Learning: Consistency of homework	0.29*** (0.07)	0.28*** (0.08)	0.30*** (0.08)
Monitoring: Parental engagement	-1.10*** (0.09)	-1.10*** (0.09)	-1.08*** (0.09)
Training in education		-2.24 (2.46)	-1.94 (2.42)
Bachelor's degree		0.28 (2.09)	-0.002 (2.07)
Bachelor's degree (mathematics)		1.68 (2.03)	1.08 (1.99)
Wage (1 to 3 min. wages)		1.59 (1.86)	0.63 (1.84)
Wage (3 to 4 min. wages)		1.87 (1.91)	0.45 (1.88)
Wage (4 to 7 min. wage)		3.66** (1.89)	2.87* (1.87)
Wage (>7min. wage)		6.16*** (2.03)	4.93*** (2.00)
Stability: teachers and principals time working at the school		0.11 (0.13)	-0.07 (0.13)
Teaching leadership: Teacher engagement in decision-making		0.10 (0.15)	0.08 (0.13)
Teaching leadership: Principal/teacher relationship		0.32* (0.18)	0.04 (0.18)

VARIABLE	11th GRADE		
	M1 (Students)	M2 (Class)	M3 (School)
Teaching: Teaching processes		0.50*** (0.19)	0.37** (0.18)
Low expectations		3.37 (2.92)	3.62 (2.89)
High expectations		2.06 (2.44)	1.72 (2.41)
Very high expectations		7.34*** (2.37)	6.60*** (2.35)
State-run			-24.53*** (5.91)
Urban			9.40*** (1.26)
Leadership: Engaging others (school participation)			1.17*** (0.14)
Teaching leadership: Attendance control			0.17 (0.43)
Teaching leadership: Management support			0.37** (0.16)
School culture: Absence of violence			0.02 (0.14)
School culture: Safety measures			0.11 (0.09)
School culture: Infrastructure			0.55*** (0.11)
School culture: Shortage of teachers			-0.51 (0.68)
Monitoring: Programs to reduce retention rates			3.92** (1.82)
Monitoring: Tutoring programs			3.38*** (0.77)
Monitoring: Teacher training at the school			3.41*** (0.66)
Random intercept	251.56*** (1.47)	236.38*** (4.20)	229.02*** (8.62)
Random intercept (null model)		255.90*** (0.38)	

Source: prepared by the authors.
Note: Standard error in parentheses. *; ** and ***: statistical significance at 10%, 5%, and 1%, respectively.

Based on the complete estimation (M3), it is then possible to determine the importance of teachers' expectations for student performance in relation to other control characteristics and other school processes considered effective. It was found that very high expectations proved to be the school process with the greatest influence on student performance, compared to the others.

Thus, students belonging to classes in which teachers have very high expectations regarding the number of students who will enter higher education score, on average, 6.60

points higher on the SAEB mathematics proficiency scale than those in classes in which teachers believe that few students will succeed. These results are consistent with what has been confirmed nationally by Silva (2017) and Soares *et al.* (2010), as well as with some international studies, such as Becker (2013) and Papageorge, Gershenson and Kang (2018). Furthermore, this result is consistent with the Attribution Theory of Causality, developed in a seminal way by Weiner (1985), discussed in the second section of the present study.

Therefore, it is possible to answer the two questions that guided the development of this study. First, teachers' expectations proved to be not only an effective school process, but also a mechanism with a high power to counterbalance the often perverse effects of students' socioeconomic and family characteristics on the quality of learning and, consequently, on their school trajectory.

This type of evidence does not demonstrate that high expectations are capable of solving all the numerous and complex problems in schools, but it does point to an important factor that can contribute effectively to overcoming some of the unique obstacles faced by Brazilian education.

Based on literature related to the topic and the Attribution Theory of Causality, teachers form expectations of their students, based on their perception of their cognitive abilities or stereotypes. Based on these expectations, teachers exhibit specific behaviors that are perceived by students in a way that influences their socio-psychological characteristics, self-perception of ability, and motivation, ultimately impacting their academic performance (Wang; Rubie-Davies; Meissel, 2018).

Regarding the other control variables at the student level, all were statistically significant, with retention being unquestionably the most severe condition, negatively affecting student performance. This result is similar to that found by Correa, Bonamino and Soares (2014).

Male sex students performed better in mathematics, while students who self-identified as black, brown, Asian, or indigenous performed worse than white students. A history of retention was strongly associated with losses in proficiency, confirming previous findings for Brazil (Correa; Bonamino; Soares, 2014). In addition, the socioeconomic and family conditions of students were positively associated with learning, in line with evidence from Alves (2006), and Soares and Alves (2003).

At the class level, variables related to teacher training and teaching processes were associated with learning gains, especially when teachers had a bachelor's degree in mathematics and higher salaries (Moriconi, 2012). Finally, at the school level, the effects of variables associated with monitoring (programs to reduce retention rates, tutoring, and teacher training), leadership (management support and school participation), and infrastructure stood out positively. These results are consistent with studies that relate school management to better indicators of educational effectiveness (Banerjee *et al.*, 2007; Gomes *et al.*, 2010).

Concluding remarks

This study aimed to analyze the relationship between teachers' expectations and the mathematics performance of 11th-grade students in Brazilian public schools, based on microdata from SAEB 2017. Although Brazilian education has advanced in terms of access

in recent decades, high school remains one of the main bottlenecks in the educational system, especially for students in conditions of socioeconomic vulnerability.

The use of three-level multilevel models (students, classes, and schools) allowed for a more accurate measurement of the influence of teacher expectations, combined with individual, family, and school variables. The results showed that very high expectations were associated with significant gains in mathematics proficiency, even after controlling for socioeconomic characteristics and school processes. This evidence underscores the importance of teacher expectations as a factor associated with school effectiveness.

However, it is important to highlight the limits of the scope of the analysis. Teacher expectations should not be interpreted as a sufficient factor to explain, in isolation, the quality of teaching or the totality of learning outcomes. Other elements, such as socioeconomic conditions, previous school history, teacher training, and school infrastructure, play an equally decisive role in determining academic performance. In this sense, the results indicate that high expectations are a relevant but complementary mechanism in mitigating educational inequalities.

The evidence presented also dialogues with Attribution Theory, according to which the way teachers interpret student performance influences their expectations, behaviors, and interactions in the classroom. By recognizing students' potential and expressing higher expectations, teachers tend to stimulate more motivating and productive learning environments.

From a public policy perspective, the results suggest the need for teacher training and capacity-building programs that explicitly address the role of expectations in the teaching-learning process. Such programs could contribute to raising teachers' awareness of the impact of their perceptions and practices, thereby promoting the creation of more equitable school environments.

Finally, it is recognized that the results obtained here derive from cross-sectional data and self-reported measures, which requires caution regarding causal inferences. Future research can advance by exploring longitudinal approaches, incorporating multiple disciplinary fields beyond mathematics, and examining in greater depth the interaction between teacher expectations, school policies, and regional contexts.

References

ALVES, Maria Teresa Gonzaga. **Efeito-escola e fatores associados ao progresso acadêmico dos alunos entre o início da 5ª série**. Tese (Doutorado em Educação) – Universidade Federal de Minas Gerais, Belo Horizonte, 2006. Disponível em: https://repositorio.ufmg.br/handle/1843/VCSA-6V8LRM. Acesso em: 8 out. 2025.

BANERJEE, Abhijit Vinayak; COLE, Shawn; DUFLO, Esther; LINDEN, Leigh. Remedying education: evidence from two randomized experiments in India. **The Quarterly Journal of Economics**, Oxford, v. 122, n. 3, p. 1235-1264, 2007. https://doi.org/10.1162/qjec.122.3.1235

BECKER, Dominik. The impact of teachers' expectations on students' educational opportunities in the life course. **Rationality and Society**, Thousand Oaks, v. 25, p. 422-469, 2013. https://doi.org/10.1177/1043463113497993

CORREA, Erisson; BONAMINO, Alicia; SOARES, José Francisco. Efeitos das características escolares no aprendizado dos alunos: uma análise com dados longitudinais. **Educação e Pesquisa**, São Paulo, v. 40, n. 4, p. 1001-1016, 2014. https://doi.org/10.1590/S1517-97022014000400004

GELMAN, Andrew; HILL, Jennifer. **Data analysis using regression and multilevel/hierarchical models**. New York: Cambridge University Press, 2007. https://doi.org/10.1017/CBO9780511790942

GOLDSTEIN, Harvey. **Multilevel models in educational and social research**. London: Charles Griffin, 1987.

GOMES, Cândido Alberto; MARIANO, Flávia; OLIVEIRA, Andreia de; BARBOSA, André; SOUSA, José Henrique; FRIEDRICH, Nayana. Reforço escolar: gastos e desigualdades sociais. **Revista Brasileira de Estudos Pedagógicos**, Brasília, DF, v. 91, n. 227, p. 55-74, 2010. Disponível em: http://rbep.inep.gov.br/ojs3/index.php/rbep/article/view/2834. Acesso em: 8 out. 2025.

GREGORY, Anne; HUANG, Francis. It takes a village: the effects of 10th grade college-going expectations of students, parents, and teachers four years later. **American Journal of Community Psychology**, New York, v. 52, p. 41-55, 2013. https://doi.org/10.1007/s10464-013-9575-5

HANUSHEK, Eric Alan; WOESSMANN, Ludger. The economics of international differences in educational achievement. *In*: HANUSHEK, Eric A.; MACHIN, Stephen; WOESSMANN, Ludger (ed.). **Handbook of the economics of education**. v. 3. Amsterdam: Elsevier, 2011. p. 89-200. https://doi.org/10.1016/B978-0-444-53429-3.00002-9

HEIDER, Fritz. **The psychology of interpersonal relations.** New York: Wiley, 1958.

KELLEY, Harold Harold. Attribution theory in social psychology. *In*: LEVINE, David (ed.). **Nebraska symposium on motivation**. Lincoln: University of Nebraska Press, 1967. p. 1-39.

MENDES, Marcos. **A despesa federal em educação**. Brasília, DF: IPEA, 2015. Disponível em: https://www.ipea.gov.br/portal/index.php?option=com_content&id=25716. Acesso em: 8 out. 2025.

MORICONI, Gabriela Miranda. **Medindo a eficácia dos professores**. 2012. Tese (Doutorado em Administração Pública e Governo) – Fundação Getulio Vargas, São Paulo, 2012. Disponível em: https://bibliotecadigital.fgv.br/dspace/handle/10438/10069. Acesso em: 8 out. 2025.

PAPAGEORGE, Nicholas; GERSHENSON, Seth; KANG, Kyung Min. Teacher expectations matter. **NBER Working Paper**, Cambridge, n. 25255, 2018. National Bureau of Economic Research. https://doi.org/10.3386/w25255

RAUDENBUSH, Stephen W.; BRYK, Anthony S. **Hierarchical linear models**: applications and data analysis methods. 2. ed. Thousand Oaks: Sage, 2002. https://doi.org/10.4135/9781412984772

ROSENTHAL, Robert; JACOBSON, Lenore. **Pygmalion in the classroom**. Carmarthen: Crown House, 2003. 1. ed. 1968.

SENKEVICS, Adriano Souza; CARVALHO, Marília Pinto de. Novas e velhas barreiras à escolarização da juventude. **Estudos Avançados**, São Paulo, v. 34, n. 99, p. 333-351, 2020. https://doi.org/10.1590/s0103-40142020.3499.020

SILVA, Ana Luíza Farage. **O processo importa**. Dissertação (Mestrado em Educação) – Universidade Federal de Minas Gerais, Belo Horizonte, 2017. Disponível em: https://repositorio.ufmg.br/handle/1843/BUBD-BBBMP2. Acesso em: 8 out. 2025.

SOARES, José Francisco. O efeito da escola no desempenho cognitivo de seus alunos. **Revista Electrónica Iberoamericana sobre Calidad, Eficacia y Cambio en Educación**, Madrid, v. 2, n. 2, p. 83-104, 2004. Disponível em: https://revistas.uam.es/reice/article/view/5493. Acesso em: 8 out. 2025.

SOARES, José Francisco; ALVES, Maria Teresa Gonzaga. Desigualdades raciais no sistema brasileiro de educação básica. **Educação e Pesquisa**, São Paulo, v. 29, n. 1, p. 147-165, 2003. https://doi.org/10.1590/S1517-97022003000100011

SOARES, José Francisco; COLLARES, Ana Cristina Murta. Recursos familiares e o desempenho cognitivo dos alunos do ensino básico. **Dados**, Rio de Janeiro, v. 49, n. 3, p. 615-650, 2006. https://doi.org/10.1590/S0011-52582006000300004

SOARES, Tufi Machado; LEMOS, Sônia; ALVES, Maria Teresa Gonzaga; SOARES, José Francisco. A expectativa do professor e o desempenho dos alunos. **Psicologia**: Teoria e Pesquisa, Brasília, DF, v. 26, n. 1, p. 157-170, 2010. https://doi.org/10.1590/S0102-37722010000100018

TEDDLIE, Charles; REYNOLDS, David. Os processos da eficácia escolar. *In*: BROOKE, Nigel; SOARES, José Francisco (org.). **Pesquisa em eficácia escolar:** origem e trajetórias. Belo Horizonte: UFMG, 2008. p. 297-328.

WANG, Shengnan; RUBIE-DAVIES, Christine; MEISSEL, Kane. A systematic review of the teacher expectation literature over the past 30 years. **Educational Research and Evaluation**, London, v. 24, n. 3-5, p. 124-179, 2018. https://doi.org/10.1080/13803611.2018.1548821

WEINER, Bernard. An attributional theory of achievement motivation and emotion. **Psychological Review**, Washington, DC, v. 92, n. 4, p. 548-573, 1985. https://doi.org/10.1037/0033-295X.92.4.548

WEINER, Bernard. **An attributional theory of motivation and emotion**. New York: Springer, 1986. https://doi.org/10.1007/978-1-4612-4948-1

WEINER, Bernard. **Social motivation, justice, and the moral emotions**. Mahwah: Lawrence Erlbaum, 2004.

WEINER, Bernard. The development of an attribution-based theory of motivation. **Educational Psychologist**, Philadelphia, v. 45, n. 1, p. 28-36, 2010. https://doi.org/10.1080/00461520903433596

XAVIER, Flávia Pereira; OLIVEIRA, Valéria Cristina de. Aprendizado, expectativas docentes e relação professor-aluno. **Estudos em Avaliação Educacional,** São Paulo, v. 31, n. 76, p. 76-103, 2020. https://doi.org/10.18222/eae.v31i76.6767

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