



Brazil

DATA MUST SPEAK

Unpacking Factors Influencing School Performance in Maranhão

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Unpacking Factors Influencing School Performance in Maranhão

State Department of Education in Maranhão
UNICEF Brazil
UNICEF Innocenti – Global Office of Research and Foresight



ARVATE

- ESCREVA UMA PALAVRA DE
- ESCREVA O SEU NOME
- ESCREVA A PRIMEIRA LETRA DE
- ESCREVA UM VOGAL
- ESCREVA UM CONSOANTE

A Z

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Executive summary

Executive summary

The Data Must Speak (DMS) Positive Deviance research aims to improve the equity and quality of education through the use of data by studying the practices and behaviours of ‘positive deviant’ schools – schools that outperform others despite operating in similar contexts and with equivalent resources. The analysis aims to inform practical recommendations on how to scale these practices and behaviours to lower-performing schools. This report presents the results of the first stage of the DMS research in Maranhão state in Brazil, which analyses different factors related to educational performance. The main findings and areas for further exploration based on the analysis are summarized below.



There is a positive correlation between the average time spent daily in school and individual student performance. The expansion of full-time education is considered a promising pathway in Brazil.¹

Given the costs related to the expansion of full-time education, it is important to analyse the extent to which its benefits depend on the grade and on the characteristics of students and schools, as well as which modalities are the most beneficial.

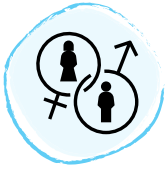


Maranhão has a high proportion of students who repeated a grade, but repeating does not seem to be sufficient to help students catch up. In 2019, 1 in 4 grade 5 students and more than one third of grade 12 students reported having already repeated a grade once. The data show that these students remain significantly behind in exam performance. It is key to understand what alternatives or complementary measures might be more effective in supporting students to remain on track.



Students enrolled in evening classes perform significantly worse than their peers, even after taking into account their socioeconomic background. In 2019, 1 in 4 grade 12 students in Maranhão attended evening classes. A more in-depth analysis of the factors that contribute to the lower performance of these students (such as financial problems, security issues and access to less qualified teachers, among others) can support the design of specific policies to help these students succeed in school.

¹ In Brazil, school hours have traditionally been divided into shifts (morning, afternoon and evening), with most students attending school in either the morning or the afternoon. In recent years, an increasing number of schools have started to offer full-time education, where students spend seven hours or more in school, and that often involves activities aimed at their holistic development.

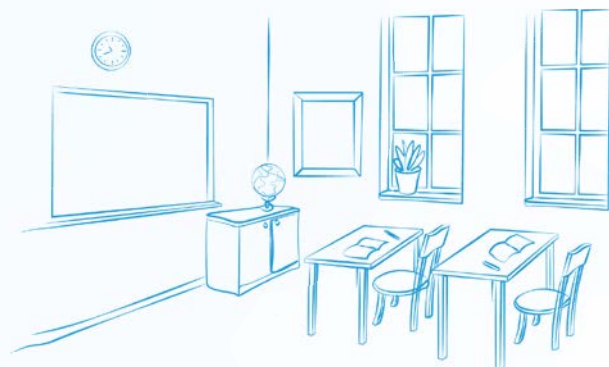


Significant inequalities in student performance exist in Maranhão, linked to students' gender, race and socioeconomic background. Both black students and students whose mothers did not complete secondary school perform worse on average in mathematics and Portuguese. Girls tend to perform worse than boys in mathematics but better than boys in Portuguese. Resource allocation strategies that consider student characteristics, which are being developed in Maranhão, and adapting teaching to take into account difficulties faced by specific groups of students can help reduce inequalities. Assessing unconscious biases, as well as the attitudes and behaviours that exist within the school and that can affect students with certain characteristics, is also essential for reducing inequalities.²



As students advance in the education system, they are less likely to achieve adequate learning.³ In 2019, 23 per cent of grade 5 students achieved adequate learning in mathematics, while this proportion was only 7 per cent for grade 12 students. Preventive measures, such as initiatives aiming to establish learning assessments, provide specific support for students with difficulties and address the important challenges posed by the COVID-19 pandemic. These measures should continue to play a key role in current educational policies.

In the next stages of the research, quantitative and qualitative data will be collected with the objective of understanding and analysing the practices and behaviours that characterize positive deviant schools. The analysis of the data collected will complement this analysis, providing a more complete picture of the different factors that influence the performance of Maranhão's schools.



² It is important to note that the gender and race of the students and the education of their mothers were analysed independently, revealing evidence, for example, that black students perform worse regardless of their socioeconomic status. Similarly, girls perform worse in mathematics regardless of their socioeconomic status. This can be linked to the attitudes and behaviours of teachers, students and school administrators, or even to unrepresentative teaching materials. Studies on these issues will be fundamental for future public policies.

³ The adequate learning criterion was defined based on the parameters established by [Todos Pela Educação](#), which defined the reference point for learning considered adequate to be the average of the Organisation for Economic Co-operation and Development (OECD) countries in its Programme for International Student Assessment (PISA). As such, students who obtained scores corresponding to levels 4, 5 or more on the *Sistema de Avaliação da Educação Básica* [Basic Education Assessment System] (Saeb) scale in Portuguese and mathematics were considered to be performing adequately.



1. Introduction: the Data Must Speak research in Maranhão



Introduction: the Data Must Speak research in Maranhão

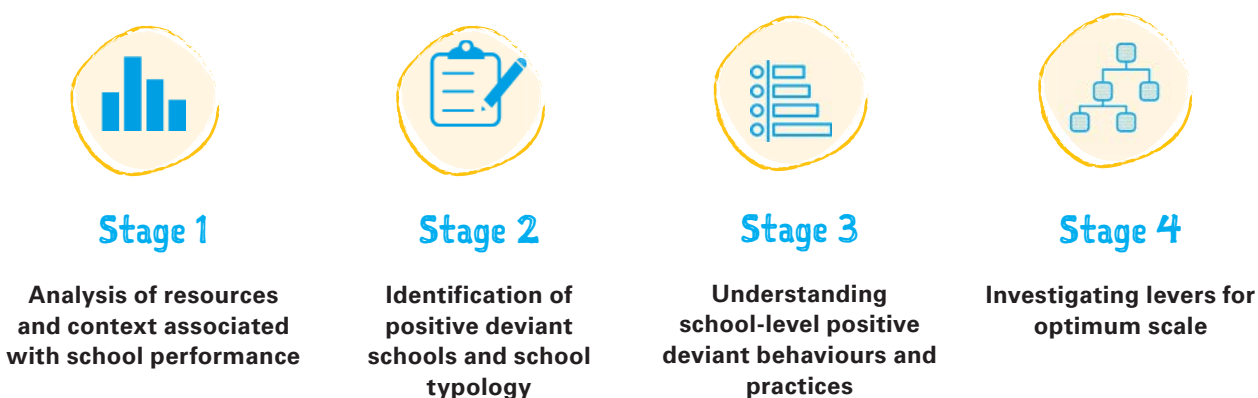
The Data Must Speak (DMS) initiative, launched in 2014, aims to improve the equity and quality of education through better use of data. Given the country's size and social and geographical diversity, the DMS research component began in Brazil in 2022 and focuses on the state of Maranhão, and is implemented jointly by UNICEF Innocenti – Global Office of Research and Foresight, UNICEF Brazil and the State Department of Education in Maranhão (SEDUC-MA).

The research aims to study the practices and behaviours of 'positive deviant' schools – schools that outperform others despite operating in similar contexts and with equivalent resources. This can inform practical recommendations on how to promote and scale these practices and

behaviours to lower-performing schools. The research thus aims to find local solutions to improve education quality in Maranhão and then to disseminate them to similar contexts around the country, contributing to improving the quality of education on a wider scale.

The DMS research is structured around four stages, shown in **Figure 1**. This study describes the first stage of the research, which consists of a quantitative analysis based on Brazilian administrative data that allows the identification of various factors correlated with educational outcomes in Maranhão. The different stages of the research are described in more detail in Appendix 1.

Figure 1: Stages of the DMS research



The different research activities are based on a participatory process, with the aim of making the research as relevant as possible. As such, a state advisory team was formed, whose role was to monitor and supervise the research, provide strategic guidance, validate the results and ensure their dissemination. In parallel, a small technical team was appointed by SEDUC-MA to jointly implement the research process and to prepare and analyse the administrative data.

The first stage of the research was implemented through a workshop held in December 2022 in São Luis, Maranhão, during which joint creation sessions were held with the teams mentioned. During these sessions, participants made important decisions regarding the analysis of administrative data, as well as essential methodological decisions for the implementation of the research.



2. The education system, current challenges and public policies

The education system, current challenges and public policies



1. Structure of the Brazilian education system

The current structure of basic education in Brazil is defined and regulated by the 1996 *Lei de Diretrizes e Bases da Educação Nacional* [Law of Directives and Bases of National Education]. This law states that basic education is compulsory and free for children and young people aged between 4 and 17, and is split into three stages: pre-primary education, primary education and secondary education (see **Table 1**). It also defines the system for collaboration between the federal government of Brazil, the states and the municipalities, establishing the responsibilities and obligations of each of these levels. Today, the education system in Brazil comprises both public and private

schools, and public schools can be run by the federal, state or municipal government.

Currently, federal schools are a minority in Brazil and generally have different characteristics to other public schools, such as better infrastructure and resources. Many offer technical and vocational education.

In Brazil as a whole, the majority of schools serving students in primary education are run by the municipalities, while the majority of schools offering secondary education are run by the states. In Maranhão, in particular, primary education is largely run by the municipalities: 87 to 88 per cent of schools serving students in the initial and final years of primary education are municipal, compared to 44 to 69 per cent in Brazil as a whole (see **Tables 2A and 2B**).⁴

Table 1: Structure of the Brazilian education system⁵

	Description	Years/ages
Pre-primary education	Nursery	0–3 years of age
	Preschool	4–5 years of age
Primary education	Early years/Basic I	Grades 1, 2, 3, 4 and 5 (6–10 years of age)
	Final years/Basic II	Grades 6, 7, 8 and 9 (11–14 years of age)
Secondary education		Grades 10, 11 and 12 (15–17 years of age)
Higher education	Universities, colleges and other higher education institutions	

Source: The authors of this report, based on information from the Ministry of Education.

⁴ In recent years, the proportion of primary school students enrolled at municipal schools has increased, but this figure has decreased for state schools, continuing a trend of decentralization of school management that began in the 1990s.

⁵ Mapping of the Brazilian system in relation to the UNESCO International Standard Classification of Education can be found at <<https://isced.uis.unesco.org/data-mapping>>.

Table 2A: Number of schools and percentage of registered students by type of school (initial years of primary education, 2022)

	Brazil		Maranhão	
	Schools	% enrolment	Schools	% enrolment
Private	23,673	19%	751	14%
Public				
Municipal	72,150	69%	7,543	85%
State	9,511	12%	258	1%
Federal	26	0%	2	0%

Source: 2022 School Census.

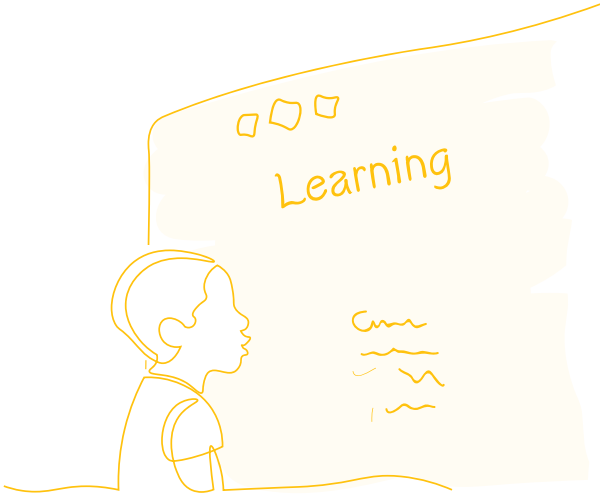
Note: Schools with at least one student enrolled in the initial years of primary education are considered.

Table 2B: Number of schools and percentage of registered students by type of school (final years of primary education, 2022)

	Brazil		Maranhão	
	Schools	% enrolment	Schools	% enrolment
Private	14,405	16%	446	9%
Public				
Municipal	29,143	44%	3,688	88%
State	18,198	40%	127	3%
Federal	39	0%	2	0%

Source: 2022 School Census.

Note: Schools with at least one student enrolled in the initial years of primary education are considered.





2. Current challenges and public policies

In recent decades, Brazil has made progress in terms of school enrolment figures and the level of schooling of its population. In 2022, 69 per cent of people aged 14 and over had completed primary education, compared to 63 per cent in 2016.⁶ Primary education is close to being universal, with 99.4 per cent of children aged 6–14 attending school in 2022.⁷ Improvements have also been seen in learning, especially among students in primary education. Between 2011 and 2019,⁸ the percentage of grade 5 students in the public education system with adequate Portuguese skills in the Saeb test rose from 36 per cent to 57 per cent.⁹

However, despite the progress made in terms of access to and quality of education, the level of student learning remains relatively low compared to other countries. According to 2018 PISA data, only 26.5 per cent of the Brazilian students assessed had an adequate level of learning in reading, compared to 52.5 per cent in OECD countries.¹⁰ In addition, the average performance of students in mathematics, reading and science did not improve significantly between 2009 and 2018.¹¹

These figures hide significant inequalities between students relating to their socioeconomic conditions, race and geographical location. The difference in the percentage of students with adequate learning according to 2018 PISA data, comparing students from the highest and lowest socioeconomic levels (top and bottom thirds), is 44 percentage points. A recent UNICEF study indicates that the majority of out-of-school children (2.7 per cent

of children aged between 4 and 17 in 2019) are black, brown or indigenous and that this proportion is higher in the North and Midwest regions.¹² Other challenges facing Brazilian schools include the high dropout rate of secondary school students, the need to improve the quality of initial and continuing teacher training, and the need to make teaching more attractive as a career.

Significant effort has been made in recent years, through federal, state and municipal policies, to improve learning and student retention and to reduce inequalities in education. Some examples include the programme for the early childhood development of children aged 0 to 6 in socially vulnerable situations (the *Criança Feliz* [Happy Child] programme), the expansion of full-time secondary education and the continuation of the *Fundo de Manutenção e Desenvolvimento da Educação Básica* [Basic Education Maintenance and Development Fund]. In 2018, the *Base Nacional Comum Curricular* [Common National Curriculum Base]¹³ was also implemented, which sets out the skills and competencies that students should acquire in each part of the curriculum and in each school year. This allows for more consistency in learning throughout the country.

The COVID-19 pandemic has brought immense additional challenges to education in Brazil, which had one of the longest school closures of all countries around the world, at 40 weeks.¹⁴ Despite the authorities' efforts to keep students connected to learning during this period through remote learning and hybrid learning (which combines face-to-face and remote learning), many students struggled to keep up with lessons, partly due to difficulties in

⁶ Data from the Brazilian Institute of Geography and Statistics.

⁷ *Pesquisa Nacional por Amostra de Domicílios Contínua Anual – 2º trimestre* [Annual Continuous National Household Sample Survey – second quarter], Brazilian Institute of Geography and Statistics.

⁸ When preparing the report, we worked with the most recent data available, such as the 2021 Saeb findings.

⁹ Data from *Todos Pela Educação* (2021). See footnote 3 for a definition of adequate learning criteria.

¹⁰ The OECD currently includes 38 member countries and is responsible for implementing PISA, which is aimed at 15-year-old students.

¹¹ See <www.oecd.org/pisa/publications/PISA2018_CN_BRA.pdf>.

¹² United Nations Children's Fund, 2021.

¹³ See <<http://basenacionalcomum.mec.gov.br>>.

¹⁴ *Todos Pela Educação*, 2021.

accessing the required technology. Different studies have shown that the level of learning dropped significantly compared to previous years and that the dropout rate increased; Saeb data show a fall in student performance to levels below those seen in 2017.¹⁵

The state of Maranhão, in the Northeast region, faced similar challenges to the rest of Brazil, exacerbated by the fact that it is one of the poorest states in the country and has lower-than-average educational indicators.¹⁶ In 2021, less than 20 per cent of public school students finished primary education with adequate Portuguese learning in Maranhão, compared to 31 per cent in Brazil as a whole. In Maranhão, 20 per cent of students aged 16–17 were out of school in 2020, compared to 9 per cent nationally.¹⁷ Data from the 2021 School Census also indicate that the proportion of students who had difficulties accessing adequate equipment to support their remote learning during the pandemic was higher in Maranhão than in the rest of the country.

Since before the pandemic, SEDUC-MA has been implementing initiatives to improve the quality of education in the state. One important initiative is the *Escola Digna* [Dignified Schooling] educational policy, implemented in 2015.¹⁸ The objectives of this policy are: (i) to ensure that all students in Maranhão are literate in Portuguese and mathematics at the right age; (ii) to reduce age-grade distortion in basic education; and (iii) to raise the Basic Education Development Index, made up of Saeb scores and promotion rates.

A key axis of the Dignified Schooling policy is the *Pacto pela Aprendizagem* [Pact for Learning], which consists of a series of strategic actions focused on collaboration between the state and the municipalities of

Maranhão. Strengthening the collaboration system has driven major efforts on the part of SEDUC-MA and has been one of the priority approaches taken to improve the quality of education in the state. The programme's actions include policies aimed at training and qualifications for education professionals, enhancing school infrastructure and improving educational indicators.

As part of the Dignified Schooling programme, SEDUC-MA has also been developing the *Sistema Estadual de Avaliação do Maranhão* [Maranhão State Evaluation System] (SEAMA), which aims to monitor student's academic performance and support educational policies in the state. SEAMA makes it possible to monitor information such as the percentage of students taking a test, student performance in mathematics and Portuguese, the distribution of students by performance standard, the percentage of correct answers per skill and a socioeconomic indicator.

The tests are aimed at students in the state and municipal systems enrolled in grades 2, 5, 9 and 12. The evaluation is carried out in two stages: one at the beginning of the school year, to identify the students' learning gaps, and another at the end of the school year to identify the learning that has been consolidated over the year. The results are available based on both the item response theory, the same methodology used by Saeb, and the classical test theory, which is based on the students' right and wrong answers.

The SEAMA indicators also help to train education professionals to use the findings for teaching, support the planning of actions aimed at learning recovery, monitor and support the equity and quality of teaching and learning, and increase successful practices in the development of learning.

¹⁵ The participation rate in the Saeb test was lower in 2021 than in previous years (86 per cent, compared to 94 per cent in 2019). As a result, these findings may not accurately portray students' performance over the period.

¹⁶ Maranhão placed last in the Atlas of Human Development in Brazil's human development index ranking of Brazilian states in 2022 (see <www.atlasbrasil.org.br/ranking>).

¹⁷ See <<https://qedu.org.br>>.

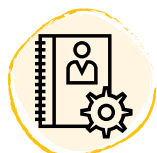
¹⁸ See <www.educacao.ma.gov.br/escola-digna>.



3. Data and methodology

1. Datasets

This analysis of the factors associated with school performance in Maranhão is based on the following databases:¹⁹



Saeb for the years 2015, 2017, 2019 and 2021. Saeb is a census assessment carried out every two years by the Anísio Teixeira National Institute for Educational Studies and Research (INEP), with the aim of evaluating the quality of education through standardized tests focused on reading and mathematics. It enables the creation of educational indicators and diagnoses aimed at improving public policy on education in Brazil. The Saeb databases provide socioeconomic information and data on the individual test performance of students in grades 5, 9 and 12.²⁰ As well as information about the students, the Saeb databases also contain information about the schools, head teachers and teachers of the subjects tested (Portuguese and mathematics).

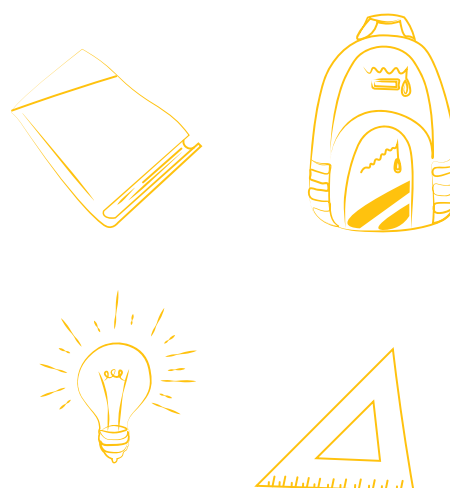


School Census for 2015, 2017, 2019 and 2021. The School Census databases include information on schools, such as

infrastructure, enrolment and teachers. INEP also provides school-level indicators calculated from data from the School Census, such as the repetition rate, promotion rate and dropout rate.

This study focuses on the public schools in Maranhão that took part in the Saeb assessment and are included in the School Census databases.²¹

The information contained in the different Saeb and School Census databases is presented in Appendix 2 and the process of preparing and connecting the different databases is detailed in Appendix 3.



¹⁹ In this study, it was not possible to use data from SEAMA, the new evaluation system introduced in Maranhão in 2019. At the time this report was written, representative data for all of Maranhão's municipalities were only available for 2021. Recent changes in Brazilian data protection legislation have also posed challenges in terms of access to data.

²⁰ The Saeb databases also include students in grade 13 in some states. Only students in grade 12 at traditional secondary schools were considered in this study.

²¹ In 2015 and 2017, the criteria adopted for schools to take part in the Saeb test was having at least 20 students enrolled in the grades assessed. In 2019 and 2021, the criteria changed to a minimum of 10 students taking the test and participation of at least 80 per cent and 50 per cent, respectively, of those enrolled according to the School Census. In both cases, very small schools, which represent approximately 10 per cent of all schools in Maranhão, are excluded from the analysis. Federal schools are excluded from the analysis because they have different characteristics and represent less than 1 per cent of enrolments in all the years considered.



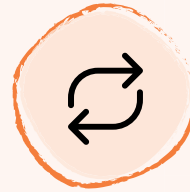
2. Performance indicators



The performance indicators considered in this study are presented below:



Saeb student performance in Portuguese and mathematics: this indicator shows the student's score on the Saeb proficiency scale in Portuguese and mathematics.



School repetition rate: this indicator shows, for each school year, the percentage of students who did not meet the criteria for completing that stage of education at the end of the school year.



School promotion rate: this indicator shows, for each school year, the percentage of students who successfully completed the school year with satisfactory grades and attendance.



School dropout rate: this indicator shows the percentage of students who stopped attending school during the school year (after the School Census reference date).



3. Methodology

3.1.1 Estimated model

To analyse the correlations between the different explanatory variables (characteristics of students, schools, head teachers and teachers) and school performance, this study employs linear regressions. Analyses using Saeb test scores are based on observations at the student level, and analyses based on performance indicators (promotion, repetition and dropout rates) are based on aggregate observations at the school level.²²

In the models with student-level data, stacked data are used with different groups of individuals for each year (i.e., it is not possible to follow the same student over time). In the models with school-level data, it is possible to observe the same school over time, despite changes in the composition of schools due to closures or the municipalization process.

3.1.2 Selection of explanatory variables

The explanatory variables were selected according to different criteria. Firstly, in collaboration with SEDUC-MA and other partners, the explanatory variables were selected according to their relevance in the context of Maranhão and its public policies to explain the performance variables considered. Secondly, the explanatory variables considered in the model must have sufficient variability to be informative (if a

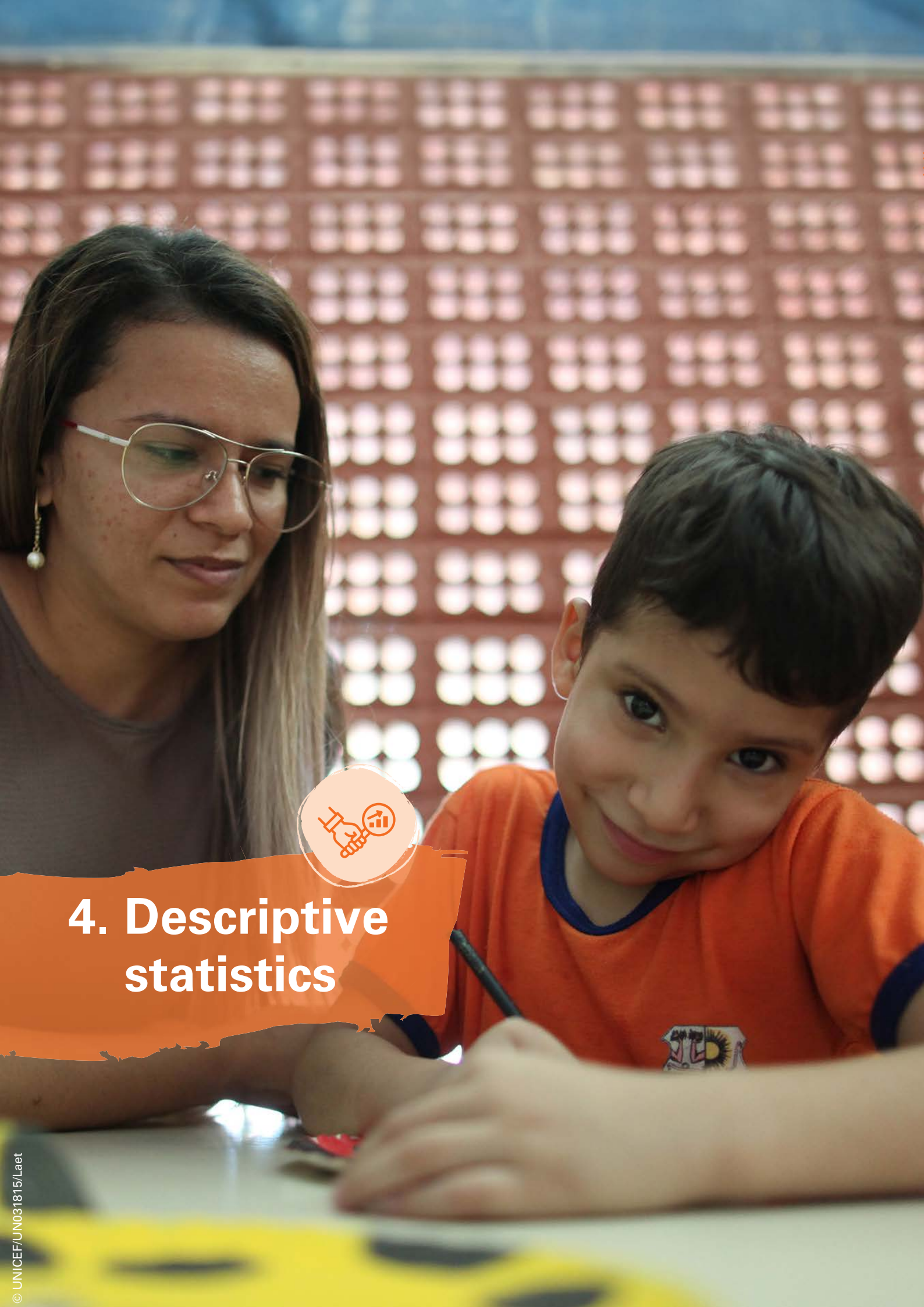
very small number of schools have a certain characteristic or infrastructure, for example, it will be challenging to estimate the coefficient of these characteristics). Thirdly, including variables in the model that vary very similarly to each other would also make it difficult to estimate their coefficients. For example, there is a reasonable correlation in the data between the total number of years of experience of a teacher and the number of years of experience of the same teacher in the current school. Thus, including these two variables simultaneously in the model makes it difficult to interpret the coefficients in question.

Finally, it is important that the variables selected are not dependent on subjective evaluations. Some questions in the Saeb questionnaire for head teachers and teachers, for example, are based on the subjective assessment of the person being interviewed. Given that the answers to these questions can be influenced by the individual characteristics and experience of the interviewees, the inclusion of variables of this type does not allow for a precise estimation of their coefficients.

3.1.3 Robustness tests

In order to check whether the results obtained are robust to different choices for the estimated models, regressions were carried out using alternative models. These results are described in detail in Appendix 7.

²² The equations estimated at school level are of the form $Y_{jt} = f(x_{(jt1)}, x_{(jt2)}, x_{(jt3)}, \dots, x_{(jtn)})$, where Y_{jt} designates the performance variable considered for school j and year t , and $x_{(jt1)}, x_{(jt2)}, x_{(jt3)}, \dots, x_{(jtn)}$ designate the explanatory variables for the school considered. The equations estimated at student level are of the form $Y_{ijt} = f(x_{(ijt1)}, x_{(ijt2)}, x_{(ijt3)}, \dots, x_{(ijtn)})$, where Y_{ijt} designates the performance variable considered for student i , school j and year t , and $x_{(ijt1)}, x_{(ijt2)}, x_{(ijt3)}, \dots, x_{(ijtn)}$ designate the explanatory variables for the student and school considered.



4. Descriptive statistics



1. Performance variables

The proportion of students with an adequate level of learning decreases significantly as students progress through the education system.²³ In 2021, 31 per cent and 18 per cent of grade 5 students achieved adequate performance in Portuguese and mathematics, respectively, but these figures are lower for grade 12 students, at 17 per cent and 5 per cent, respectively (see Figure 2).

At the same time, the COVID-19 crisis and resulting school closures had a negative effect on student performance. There was a drop in student performance in 2021, to levels similar to those for 2017, following consecutive increases in previous years (see Figure 2). It is important to note that this drop may be underestimated, given that in 2021 there was an increase in dropout rates and a fall in the Saeb test participation rate, as the most vulnerable students with the greatest difficulties are the ones most likely to drop out of school.

On average, girls perform better than boys in Portuguese but slightly worse than boys in mathematics. In 2021, 38 per cent and 17 per cent of girls in grade 5 obtained adequate performance in Portuguese and mathematics, respectively; these figures were 25 per cent and 19 per cent, respectively, for boys. There are also differences between students in terms of performance according to race. In grade 5, the proportion of black students who obtained adequate proficiency in the Saeb was around 10 percentage points lower than that of other students in the two subjects considered. This gap narrows in later years, and one possible explanation could be linked to the higher dropout rates among the lowest-performing black students.

The most significant differences in performance are observed between students from schools with a lower socioeconomic level indicator and other students.²⁴ In 2021, 17 per cent of grade 5 students in schools with the lowest socioeconomic index (a socioeconomic level indicator of 1 and 2) obtained adequate performance in Portuguese, while 10 per cent did so in mathematics. For the rest of the students, these proportions were 35 per cent and 20 per cent, respectively. **Figures A3 to A5 in Appendix 4** show the performance of students in 2021 according to the gender and race of the students and the socioeconomic level of the schools.

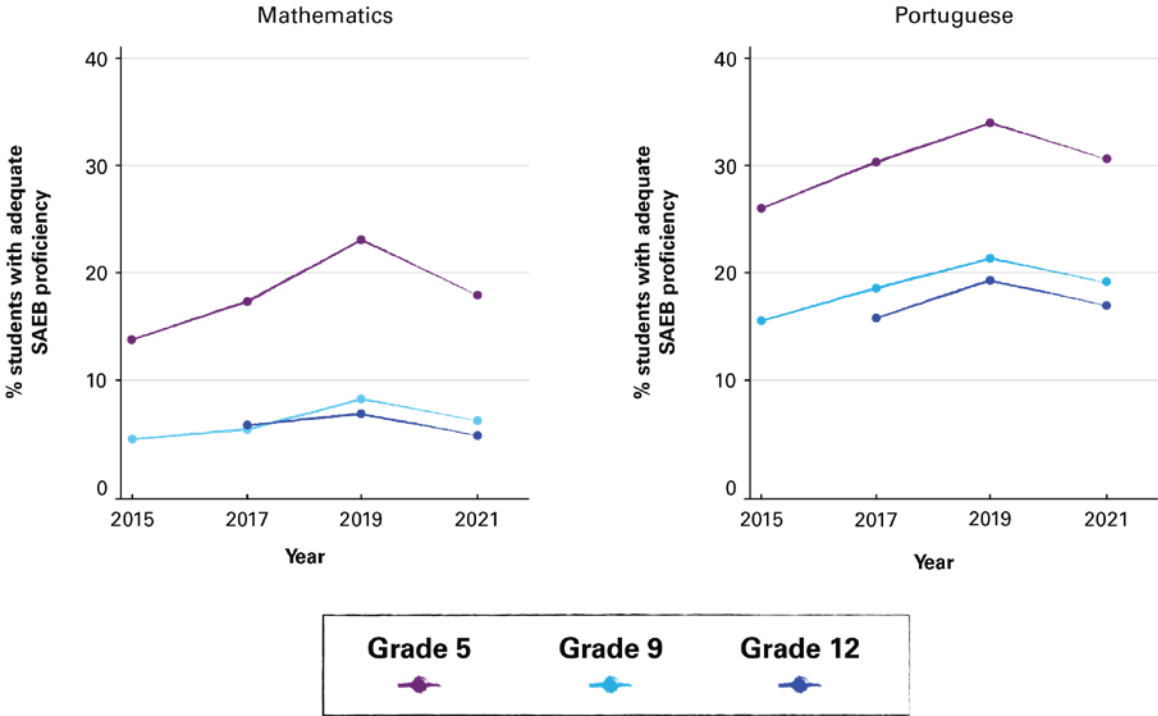
As expected, the average dropout rates are considerably higher among students in later school years. In 2019, the dropout rates for grade 9 and grade 12 students, at 4.7 per cent and 3.8 per cent, respectively, were more than double the rate for grade 5 students (1.5 per cent). On the other hand, the repetition rates of grade 5 students are higher than those of students in later years. Promotion rates are similar for the different school years considered, standing at around 90 per cent (see Table 3).

The average dropout rates in Maranhão had been falling for all the school years considered until the COVID-19 crisis. The dropout rate for grade 12, which is the grade most affected by the problem, fell significantly between 2015 and 2019, from 7.2 per cent to 3.8 per cent. In 2021, dropout rates increased again for all school years and in particular for grade 12, exceeding those observed in 2015. Repetition rates fell and promotion rates increased over the period considered for grades 5 and 9. However, the 2021 data should be interpreted with caution due to the impact of the pandemic on the repetition criteria adopted by schools.

²³ See footnote 3 for a definition of adequate learning criteria.

²⁴ In 2021, the socioeconomic level indicator was calculated using eight levels, with the last level corresponding to the highest socioeconomic level. The schools in the sample considered were distributed among the first five levels in 2021.

Figure 2: Maranhão’s Saeb performance by year



An analysis of the distribution of repetition rates by calendar year and school year provides a better understanding of schools’ repetition practices and the changes that have taken place since the pandemic. In general, there is a high proportion of schools with a repetition rate of 0 per cent in the period observed – in other words, no students repeated a year in the school years considered. Between 2015 and 2019, 50–60 per cent of schools in Maranhão had no grade 5 students that had to repeat the year, and around 60 per cent of schools had no grade 9 students that had to repeat the year, possibly due to the cycle policies defined by the

municipalities. These figures are lower for grade 12: 30–40 per cent of schools had no students that had to repeat the year between 2015 and 2019. In 2021, there was a clear increase in the proportion of schools with no students having to repeat the year, reaching 80 per cent of public primary schools and almost 50 per cent of public secondary schools in Maranhão. This jump highlights the effects of the COVID-19 pandemic on the guidelines adopted in the period with regard to students repeating years and emphasizes the importance of exercising caution when analysing and interpreting data from 2021.²⁵

²⁵ As mentioned in United Nations Children’s Fund and CENPE (2021), the 2020 school flow results are not comparable to the indices of previous years and are the result of measures adopted in response to the pandemic.

Table 3: Performance indicators in Maranhão (%)

	2014–2015	2015–2016	2016–2017	2017–2018
Grade 5				
Dropout rate	2.6	2.4	1.5	1.8
Promotion rate	88	88	90	95
Repetition rate	9.6	9.3	8.2	3.6
Grade 9				
Dropout rate	6.1	6.0	4.7	5.4
Promotion rate	89	89	91	93
Repetition rate	5.0	5.0	4.3	2.0
Grade 12				
Dropout rate	7.2	5.4	3.8	7.5
Promotion rate	87	90	93	89
Repetition rate	5.4	4.6	3.3	3.3

Source: Indicators produced by INEP based on the School Census.

Note: The indicators presented correspond to all municipal and state schools in Maranhão, regardless of whether they took part in the Saeb/Prova Brasil test. As such, this sample differs slightly from the one considered in the analysis, as it includes small schools that do not take part in the Saeb test. This decision was made in order to show the evolution of the indicators between 2015 and 2021, given that few secondary schools took part in the Saeb in 2015, and that it was not possible to merge the Saeb and School Census databases in 2021. The total number of schools varies between 7,811 and 6,786 for grade 5, between 3,432 and 3,480 for grade 9 and between 759 and 788 for grade 12 depending on the year and indicator considered.



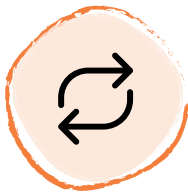
2. Explanatory variables

The following are the main characteristics of the students, schools, head teachers and teachers of the Maranhão schools included in the sample for analysis (see **Tables 4 to 7**). The statistics for teachers apply to those who teach the subjects tested by Saeb and not to all the teachers at the school.²⁶



The majority of students have parents who have not completed secondary school (only 41 per cent of the mothers of grade 5 students had completed secondary school in 2021), although this proportion has increased since 2015. In general, students' mothers are more likely to have finished secondary school than their fathers.²⁷

Student characteristics



The proportion of students who have already repeated a year is high, with 1 in 4 of those in grade 5 indicating that they had repeated a year in the 2019 Saeb questionnaire. This figure reached 37 per cent for secondary school students in 2019. However, there is a downward trend in the proportion of students who have repeated a grade over the years.



The student participation rate in the Prova Brasil exam is high (around 90 per cent), but there was a significant drop of 8 to 10 percentage points depending on the school year considered. This means that the composition of participating students in 2021 may differ from previous years, and this year's data should therefore be interpreted with caution.



There is a gender balance in enrolment, with a similar percentage for both girls and boys, but the figure does increase slightly for girls as schooling progresses.



The proportion of students enrolled in evening classes, which is low for primary school students in general and close to zero for grade 5 students (not shown in the table), reached 25 per cent for grade 12 students in 2019.

²⁶ Students in grades 9 and 12, in particular, have additional teachers for other subjects.

²⁷ The data on the education of the parents of grade 5 students should be interpreted with caution, since fewer than half of the students answered this question in some years, and there may be some selection bias among those who did answer. However, the findings of models based on the sub-sample of students who answered the questions about their parents' level of education do not suggest that this selection bias affects the overall conclusions of the model.

Table 4: Characteristics of Maranhão students (Saeb)

	2015	2017	2019	2021
Grade 5				
% who are girls	49	49	–	47
% who are black	12	15	14	16
% who have a computer	31	27	30	28
% who have already repeated a year	30	27	25	22
% whose mother completed secondary school	35	37	43	41
% whose father completed secondary school	30	32	43	38
Total number of students	80,152	79,434	87,466	79,369
Prova Brasil participation rate	89	93	94	86
Total number of schools	1,802	2,136	2,253	2,490
Grade 9				
% who are girls	53	52	–	51
% who are black	12	12	13	15
% who have a computer	32	27	31	29
% who have already repeated a year	37	35	29	27
% whose mother completed secondary school	37	41	51	52
% whose father completed secondary school	29	32	43	42
% evening classes	4	2	1	–
Total number of students	71,263	57,946	72,396	81,516
Prova Brasil participation rate	86	91	92	82
Total number of schools	1,432	1,465	1,732	2,197
Grade 12				
% who are girls	–	56	–	54
% who are black	–	13	14	16
% who have a computer	–	26	30	32
% who have already repeated a year	–	36	37	30
% whose mother completed secondary school	–	39	47	51
% whose father completed secondary school	–	28	36	40
% evening classes	–	29	25	–
Total number of students	–	43,413	66,067	62,212
Prova Brasil participation rate	–	88	91	82
Total number of schools	–	454	612	714

Note: Data from Saeb databases. The sample considered includes municipal and state schools in Maranhão between 2015 and 2019. The 2021 Saeb data do not allow the type of school ownership (federal, state or municipal) to be identified and therefore include all public schools. For grades 5 and 9, the proportion of municipal schools varied between 97 per cent and 100 per cent between 2015 and 2019; for grade 12, 100 per cent of the schools considered were state schools in the same period.

2.3.1 School characteristics



Half of the schools serving grade 5 students in Maranhão and a third of the schools serving grade 12 students are **located in rural areas**. This proportion has increased over time for primary schools (almost all of which are municipal schools).



According to data from the School Census, the **average number of students enrolled** in grades 5 and 9 per school (38 and 46, respectively, in 2021) has been decreasing over time.



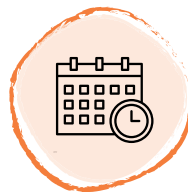
There was a **significant increase in the number of schools in the sample** over time, reaching an almost 40 per cent increase between 2015 and 2021 for schools serving grade 5 students. This trend may be linked both to the process of education becoming more municipality-run and to the construction of new schools.



There has been a **significant increase in the proportion of schools with internet and broadband**. Among those teaching grade 5, the proportion of schools with internet increased by almost 20 percentage points, from 56 per cent in 2015 to 75 per cent in 2021. The increase in the proportion of schools with internet has been more significant in rural schools since 2019, while the increase in the existence of broadband has been similar in urban and rural areas.



The **pupil-teacher ratio**, which indicates the average number of students per teacher, is around 20 in grade 5, with a slight increase over the period observed.²⁸



The **average time students spend at school** is around four hours a day, but is slightly more for grade 12 students.²⁹

²⁸ The pupil-teacher ratio is shown only for grade 5 students, as older students tend to have different teachers for different subjects. This indicator is calculated from Saeb data; data from the School Census provide similar information.

²⁹ Data available for 2015 to 2019. This variable is not available at the individual level for students who took part in Saeb but can be calculated for each school based on School Census data.

Table 5: Characteristics of Maranhão schools (Census and Saeb)

	2015	2017	2019	2021
Grade 5				
% rural	33	49	49	50
% municipal	98	99	100	–
Average number of students enrolled	51	40	40	38
Pupil-teacher ratio	19	17	23	23
% with a teachers' lounge	50	45	48	48
% with a head teachers' lounge	70	65	66	67
% with a covered patio	51	51	54	58
% with a library	28	20	17	18
% with a dining hall	13	11	12	14
% with internet	56	49	60	75
% with broadband	44	36	81	79
Average time at school (hours)	4.2	4.2	4.3	–
Total number of schools	1,802	2,136	2,253	2,490
Total number of municipalities	217	216	215	217
Grade 9				
% rural	38	52	53	57
% municipal	92	95	97	–
Average number of students enrolled	59	44	44	46
% with a teachers' lounge	63	57	58	57
% with a head teachers' lounge	75	73	71	70
% with a covered patio	53	54	57	60
% with a library	37	27	22	23
% with a dining hall	15	14	14	14
% with internet	59	54	65	76
% with broadband	46	39	82	77
Average time at school (hours)	4.2	4.2	4.4	–
Total number of schools	1,432	1,465	1,732	2,197
Total number of municipalities	217	208	215	217

Grade 12

% rural	–	33	28	33
% municipal	–	0	0	–
Average number of students enrolled	–	109	116	109
% with a teachers' lounge	–	76	80	82
% with a head teachers' lounge	–	85	89	88
% with a covered patio	–	54	61	65
% with a library	–	49	54	58
% with a dining hall	–	10	13	17
% with internet	–	69	75	78
% with broadband	–	55	88	85
Average time at school (hours)	–	4.5	4.6	
Total number of schools	–	454	612	714
Total number of municipalities	–	190	214	217

Note: Data from the School Census databases for the sample of schools considered in the study (those present in the Saeb databases). The sample includes municipal and state schools in Maranhão between 2015 and 2019. The 2021 Saeb data do not allow the type of school ownership (federal, state or municipal) to be identified and therefore include all public schools. It was not possible to merge the School Census and Saeb databases in 2021. Thus, for the variables coming from the School Census in 2021, the statistics presented are based on all public schools with more than 50 students enrolled in the corresponding cycle (initial or final years of primary school and secondary school), in an attempt to bring the sample closer to that used in previous years and exclude very small schools that did not take part in the Saeb test.

Characteristics of head teachers and teachers³⁰



The data show a high proportion of women among head teachers and teachers of schools serving grade 5 students in Maranhão (77 per cent and 78 per cent in 2021, respectively). However, this proportion drops considerably in later years, reaching 57 per cent and 50 per cent, respectively, for the head teachers and teachers of schools providing secondary education.



In Brazil, teachers who teach grades 5 and 9 must have a higher education degree. Information on the percentage of teachers with higher education in Maranhão indicates that 84 per cent of grade 5 teachers had higher education in 2017. This proportion was even higher among grade 9 teachers, at 95 per cent.

³⁰ The teachers included in the sample are those responsible for the subjects tested by Saeb (Portuguese and mathematics).



Secondary school head teachers and teachers have, on average, more years of experience in teaching activities compared to primary school head teachers and teachers, although these differences are moderate.



The vast majority of teachers have a permanent contract³¹ (between 69 per cent and 78 per cent in 2021, depending on the school year considered), and this proportion has been increasing since 2015.

Table 6: Characteristics of Maranhão head teachers (Saeb)

	2014–2015	2015–2016	2016–2017	2017–2018
Grade 5				
% who are women	79	78	–	77
% who are black	11	10	10	11
Age	43	42	–	44
Years of experience – head teacher	6	5	7	–
Years of experience – teacher	11	11	13	14
Total number of schools	1,802	2,136	2,253	2,490
Grade 9				
% who are women	72	72	–	69
% who are black	10	9	10	11
Age	43	43	–	44
Years of experience – head teacher	6	5	7	–
Years of experience – teacher	11	12	13	14
Total number of schools	1,432	1,465	1,732	2,197
Grade 12				
% who are women	–	57	–	57
% who are black	–	13	10	12
Age	–	45	–	48
Years of experience – head teacher	–	5	7	–
Years of experience – teacher	–	13	15	16
Total number of schools	–	454	612	714

Note: Data from Saeb databases. The sample considered includes municipal and state schools in Maranhão between 2015 and 2019. The 2021 Saeb data do not allow the type of school ownership (federal, state or municipal) to be identified, so the 2021 Saeb statistics include all public schools. For grades 5 and 9, the proportion of municipal schools varied between 97 per cent and 100 per cent between 2015 and 2019; for grade 12, 100 per cent of the schools considered were state schools in the same period.

³¹ Teachers with permanent contracts are ‘statutory’ teachers, hired after passing a public examination, who can only be dismissed with just cause.

Table 7: Characteristics of Maranhão teachers – subjects tested in the Saeb

	2014–2015	2015–2016	2016–2017	2017–2018
Grade 5				
% who are women	84	79	–	78
% who are black	14	13	13	14
Age	39	40	–	42
% with higher education	81	84	–	–
Years of teaching experience in general	13	13	14	15
Years of teaching experience at this school	6	6	7	7
% with a permanent contract	60	60	73	74
Total number of schools	1,802	2,136	2,253	2,490
Grade 9				
% who are women	59	61	–	54
% who are black	13	14	14	16
Age	39	40	–	42
% with higher education	95	95	–	–
Years of teaching experience in general	14	14	15	16
Years of teaching experience at this school	6	6	8	8
% with a permanent contract	74	70	79	78
Total number of schools	1,432	1,465	1,732	2,197
Grade 12				
% who are women	–	–	–	50
% who are black	–	–	14	15
Age	–	–	–	43
% with higher education	–	–	–	–
Years of teaching experience in general	–	–	15	17
Years of teaching experience at this school	–	–	8	8
% with a permanent contract	–	–	76	69
Total number of schools	–	–	612	714

Note: Data from Saeb databases. The sample considered includes municipal and state schools in Maranhão between 2015 and 2019. The 2021 Saeb data do not allow the type of school ownership (federal, state or municipal) to be identified, so the 2021 Saeb statistics include all public schools. For grades 5 and 9, the proportion of municipal schools varied between 97 per cent and 100 per cent between 2015 and 2019; for grade 12, 100 per cent of the schools considered were state schools in the same period. The statistics presented refer to teachers of the subjects tested in the Saeb exam (Portuguese and mathematics).





5. Results



Results



1. Results using student-level data

Below are the results of the models whose outcome variable is individual performance in the Saeb test in Portuguese and mathematics, for students in grades 5 and 9 (see **Tables 8 and 9**). These models use year and municipality fixed effects in order to take into account unobservable factors specific to each year and municipality that could affect the results. Saeb performance is transformed so that the model coefficients can be interpreted in terms of standard deviation.³² Three models using different periods are estimated: for the period 2015–2019, in which variables such as gender of students, head teachers and teachers are not included because they are not available for 2019; for the period 2015–2017, which allows the inclusion of a greater number of variables; and for 2021, which does not allow the inclusion of infrastructure variables (as it was not possible to merge the 2021 School Census and Saeb databases) and which should be interpreted with caution due to the impacts related to the COVID-19 crisis.



Student characteristics

On average, girls perform better in Portuguese than boys in both school years (0.2 to 0.3 standard deviations). However, girls show a disadvantage in mathematics in grade 9 compared to boys (between 0.2 and 0.3 standard deviations less).

On average, black students have lower outcomes in both grade levels and subjects.

This difference is more significant among grade 5 students.

There is significant correlation between the level of education of the student's mother and the student's performance. Students whose mothers have completed secondary school perform better on average than others (between 0.3 and 0.5 standard deviations for grade 5 and between 0.2 and 0.3 standard deviations for grade 9).

There is strong negative correlation between a student having already repeated a year and their performance (-0.4 to -0.6 standard deviations depending on the school year).

Global evidence has consistently shown that investment in early childhood education has a positive effect on students' school trajectory, as the first years of life are fundamental for cognitive development.³³ In Brazil, evidence has also shown positive associations between preschool attendance and student learning in subsequent years.³⁴ Although the DMS analysis shows a negative correlation between preschool attendance and student performance among grades 5 and 9, these results should be interpreted with caution, as they may be related to other unobservable characteristics of the model, such as parents' education or the quality of the preschool. There could also be selection bias in the sample observed.

For grade 9 students, attending classes in the evening has a negative correlation with performance. This may partly reflect the specific difficulties faced by these students, such as the need to work during the day, greater difficulty in accessing school in general and problems of insecurity.³⁵ Descriptive statistics disaggregated by shift also show that students studying in

³² For each observation, subtract the mean and divide the result by the standard deviation of the sample considered. This method makes it possible to compare the coefficients obtained in different studies that use grades as the outcome variable, given that the scales used vary from one context to another.

³³ Vindrola et al., 2023.

³⁴ De Felício and Vasconcellos (2007) and Curil and Menezes-Filho (2009) obtained positive student learning results from preschool.

³⁵ The shift variable was not included in the grade 5 models because the number of students in this situation is very small.

the evening have teachers with different characteristics, including fewer women and fewer teachers who have attended higher education. Although these characteristics were controlled for in the models, there may be other differences in the composition of evening-shift teachers that cannot be observed in the data but that influence performance.



School characteristics

On average, students from rural schools perform worse in Portuguese and mathematics in the Saeb test (between -0.1 and -0.3 standard deviations according to the model). This also seems to be the case for schools in distinctive locations (indigenous land, settlement area or quilombo remnant community)³⁶ that offer grade 9, although these differences are more modest. Conversely, schools in distinctive locations that offer grade 5 perform slightly better.

There are no clear differences in performance between municipal and state schools that offer grade 5, but state schools that offer grade 9 perform better on average than municipal schools (around 0.1 standard deviations).

In general, school infrastructure (existence of a library, dining hall, teachers' lounge, sports field, etc.) does not seem to play an important role in the performance of grade 5 students. For grade 9 students, there is a positive but modest correlation between performance and the existence of a teachers' lounge and dining hall.

There is also a positive but modest correlation between the school having internet access and the performance of grade 9 students (between 0.05 and 0.06 standard deviations in the models using data from 2015–2019).

The average time students spend at school has a positive correlation with performance, particularly in grade 9. The results indicate that students spending an extra hour at school, on average, correlates with better individual performance (between 0.07 and 0.1 standard deviations). The positive coefficients observed may be related both to the longer time spent at school and to the fact that these students have access to different activities.



Characteristics of head teachers and teachers³⁷

Schools with female head teachers performed better on average than the others between 2015 and 2017, although this difference is modest (between 0.03 and 0.04 standard deviations higher).³⁸ This positive correlation was not observed in 2021, which may be related to the changes caused by the COVID-19 pandemic and differences in the relationship between head teachers, students and teachers in the different periods, as well as the aforementioned limitations in the 2021 data.

³⁶ Schools in distinctive locations are those that are in one of the following categories defined by the School Census: indigenous land, settlement area, quilombo remnant community and/or sustainable use unit.

³⁷ Teacher characteristics are aggregated at class level.

³⁸ There is emerging evidence from nine DMS countries showing a positive association between the presence of female head teachers and educational outcomes. For more information on the UNICEF Innocenti and IIEP-UNESCO Dakar joint research initiative, Women in Learning Leadership (WiLL), visit: <www.unicef-irc.org/research/women-in-learning-leadership>.

Taking the results for grades 5 and 9 together, it can be seen that **the proportion of teachers with a permanent contract has a significant positive correlation** with performance in most items considered.

With regard to other teacher characteristics, there are positive and statistically significant coefficients for the proportion of women only among grade 5 students and considering performance in Portuguese. There is also positive correlation among grade 5 students between performance and the proportion of teachers having attended higher education.

Table 8: Factors associated with Saeb performance – grade 5 (2015–2019)

	Portuguese	Portuguese	Portuguese	Mathematics	Mathematics	Mathematics
Years	2015–2019 (1)	2015–2017 (2)	2021 (3)	2015–2019 (4)	2015–2017 (5)	2021 (6)
Student variables						
Black	-0.216***	-0.192***	-0.209***	-0.187***	-0.181***	-0.224***
Girl		0.247***	0.281***		-0.039***	-0.026*
Has a computer	0.019**	0.041***	0.036**	0.045***	0.067***	0.044***
Mother completed secondary school	0.405***	0.383***	0.448***	0.368***	0.347***	0.479***
Already repeated a year	-0.583***	-0.524***	-0.552***	-0.508***	-0.497***	-0.540***
Preschool	-0.216***	-0.192***	-0.209***	-0.187***	-0.181***	-0.224***
School variables						
Rural	-0.200***	-0.209***	-0.174***	-0.180***	-0.179***	-0.135***
State	0.059**	0.080***		-0.030	-0.001	
Pupil-teacher ratio	-0.000	-0.001	0.002**	-0.001	-0.001	0.002***
Library	-0.000	-0.000	0.002***	-0.000	-0.000*	0.002***
Dining hall	0.001	-0.003		-0.001	-0.002	
Teachers' lounge	0.008	0.002		0.028**	0.014	
Sports field	0.010	0.017*		0.010	0.035***	
Green space	0.008	0.020*		0.003	0.017	
Internet	0.021**	0.027**		0.022**	0.020*	
Time at school	0.081***	0.063***		0.073***	0.044***	

	Portuguese	Portuguese	Portuguese	Mathematics	Mathematics	Mathematics
Years	2015–2019 (1)	2015–2017 (2)	2021 (3)	2015–2019 (4)	2015–2017 (5)	2021 (6)
Distinctive location	0.018**	0.068***		0.047***	0.088***	
Head teacher variables						
Woman		0.041***	-0.005		0.032***	-0.019
Black	-0.004	0.001	-0.059**	-0.005	0.018	-0.050**
Age		0.003***	0.001		0.002***	0.002**
Teaching experience	0.000	-0.001	-0.002	-0.000	-0.002**	-0.001
Teacher variables						
Woman		0.054***	0.056***		0.016	0.042**
Black	-0.001	0.011	0.020	-0.011	0.005	0.039*
Age		-0.003***	0.003**		-0.003***	-0.000
Higher education		0.076***			0.047***	
Teaching experience	0.000	0.001	0.000	-0.001	0.000	0.002
Permanent contract	0.040***	0.046***	0.010	0.046***	0.054***	0.023
Other controls						
Constant	0.242***	-0.188***	-0.091	0.111**	-0.080	0.055
Municipality fixed effect	✓	✓	✓	✓	✓	✓
Year fixed effect	✓	✓	✓	✓	✓	✓
Observations	76,370	53,152	16,582	76,370	53,152	16,582
R-squared	0.204	0.212	0.248	0.175	0.164	0.231

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Data from the Saeb and School Census databases. The sample considered includes municipal and state schools in Maranhão between 2015 and 2019. The 2021 Saeb data do not allow the type of school ownership (federal, state or municipal) to be identified and therefore include all public schools (the vast majority of which are municipal). The models using 2021 data (columns 3 and 6) do not include variables from the School Census, since it was not possible to merge the School Census and Saeb databases in 2021. Teacher characteristics are aggregated at class level. The variable 'time at school' refers to the average time spent at school by students, according to the School Census.

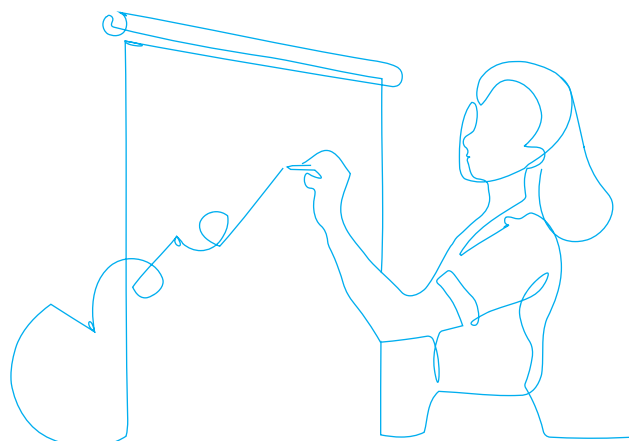


Table 9: Factors associated with Saeb performance – grade 9 (2015–2019)

	Portuguese	Portuguese	Portuguese	Mathematics	Mathematics	Mathematics
Years	2015–2019 (1)	2015–2017 (2)	2021 (3)	2015–2019 (4)	2015–2017 (5)	2021 (6)
Student variables						
Black	-0.083***	-0.050***	-0.098***	-0.068***	-0.066***	-0.140***
Girl		0.222***	0.263***		-0.288***	-0.196***
Has a computer	0.111***	0.141***	0.110***	0.151***	0.150***	0.125***
Mother completed secondary school	0.217***	0.223***	0.266***	0.238***	0.219***	0.259***
Already repeated a year	-0.514***	-0.437***	-0.535***	-0.422***	-0.428***	-0.580***
Preschool	-0.065***	-0.080***	-0.022**	-0.057***	-0.081***	-0.006
Evening	-0.140***	-0.138***		-0.054**	-0.040*	
School variables						
Rural	-0.191***	-0.161***	-0.269***	-0.147***	-0.123***	-0.244***
State	0.143***	0.122***		0.115***	0.087***	
Library	-0.012	0.000		-0.003	0.010	
Dining hall	0.019**	0.030**		0.035***	0.055***	
Teachers' lounge	0.057***	0.064***		0.036***	0.045***	
Sports field	0.009	0.008		0.030***	0.018*	
Green space	0.015*	0.004		0.017**	-0.001	
Internet	0.058***	0.057***		0.047***	0.048***	
Time at school	0.070***	0.087***		0.090***	0.104***	
Distinctive location	-0.068***	-0.075***		-0.053***	-0.063***	
Head teacher variables						
Woman		0.036***	-0.038***		0.024**	-0.047***
Black	-0.028***	-0.013	-0.054***	-0.034***	-0.026*	-0.080***
Age		0.000	0.004***		0.000	0.004***
Teaching experience	-0.003***	-0.004***	-0.001	-0.003***	-0.003***	-0.001
Teacher variables						
Woman		-0.005	-0.005		-0.014	0.011
Black	-0.024**	-0.031**	-0.027	-0.018	-0.015	-0.005
Age		-0.004***	-0.002		-0.003***	0.001
Higher education		0.010			-0.003	
Teaching experience	-0.000	0.004***	0.002	-0.002*	0.002	0.000
Permanent contract	0.059***	0.066***	0.112***	0.046***	0.066***	0.097***

	Portuguese	Portuguese	Portuguese	Mathematics	Mathematics	Mathematics
Years	2015–2019 (1)	2015–2017 (2)	2021 (3)	2015–2019 (4)	2015–2017 (5)	2021 (6)
Other controls						
Constant	-0.024	-0.155**	0.026	-0.167***	0.028	0.206***
Municipality fixed effect	✓	✓	✓	✓	✓	✓
Year fixed effect	✓	✓	✓	✓	✓	✓
Observations	88,808	59,615	28,080	88,808	59,615	28,080
R-squared	0.171	0.183	0.205	0.147	0.157	0.191

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Data from the Saeb and School Census databases. The sample considered includes municipal and state schools in Maranhão between 2015 and 2019. The 2021 Saeb data do not allow the type of school ownership (federal, state or municipal) to be identified and therefore include all public schools (the vast majority of which are municipal). The models using 2021 data (columns 3 and 6) do not include variables from the School Census, since it was not possible to merge the School Census and Saeb databases in 2021. Teacher characteristics are aggregated at class level. The variable 'time at school' refers to the average time spent at school by students, according to the School Census.

The results for grade 12 students, as well as a discussion of the limitations in interpreting their results, are presented in Appendix 5.

2. Results using school-level data

The main findings of the models whose outcome variables are promotion, repetition and dropout rates are shown in **Tables A.2, A.3 and A.4 in Appendix 6**. It can be seen that primary schools whose students have better socioeconomic conditions (measured by their mothers' level of education) obtain better results, with higher promotion rates and lower repetition and dropout rates on average. On the contrary, schools with a higher proportion of students who have already repeated a year have worse results on average. It is important to note that these models are based on a smaller number of observations than the previous models, since the variables are aggregated at school level. This makes it more challenging to estimate accurate coefficients.

3. Limitations of the research

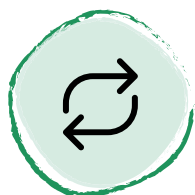
It is important to highlight some limitations of the research and take them into account when interpreting the results. Firstly, the available data only explain part of the students' performance. Other factors, such as students' family characteristics or different behaviours and practices in schools, can also explain performance, but cannot be observed in the available databases. Secondly, the results obtained make it possible to identify correlations between the variables and the statistical significance of the coefficients estimated. However, the results obtained should be interpreted with caution, as the analysis does not allow us to state that these correlations represent a causal effect.



6. Policy implications and areas for further exploration

Policy implications and areas for further exploration

The quantitative data analysis carried out in Stage 1 of the DMS research in Maranhão allows us to identify some areas that merit further exploration. A more in-depth analysis of these areas, together with an assessment of the specific context of each school, can support the design of educational policies at the school, municipal and state levels:



High repetition rates. Despite a decrease in recent years, the proportion of students who have already repeated a year in Maranhão remains high in all the school years considered: 1 in 4 of grade 5 students and more than a third of grade 12 had already repeated a year. However, repeating a grade does not seem to be sufficient to help students catch up, given that on average these students continue to perform significantly less well than others in the Saeb assessment. It is therefore important to prioritize alternatives and complementary measures that may be more efficient.



Full-time education. The results of this study point to a positive correlation between the average time spent at school and individual student performance. Similarly, some studies in recent literature have

pointed to the positive effects of full-time education (i.e., seven hours or more per day).³⁹ There is room for growth for this type of education, given that, according to the 2022 School Census, 26 per cent of enrolments in the initial years of primary school, 36 per cent of enrolments in the final years of primary school and 39 per cent of enrolments in secondary school in Maranhão were in full-time education. It is important to remember, however, that this type of program can involve not only additional time at school, but also complementary activities aimed at the students' holistic development, and the available data do not allow us to differentiate between these factors. Given the costs related to the expansion of full-time education, it is important to better understand the channels that could explain the benefits of full-time education, to analyse the extent to which its benefits depend on the grade and on the characteristics of students and schools, and to understand which types of activities are the most beneficial, to prioritize its expansion.



Performance inequalities linked to gender, race and socioeconomic conditions. Black students and students whose mothers did not complete secondary school perform significantly less well than other students, even when taking into account the characteristics of the schools, head teachers and teachers. Despite the limitations of the 2021 data, some of these differences increased in that year compared to previous

³⁹ Rosa, Leonardo, et al. (2022) show that a full-time education programme in Pernambuco, aimed at secondary school students, improved performance in mathematics and Portuguese. Estrada, Hatrick, and Llambi (2022) show in a study carried out in Ceará that a full-time teaching programme for primary school students increased both completion rates and student performance.

years. The results also indicate that although girls perform better than boys in Portuguese, they perform worse in mathematics from grade 9 onward. These findings may be linked to factors such as the attitudes and behaviours of teachers, students and school administrators, or even unrepresentative teaching materials. Studies on these issues will be fundamental for future public policies. Ensuring that resource allocation takes into account student characteristics and adapting teaching to specific groups are crucial in helping reduce inequalities in education.⁴⁰ National efforts are already under way in this sense, and SEDUC-MA, based on data from the SEAMA evaluation, has been developing initiatives to support students in the most vulnerable situations and to reduce inequalities in education.



Support for evening students. Students enrolled in evening classes perform worse than others, even after taking into account their socioeconomic background. These differences in performance are particularly visible in secondary school, where 1 in 4 students were enrolled in evening classes in 2019. As well as facing challenges such as financial difficulties, insecurity and difficulty accessing school, evening students have less qualified teachers on average (the proportion of teachers having attended higher education is lower among those teaching evening classes). Better analysis of the different factors that explain the poorer performance of these students and the evaluation of specific policy options for this group could help them succeed in their studies.

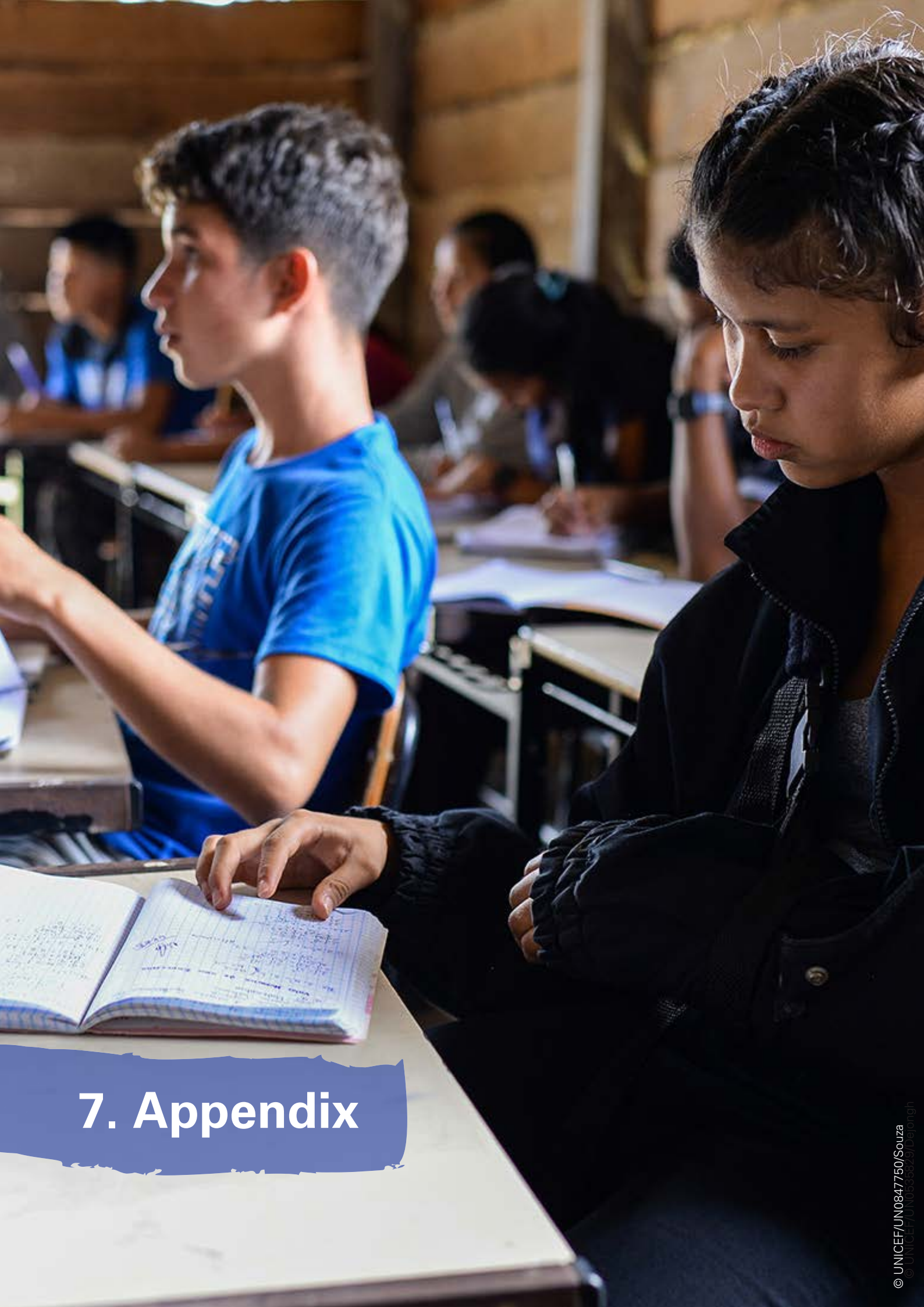


Actions to prevent students from suffering learning delays and ensure that they remain motivated. As students advance in the education system, they are less likely to achieve adequate learning. Among the schools considered in this study, only 5 per cent of students in grade 12 had adequate learning in mathematics in 2021 in the Saeb exam in Maranhão.⁴¹ Different national, state and municipal initiatives are being studied to establish learning assessments, provide specific support for students with difficulties and address the important challenges posed by the COVID-19 pandemic. These initiatives must continue to play a key role in current educational policies.

In the next stages of the research, quantitative and qualitative data will be collected in a sample of schools in Maranhão, with the objective of understanding the practices and behaviours that characterize positive deviant schools. The analysis of the data collected will complement the current analysis and help to provide insight into some of the relationships observed in this first stage, providing a more complete picture of the different factors that influence the performance of Maranhão's schools.

⁴⁰ For example, the Data Must Speak initiative in Nepal supported the government of Nepal in developing an equity index, based on education and population data, to target support and interventions to the most disadvantaged districts.

⁴¹ Data considering all schools in Maranhão indicate that this proportion was 2 per cent in 2021.



7. Appendix



Appendix 1: Stages of the Data Must Speak research

- **Stage 1 (Quantitative research):** In this first stage (the findings presented in this report), a statistical analysis is carried out using existing databases in order to identify the resources and contextual factors that contribute to school performance in Maranhão.
- **Stage 2 (Positive deviance):** This stage categorizes schools according to their context, resources and performance, and identifies 'positive deviant' schools.
- **Stage 3 (Behavioural sciences):** This third stage seeks to understand why positive deviant schools perform better by collecting primary data and using mixed methods. The practices and behaviours of positive deviant schools and average-performing schools (control group schools) are compared using data-collection instruments such as questionnaires, interviews and classroom/school observations.
- **Stage 4 (Participatory implementation research and scaling science):** This stage is based on participatory action research to identify concrete mechanisms and incentives to expand the behaviours and practices of positive deviant schools to other schools. This step involves conversations with various stakeholders to identify practical, scalable and feasible policy levers that encourage low-performing schools to adopt the behaviours and practices of positive deviant schools.



Appendix 2: Description of the Saeb and School Census databases

The Saeb databases are organized as follows:

- **Student database** – database with individual information on students in grades 5, 9 and 12. It contains basic information about the schools (location and type of ownership), the students' proficiency as obtained in their Portuguese and mathematics tests and the students' answers to the socioeconomic questionnaire.
- **School database** – in addition to basic information on schools, this database provides an indicator of the school's socioeconomic level, its participation rate in the Prova Brasil test and evaluations of the school's infrastructure, equipment and surroundings, among other information.

- **Head teacher database** – this database contains answers to the Saeb questionnaire for head teachers, with information such as the head teacher’s characteristics (gender, age, training and experience) and questions relating to the functioning of the school, the activities carried out, the difficulties encountered and the presence of violence in the school, among others.
- **Teacher base** – this database contains answers to the Saeb questionnaire for teachers of the subjects tested (Portuguese and mathematics), with information such as the teacher’s characteristics (gender, age, training and experience), professional situation, teaching resources and practices used, activities participated in, evaluation of aspects relating to the functioning of the school and the presence of violence in the school, among others.

The 2015 Saeb database includes a limited number of secondary schools in Maranhão (45 schools, compared to more than 700 in 2017, 2019 and 2021). For this reason, grade 12 students were not included in the analysis in 2015. On the other hand, the 2019 Saeb databases do not provide information on the gender of students, nor information on the gender or age of head teachers.

It is important to note that the 2021 Saeb databases present important changes compared to the databases of previous years, in order to comply with the personal data protection rules established by the 2018 *Lei Geral de Proteção de Dados* (General Data Protection Law). These databases have fictitious school codes and cannot be merged with the 2021 School Census databases. In addition, the 2021 Saeb databases do not make it possible to identify whether the schools are run by the municipality or by the state; they only include information on whether they are public or private.

The 2015, 2017 and 2019 School Census databases are organized as follows:

- **School database** – contains information about the school, including its location, type of ownership, infrastructure, sanitation, existing equipment and enrolment.
- **Class database** – contains information on the classes of students present in the schools (timetable, number of enrolments, stage of education and subjects).
- **Enrolment database** – presents characteristics of enrolled students, including gender, age, use of public transport, disabilities, characteristics of the course in which they are enrolled, and characteristics of the class and school.
- **Teacher database** – contains characteristics of teachers, including gender, age, race, disabilities, training, subjects taught, as well as information on the corresponding classes and school.
- **Manager database (2019 only)** – contains characteristics of school managers, including gender, age, race, disabilities, education and position.

The **2021 School Census** uses a different format and consists of a single database with information aggregated at school level. This database does not provide information on teacher characteristics (only the number of teachers by teaching type) and does not include the same information on enrolled students as in previous years.

Appendix 3: Preparation of databases for analysis

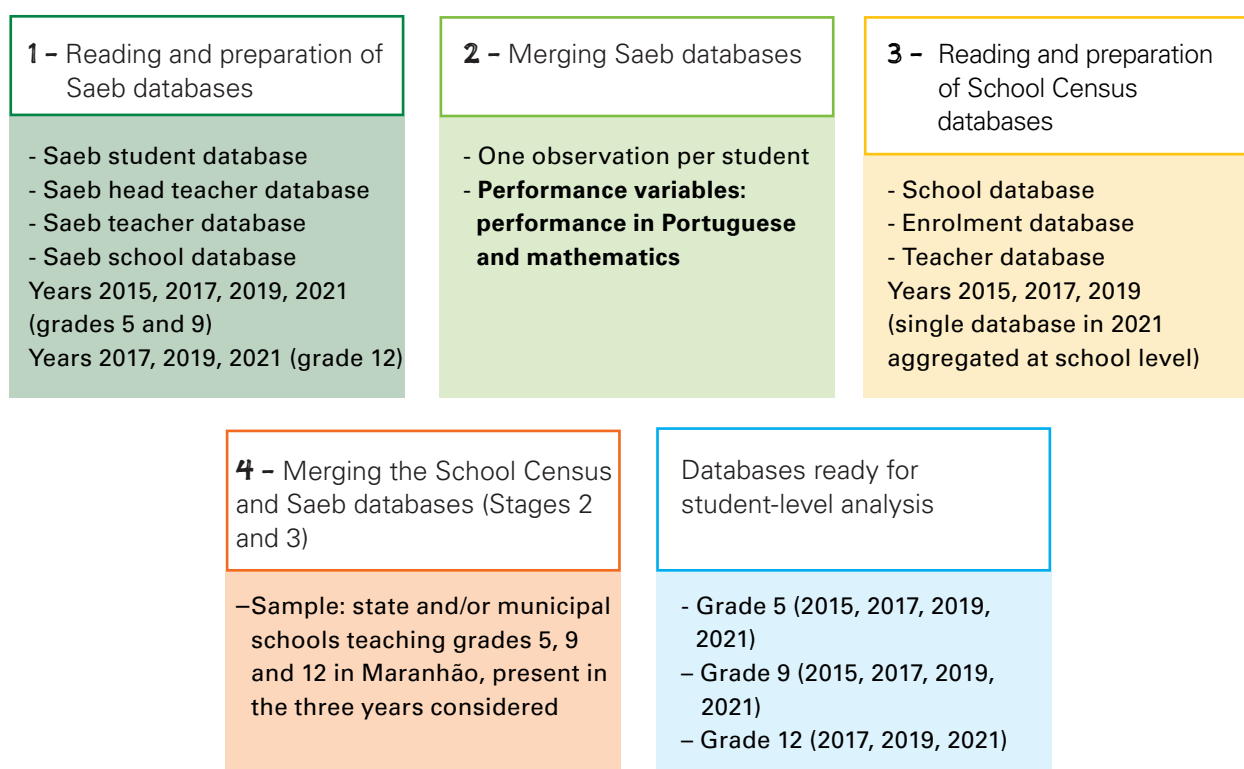
The different databases were prepared and merged prior to analysis (see **Figures 3A and 3B**).

Firstly, the databases were prepared for student-level analysis (see **Figure 3A**). The different Saeb databases were prepared independently to create the necessary indicators and select the study sample (**Stage 1**). We then merged these different Saeb databases using a single school code present in all the databases (**Stage 2**).⁴² The same process was carried out for the different

School Census databases (**Stage 3**)⁴³ and, at the end of Stages 1 to 4, we had three databases ready for analysis at student level (for grades 5, 9 and 12).

The databases were then prepared for school-level analysis (see **Figure 3B**). Databases containing school-level indicators were prepared and merged with the databases from Stages 1 to 4 in **Figure 3A**. As such, we obtained three new databases, corresponding to the three grades studied, with information at school level.

Figure 3A: Stages of database preparation (student-level analysis)

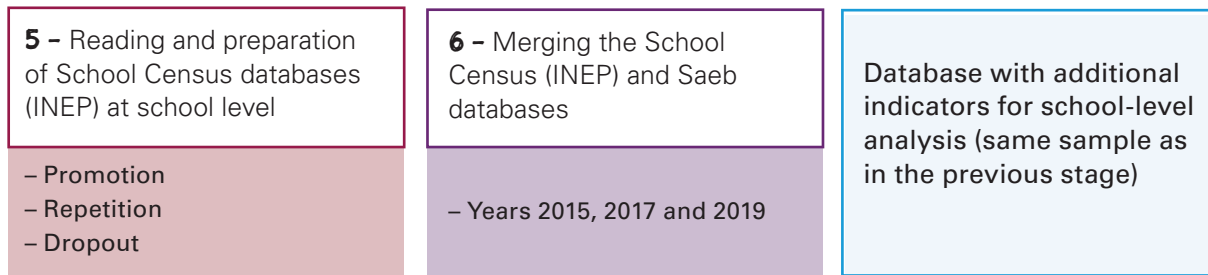


Note: The 2015 Saeb databases contain a limited number of schools teaching grade 12 (45), and so they are not included in the analysis. The 2021 Saeb and School Census databases cannot be merged because they use different school identifiers.

⁴² In the Saeb databases for grade 5, between 3 per cent and 15 per cent of schools had no information on the head teacher, depending on the year, and for 4 per cent to 7 per cent of students there was no information on the teachers of the corresponding classes. In the Saeb databases for grade 9, between 4 per cent and 18 per cent of schools had no information on the head teacher, depending on the year, and for 3 per cent to 20 per cent of students there was no information on the teachers of the corresponding classes (although the 20 per cent figure recorded for 2021 was much higher than in previous years). In the Saeb databases for grade 12, between 7 per cent and 14 per cent of schools had no information on the head teacher, depending on the year in question. In 2017, 70 per cent of students in grade 12 had no information on the teachers of the corresponding classes. In 2019 and 2021, these figures were 5 per cent and 28 per cent, respectively.

⁴³ All the schools in the Saeb databases could be identified in the School Census databases between 2015 and 2019.

Figure 3B: Stages of database preparation (school-level analysis)



Note: The 2021 Saeb and School Census (INEP) databases cannot be merged because they use different school identifiers.



Appendix 4: Descriptive statistics disaggregated by gender, race and socioeconomic level

Figure 4A: Maranhão’s Saeb performance by gender – 2021

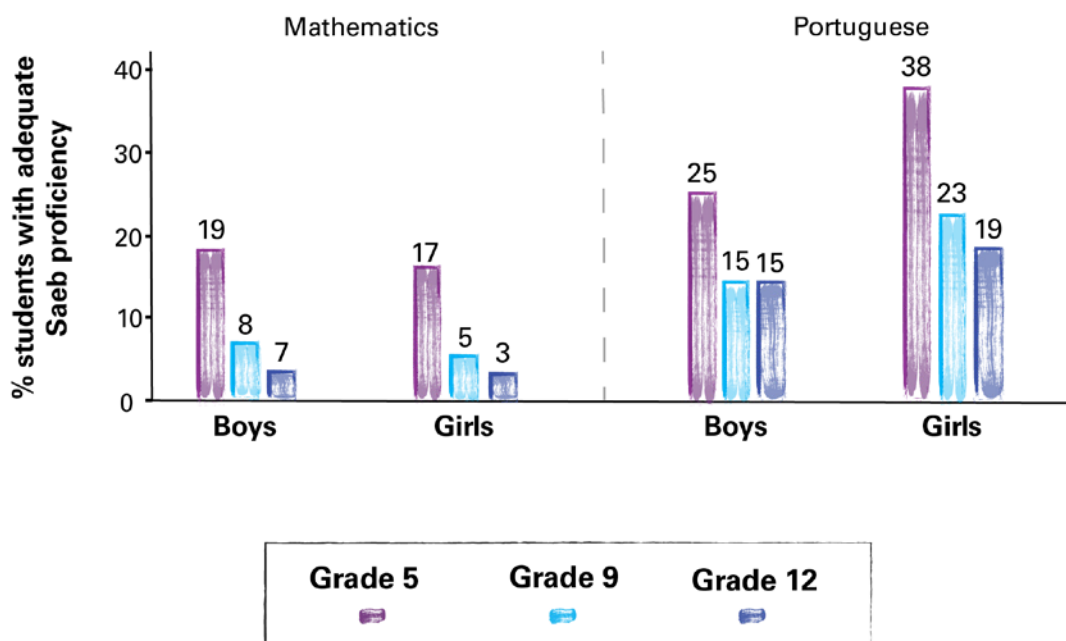


Figure 4B: Maranhão's Saeb performance by race – 2021

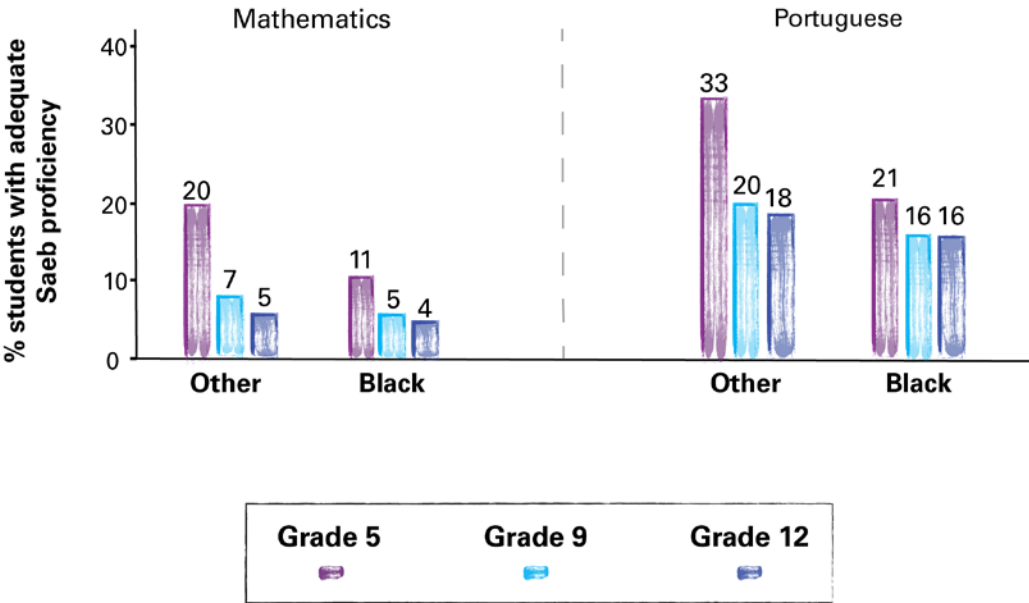
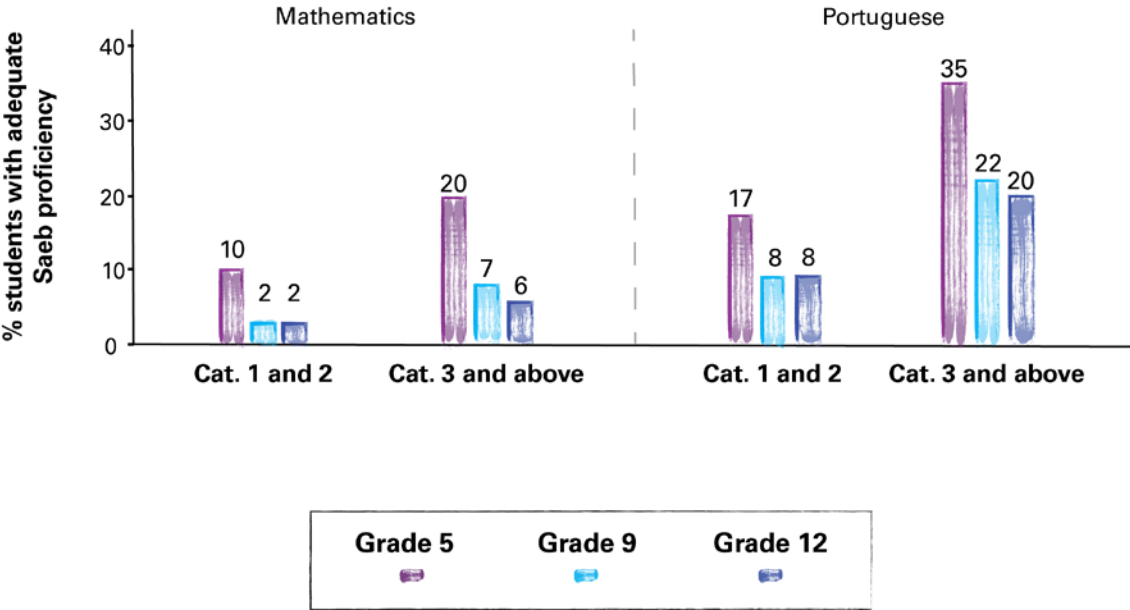


Figure 4C: Maranhão's Saeb performance by school socioeconomic level index – 2021





Appendix 5: Student results

The results for grade 12 students should be interpreted with caution for a number of reasons. Firstly, these models do not allow for the inclusion of 2015, since the number of high schools in Maranhão that took part in the Saeb test was very small that year. The results for 2017–2019 and for 2021 are presented separately. Secondly, data on teachers (from Saeb) are not available for 70 per cent of the sample considered in 2017. Finally, the 2021 models do not include infrastructure variables (as was the case with the previous models) as it was not possible to merge data from Saeb and

the School Census in 2021. However, the results are very similar to the results of the models for grades 5 and 9. The coefficient associated with taking evening classes is much higher than for grade 9 (-0.4 standard deviations, compared to -0.1 standard deviations for grade 9), indicating that these students have a significant disadvantage in terms of performance. With regard to the school's infrastructure, there was a positive correlation between performance and the presence of a dining hall, sports field and green space.

Table 5A: Factors associated with Saeb performance – grade 12 (2017–2019)

	Portuguese	Portuguese	Mathematics	Mathematics
Years	2017–2019 (1)	2021 (3)	2017–2019 (4)	2021 (6)
Student variables				
Black	-0.042***	-0.075***	-0.036***	-0.104***
Girl		0.177***		-0.220***
Has a computer	0.124***	0.125***	0.169***	0.114***
Mother completed secondary school	0.184***	0.207***	0.183***	0.187***
Already repeated a year	-0.450***	-0.481***	-0.378***	-0.461***
Preschool	-0.042***	-0.034***	-0.016**	0.002
Evening	-0.427***		-0.357***	
School variables				
Rural	-0.072***	-0.357***	-0.024	-0.327***
Library	-0.013		-0.001	
Dining hall	0.082***		0.097***	
Teachers' lounge	0.033*		0.039**	
Sports field	0.046***		0.041***	
Green space	0.067***		0.070***	
Internet	-0.009		0.021	
Time at school	0.061***		0.064***	
Distinctive location	-0.064*		-0.100***	

	Portuguese	Portuguese	Mathematics	Mathematics
Years	2017–2019 (1)	2021 (3)	2017–2019 (4)	2021 (6)
Head teacher variables				
Woman		0.019		0.036**
Black	-0.008	-0.077***	-0.007	-0.057**
Age		-0.002*		-0.003***
Teaching experience	-0.001	0.002*	-0.002**	0.003**
Teacher variables				
Woman		0.018		0.032*
Black		0.022		0.013
Age		-0.004***		-0.006***
Teaching experience		0.000		0.001
Permanent contract		0.130***		0.096***
Other controls				
Constant	0.130***	0.331***	-0.033	0.688***
Municipality fixed effect	✓	✓	✓	✓
Year fixed effect	✓	✓	✓	✓
Observations	70,423	24,283	70,423	24,283
R-squared	0.203	0.171	0.171	0.147

Note: *** p<0.01, ** p<0.05, * p<0.1.

Data from the Saeb and School Census databases. The sample considered includes state schools in Maranhão between 2017 and 2021. The models using data from 2017 and 2019 (columns 1 and 3) do not include variables relating to teachers, as this information was not available in 2017. The models using 2021 data (columns 2 and 4) do not include variables from the School Census, since it was not possible to merge the School Census and Saeb databases in 2021. Teacher characteristics are aggregated at class level. The variable ‘time at school’ refers to the average time spent at school by students, according to the School Census.

Appendix 6: School results

These models do not include 2021, since the School Census and Saeb databases could not be merged in 2021. As with the previous models, the models considering grades 5 and 9 use year and municipality fixed effects. The models for grade 12 only use data from 2019, because there was not enough information on teachers in 2017 for

the schools in the sample considered and the total number of schools with information available in 2017 and 2015 was small. The models for grade 12 therefore do not include year fixed effects.

Table 6A: Factors associated with performance – grade 5 (2015–2019)

	Promotion rate	Promotion rate	Repetition rate	Repetition rate	Dropout rate	Dropout rate
Years	2015–2019 (1)	2015–2017 (2)	2015–2019 (3)	2015–2017 (4)	2015–2019 (5)	2015–2017 (6)
Student variables						
% black students	0.330	1.506	-0.335	-1.287	0.005	-0.218
% girls		2.621*		-2.766**		0.144
% who have a computer	1.617	0.718	-1.018	-0.119	-0.598*	-0.598
% whose mother completed secondary school	2.134***	3.947***	-1.691***	-3.058***	-0.443*	-0.889**
% already repeated a year	-12.585***	-11.712***	10.904***	10.002***	1.681***	1.710***
% preschool	0.781	0.832	-0.671	-0.683	-0.110	-0.149
School variables						
Rural	-1.827***	-1.767***	1.997***	1.907***	-0.170	-0.140
State	0.276	0.445	-0.391	-0.626	0.115	0.181
Pupil-teacher ratio	-0.071***	-0.061***	0.067***	0.063***	0.004	-0.002
Library	-0.002	-0.005	0.003	0.005	-0.001	0.000
Dining hall	-0.553*	-0.504	0.461*	0.440	0.092	0.064
Teachers' lounge	-0.402	-0.504	0.201	0.246	0.201	0.258
Sports field	-0.254	-0.151	0.196	0.147	0.058	0.003
Green space	-0.445	-0.310	0.552**	0.455	-0.107	-0.145
Internet	0.082	0.533	-0.233	-0.714**	0.151	0.181
Time at school	-0.003	-0.044	-0.120	-0.099	0.123	0.143
Distinctive location	0.043	0.294	0.071	-0.220	-0.114*	-0.074
Head teacher variables						
Woman		0.186		-0.414		0.228*
Black	-0.055	0.144	-0.247	-0.372	0.301**	0.228
Age		0.000		-0.000		0.000
Teaching experience	-0.008	-0.007	-0.002	0.006	0.010	0.001

	Promotion rate	Promotion rate	Repetition rate	Repetition rate	Dropout rate	Dropout rate
Years	2015–2019 (1)	2015–2017 (2)	2015–2019 (3)	2015–2017 (4)	2015–2019 (5)	2015–2017 (6)
Teacher variables						
Woman		0.368		0.010		-0.378**
Black	-0.791*	-0.848	0.564	0.686	0.227	0.162
Age		0.024		-0.039		0.015
Higher education		0.054		-0.071		0.017
Teaching experience	-0.056**	-0.096**	0.042*	0.081**	0.014	0.014
Permanent contract	-0.363	-0.121	0.330	0.198	0.033	-0.077
Other controls						
Constant	94.862***	91.184***	3.673***	7.822***	1.465***	0.994
Municipality fixed effect	✓	✓	✓	✓	✓	✓
Year fixed effect	✓	✓	✓	✓	✓	✓
Observations	5,344	3,556	5,344	3,556	5,344	3,556
R-squared	0.289	0.309	0.262	0.292	0.157	0.174

Note: *** p<0.01, ** p<0.05, * p<0.1.

Data from the Saeb and School Census databases. The sample considered includes municipal schools in Maranhão between 2015 and 2019. All information is aggregated at school level. The variable 'time at school' refers to the average time spent at school by students, according to the School Census.

Table 6B: Factors associated with performance – grade 9 (2015–2019)

	Promotion rate	Promotion rate	Repetition rate	Repetition rate	Dropout rate	Dropout rate
Years	2015–2019 (1)	2015–2017 (2)	2015–2019 (3)	2015–2017 (4)	2015–2019 (5)	2015–2017 (6)
Student variables						
% black students	-1.980	-5.426**	0.965	1.583	1.015	3.843***
% girls		-0.187		0.041		0.147
% who have a computer	-0.617	-0.270	1.549	2.470	-0.933	-2.199**
% whose mother completed secondary school	2.522**	2.517*	-0.336	-0.304	-2.186***	-2.213**

	Promotion rate	Promotion rate	Repetition rate	Repetition rate	Dropout rate	Dropout rate
Years	2015–2019 (1)	2015–2017 (2)	2015–2019 (3)	2015–2017 (4)	2015–2019 (5)	2015–2017 (6)
Student variables						
% already repeated a year	-9.099***	-10.179***	5.337***	5.932***	3.763***	4.247***
% preschool	-1.480	-0.990	0.840	0.026	0.640	0.965
% evening	-2.049**	-2.916***	0.598	0.693	1.450***	2.223***
School variables						
Rural	1.660***	2.129***	-0.924***	-1.120**	-0.736***	-1.010***
State	0.527	0.096	0.029	0.573	-0.556	-0.670
Pupil-teacher ratio	-0.633*	-0.348	0.722***	0.544	-0.089	-0.196
Library	0.045	-0.221	-0.232	0.091	0.187	0.131
Dining hall	-1.331***	-2.030***	0.814***	1.183***	0.517***	0.847***
Teachers' lounge	-0.529	-0.374	0.355	0.248	0.175	0.126
Sports field	0.557*	0.764*	-0.539**	-0.822**	-0.018	0.057
Green space	0.157	-0.068	-0.081	-0.076	-0.076	0.144
Internet	0.208	0.404	-0.127	-0.236	-0.082	-0.168
Time at school	-1.105**	-0.669	0.594	0.397	0.511*	0.272
Distinctive location	0.043	0.294	0.071	-0.220	-0.114*	-0.074
Head teacher variables						
Woman		0.233		0.068		-0.301
Black	-0.312	0.272	0.100	-0.170	0.213	-0.101
Age		0.036		-0.017		-0.019
Teaching experience	0.027	0.012	-0.020	-0.019	-0.007	0.007
Teacher variables						
Woman		-0.358		0.254		0.103
Black	-0.133	-0.659	0.189	0.695	-0.056	-0.036
Age		0.051		-0.023		-0.028
Higher education		0.210		-0.341		0.131
Teaching experience	-0.036	-0.087	0.031	0.064	0.005	0.023
Permanent contract	-0.515	-0.680	0.605*	0.593	-0.090	0.087

	Promotion rate	Promotion rate	Repetition rate	Repetition rate	Dropout rate	Dropout rate
Years	2015–2019 (1)	2015–2017 (2)	2015–2019 (3)	2015–2017 (4)	2015–2019 (5)	2015–2017 (6)
Other controls						
Constant	92.099***	90.346***	4.421***	4.771*	3.480***	4.883*
Municipality fixed effect	✓	✓	✓	✓	✓	✓
Year fixed effect	✓	✓	✓	✓	✓	✓
Observations	3,756	2,305	3,756	2,305	3,756	2,305
R-squared	0.238	0.276	0.177	0.222	0.213	0.255

Note: *** p<0.01, ** p<0.05, * p<0.1.

Data from the Saeb and School Census databases. The sample considered includes municipal schools in Maranhão between 2015 and 2019. All information is aggregated at school level. The variable 'time at school' refers to the average time spent at school by students, according to the School Census.

Table 6C: Factors associated with performance – grade 12 (2019)

	Promotion rate	Repetition rate	Dropout rate
Years	2019 (1)	2019 (2)	2019 (3)
Student variables			
% black students	1.414	-3.959	2.545
% who have a computer	3.706	-0.766	-2.939
% whose mother completed secondary school	0.713	-0.546	-0.167
% who already repeated a year	-11.054**	1.642	9.412***
% preschool	-3.643	0.726	2.917
% evening	-1.381	1.393	-0.013
School variables			
Rural	1.642	-0.677	-0.965
Library	-1.146	0.427	0.720
Dining hall	-0.367	0.768	-0.401
Teachers' lounge	-1.396	1.116	0.280
Sports field	-0.052	-0.129	0.181
Green space	-0.294	-0.200	0.494
Internet	-0.152	1.140*	-0.988*
Time at school	0.655**	-0.436	-0.219
Distinctive location	-0.609	-1.242	1.851
Head teacher variables			
Black	-0.761	0.355	0.405
Teaching experience	0.007	-0.007	-0.000

	Promotion rate	Repetition rate	Dropout rate
Years	2019 (1)	2019 (2)	2019 (3)
Teacher variables			
Black	-1.121	0.735	0.386
Teaching experience	0.176	-0.028	-0.148*
Permanent contract	1.270	-0.170	-1.100
Other controls			
Constant	92.853***	3.290	3.856
Municipality fixed effect	✓	✓	✓
Year fixed effect	✓	✓	✓
Observations	524	524	524
R-squared	0.521	0.475	0.571

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Data from the Saeb and School Census databases. The sample considered includes municipal schools in Maranhão between 2015 and 2019. All information is aggregated at school level. The variable 'time at school' refers to the average time spent at school by students, according to the School Census.



Appendix 7: Robustness tests

The following alternative models were estimated:

1.

Models using sample weights. The aim of these models is to attribute greater weight to schools with more students. This also makes it possible to correct for the fact that because they have indicators calculated on the basis of a smaller number of students, smaller schools may show greater fluctuations in their indicators from one year to the next, affecting the results.

2.

Models including only schools that appear in all the years of the analysis. Over the period considered in the analysis (2015–2021), the total number

of schools in the sample has increased considerably. In the case of municipal primary schools, this increase may be related both to the process of education becoming increasingly run by municipalities and to the construction of new schools. To try to assess the extent to which the results obtained are related to changes in the sample studied and to the characteristics of the new schools, in this analysis we considered only the schools present in all years. Given that the 2021 Saeb school codes are masked and are different from the codes used in previous years, it is only possible to do this exercise based on the 2015–2019 period; 57 per cent of schools teaching grade 5 and 50 per cent of schools teaching grade 9 in the databases appear in all three years: 2015, 2017 and 2019.

We did not include secondary schools in these models because few secondary schools took part in Saeb in 2015.

3.

Models using fixed effects at school level. These models have the advantage of controlling for unobservable factors at school level that are fixed over time and that can affect the relationship between explanatory variables and outcome variables. They have the disadvantage of making it more difficult to estimate and interpret the coefficients associated with variables that change little over the period, such as school infrastructure variables, since these are 'absorbed' by the fixed effects. Similarly, if the school head teacher and teachers do not

change much during the period observed, the coefficients corresponding to these variables cannot be estimated correctly in the fixed effects model. However, this model provides useful information, allowing us to see the extent to which the coefficients associated with variables that change over time (such as student characteristics) vary with the inclusion of fixed effects. To run these models, we used the same sample as in the previous section – the primary schools present throughout the 2015–2019 period – because it is necessary to observe the schools repeatedly over time in order to estimate the model with fixed effects. The models using sample weights show very similar results to the previously estimated models, with a slight increase in the coefficient for grade 9 students associated with taking evening classes.

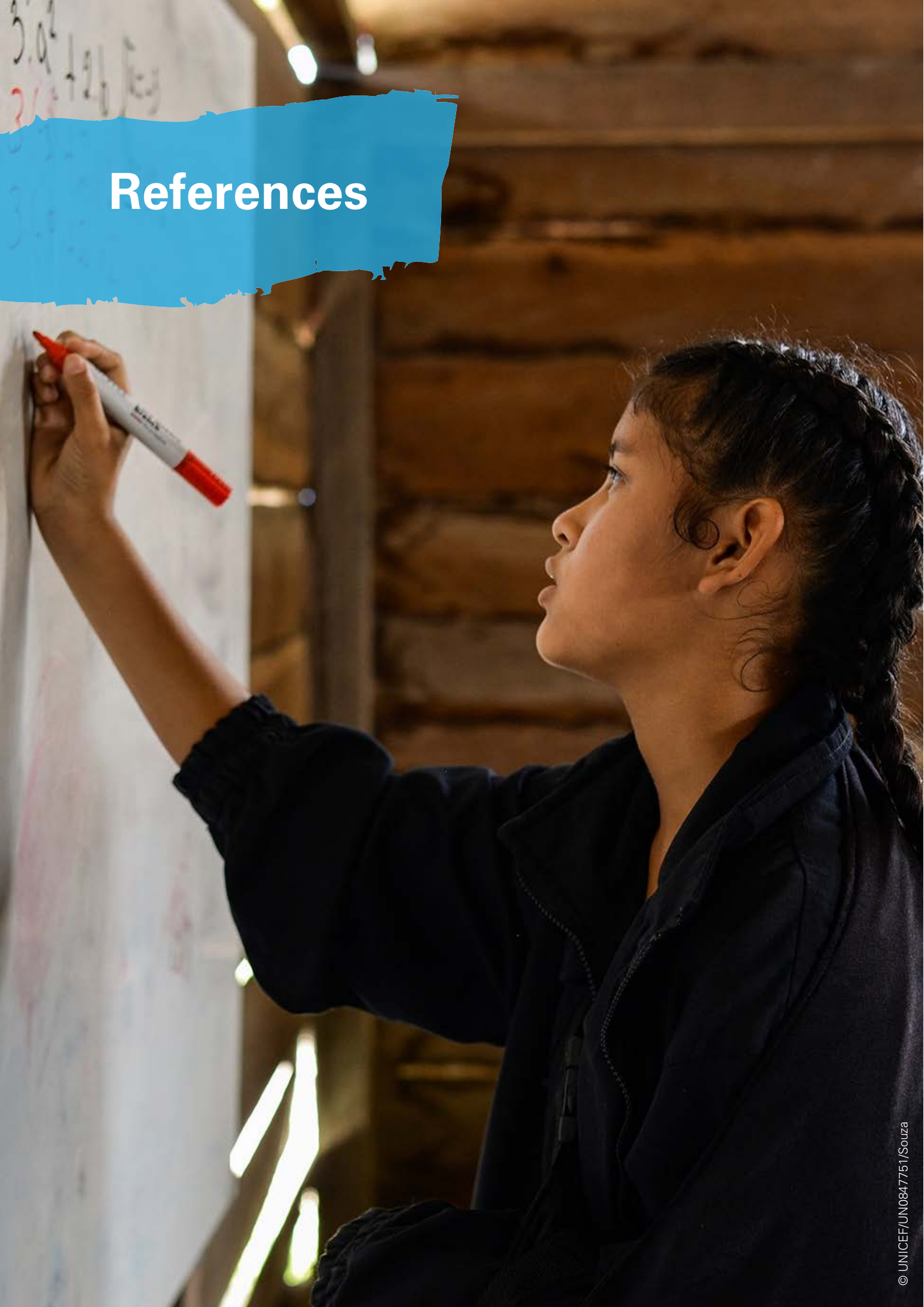
Similarly, the models based on the smaller sample of schools present in the databases in 2015, 2017 and 2019 have very similar results to previous ones. In these models, the coefficient associated with the school being in a distinctive location is no longer significant for the sample of schools teaching grade 9.

In the fixed effects models, the coefficients associated with student characteristics remain close to the coefficients estimated in the previous models and continue to be statistically significant. In the student level regression models, the coefficients associated with the average time spent at school are no longer significant, probably due to the fact that these variables changed little within the schools in the sample over the period considered. As expected, the variables related to infrastructure

and school characteristics, which tend to be more stable over time, are no longer significant. The positive coefficients observed for schools with female head teachers in the student level regression models between 2015 and 2019 (for grades 5 and 9) remain positive and significant. Finally, as observed in the previous robustness tests, there is an increase in the negative coefficients associated with taking evening classes for grade 9 students.

In conclusion, the results of the robustness tests suggest that the results of the main models are not significantly affected by changes in the composition of schools over time, by fluctuations in the indicators of small schools or by fixed unobservable factors at school level. The results of the robustness tests are available from the authors on request.

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