

The State of Ceará in Brazil is a Role Model for Reducing Learning Poverty

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Abstract

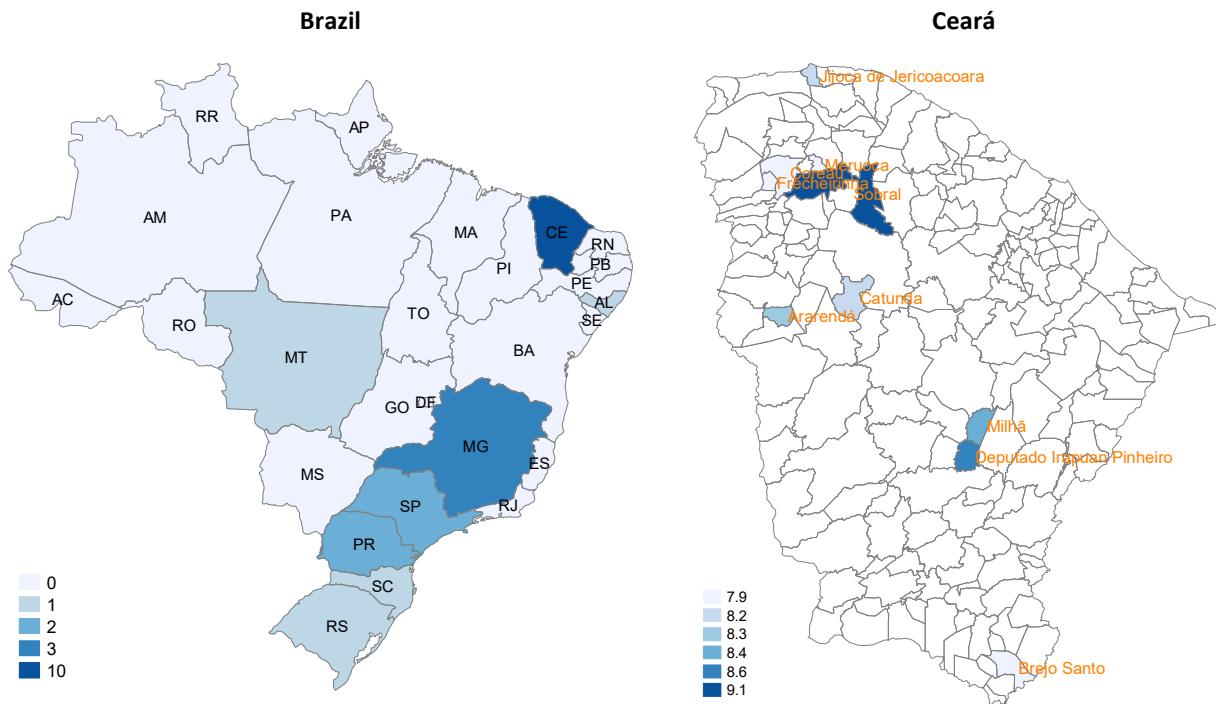
This report presents the case of the state of Ceará in Brazil that overcame adverse socioeconomic conditions to substantially improve education outcomes with efficient use of resources. Despite having the 5th lowest GDP per capita among the 26 Brazilian states, the 9-million-inhabitant state of Ceará has experienced the largest increase in the national education quality index in both primary and lower secondary education since 2005, with 10 municipalities of Ceará being among the top 20 national ranking, including Sobral which has the highest score. The state of Ceará pioneered the use of results-based financing as part of a comprehensive education reform program that among other elements included strong support to its municipalities to achieve universal literacy by the end of grade 2. The reforms allowed the state to considerably improve learning levels of students in primary and lower secondary education with a high level of efficiency in the use of resources. The main aspects of the reforms are presented and discussed.

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1. Ceará - A role model in education quality and efficiency

The state of Ceará, Brazil, provides a relevant example of how to overcome adverse socioeconomic conditions to substantially improve education outcomes with efficient use of resources. Ceará is a relatively poor state in the northeast of Brazil, with the 5th lowest GDP per capita among the 26 Brazilian states, corresponding to one-third of the income per capita of the richest states.² With a population of approximately 9 million—equivalent to Austria or Israel and larger than 100 countries, including Paraguay, Finland, Ireland, and New Zealand. Despite its scarce resources, Ceará has experienced the largest increase in the national education quality index (IDEB, an index considering progression rates and test scores in Portuguese and mathematics³) in both primary (grades 1 to 5) and lower secondary education (grades 6 to 9) since 2005, when IDEB started to be measured. Almost all of its 184 municipalities departed from very low levels of education quality (with regard to student learning and progression) to be among the highest IDEB scores in Brazil, with 10 municipalities of Ceará in the top 20, including Sobral which has the highest score (figure 1).⁴

Figure 1: Top 20 municipalities in education quality (IDEB) - primary education, 2017



Source: World Bank with *Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira* (INEP)/ Ministry of Education (MEC) data.

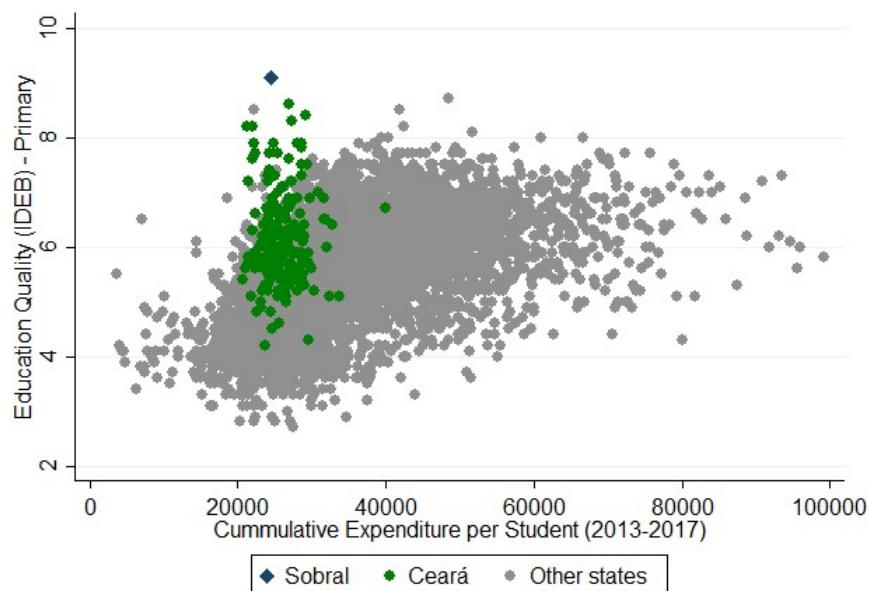
Spending in primary and lower secondary education in Ceará is very efficient. Municipalities in Ceará are highly efficient in the use of resources to generate education outcomes, as they spend less than a third of the richer Brazilian states, like São Paulo, and yet achieve higher education quality index scores. (figure 2)

² Like São Paulo State. In absolute terms, Ceará has the 12th largest total GDP among the 26 states + Federal District.

³ *Índice de Desenvolvimento da Educação Básica* or IDEB is composed of student learning scores and school progression rates.

⁴ A few municipalities are tied in the 20th place, leading to 21.

**Figure 2: IDEB in primary education vs. education expenditure per student (accumulated 2013–2017),
 Brazilian municipalities with Ceará municipalities highlighted**



Source: World Bank with INEP/MEC and SIOPE.

Note: Constant prices of 2017.

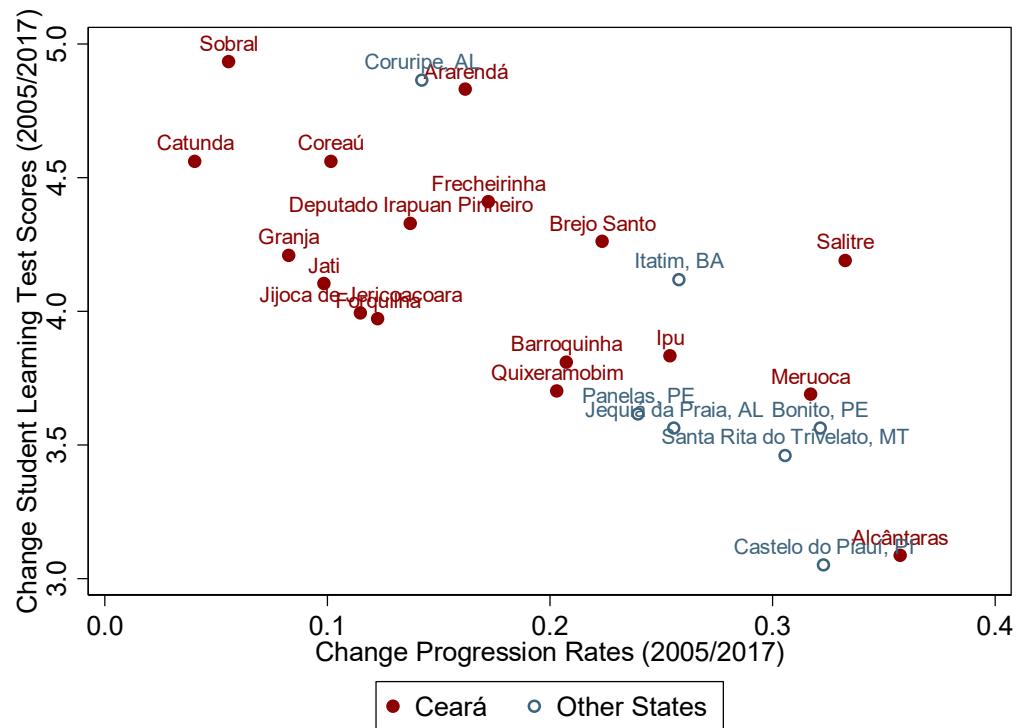
Learning is the main driver of improvements in IDEB observed in Ceará municipalities that are among the lowest levels of learning poverty in Brazil. The top education quality performers in Ceará on IDEB are also among the ones with the largest improvements between 2005 and 2017 in the learning component of IDEB, rather than the component of student flows (figure 3). The higher level of education quality in Ceará can also be observed by the learning poverty index (the proportion of 10-year-olds that cannot read and interpret a simple text or are out of school), as shown in figure 4.

Economic outcomes are expected to improve in Ceará as a consequence of improved learning. Education quality is a necessary condition for improving people's skills, driving both poverty reduction at the individual level and increased productivity and economic growth at the macro level. The existing global literature shows that improving learning for all children translates into substantial long-term gains for society, including impacts on higher incomes for individuals, labor productivity, and economic growth.⁵ Although there are not yet rigorous studies demonstrating the economic gains stemming from Ceará's improved education outcomes, the sustained economic growth observed in the state in the last few years — with substantial improvements in productivity

⁵ Key sources of evidence on the association between economic outcomes and education quality is given by Hanushek, E. A., and L. Woessman. 2008. "The Role of Cognitive Skills in Economic Development." *Journal of Economic Literature* 46 (3); Hanushek, E. A., and D. D. Kimko. 2000. "Schooling, Labor Force Quality, and the Growth of Nations." *American Economic Review* 90 (5): 1184–1208. Other relevant studies in that regard include: Barro, R. J. 2001. "Human Capital and Growth." *American Economic Review* 91 (2): 12–17; Jamison, E. A., D. T. Jamison, and E. A. Hanushek. 2007. "The Effects of Education Quality on Mortality Decline and Income Growth." *Journal of Economic Literature* 46 (3): 607–668; Woessmann, L. 2003. "Specifying Human Capital." *Journal of Economic Surveys* 17 (3): 239–270; Evans, D. K., and F. Yuan. 2019. "Equivalent Years of Schooling: A Metric to Communicate Learning Gains in Concrete Terms." World Bank Policy Research Working Paper 8752.

and the participation of the national share of Brazil's GDP⁶ — likely stems in part from the meaningful gains observed in primary and lower secondary education in Ceará. Moreover, as the state hopefully extends gains to upper secondary education through its continued efforts, economic benefits will likely accrue to the state for years to come. Examining this relationship with greater rigor is an important next step for the research agenda in Ceará.

Figure 3: Change in learning test scores and progression rates between 2005 and 2017 for top municipalities on IDEB improvement in primary education - municipalities in Ceará vs. other states

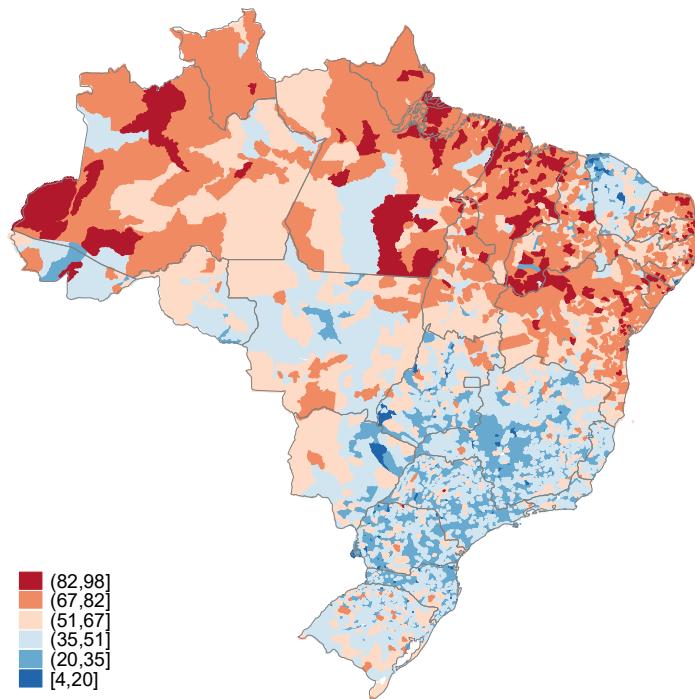


Source: World Bank with INEP/MEC data.

Note: For presentational purposes, the figure excludes the municipality of Nova América da Colina, Paraná, which is an outlier with the large increase in IDEB in the period being mainly owing to an increase in progression rates by 70 percentage points.

⁶ Ataliba, F., Trompieri Neto, N., Osterno, I. Ceará obteve de 2008 a 2018 o 4º maior volume acumulado de investimentos do país: o que está por trás desse resultado? Observatório do Federalismo Brasileiro, Novembro, 2019.

Figure 4: Learning poverty for Brazilian municipalities, 2017



Source: World Bank with INEP/MEC data.

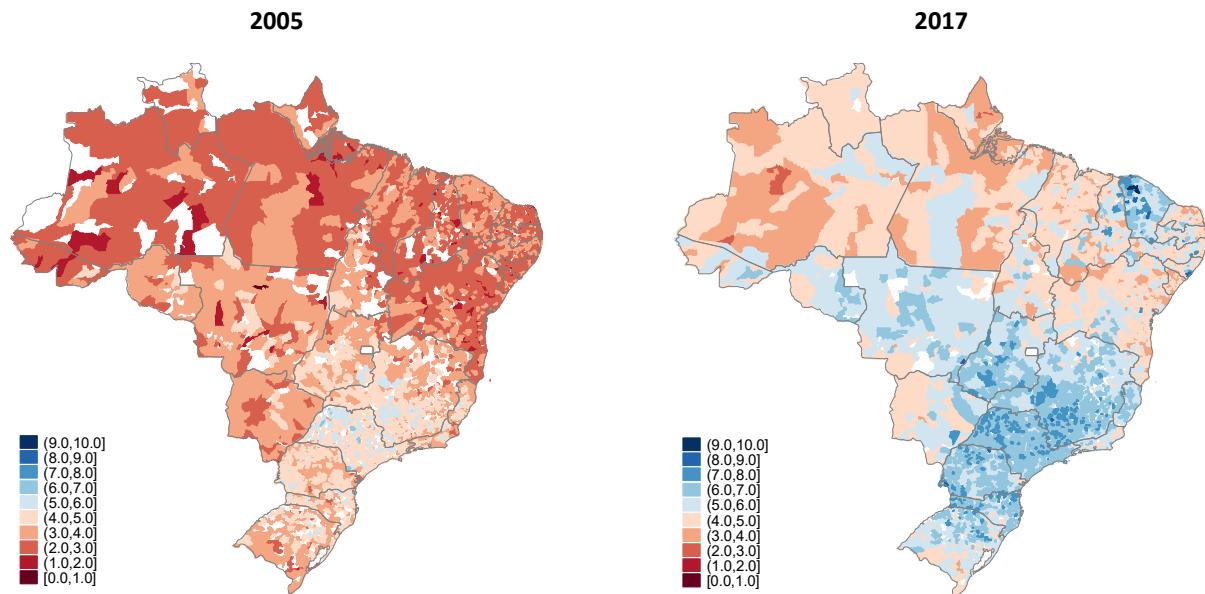
The Brazilian constitution establishes responsibility for different levels of education for each of the three layers of government. The provision of early childhood education, primary education (grades 1 to 5) and lower secondary education (grades 6 to 9) are the responsibility of the municipal governments,⁷ while upper-secondary education (grades 10 to 12) is mainly provided by the state governments. The federal government sets its focus on tertiary education (among the enrollment in public universities, 62 percent are in federal institutions).

Municipalities in Ceará had the largest improvement in both primary and lower secondary education quality since 2007 and collectively have the best education quality index in the country when socioeconomic conditions are taken into consideration. Ceará's municipalities had the largest increase in IDEB between 2005 and 2017 among all 5,570 Brazilian municipalities, with one of its municipalities, Sobral, reaching the first place in the latest IDEB ranking (2017). Figure 5 plots the Brazilian municipalities on IDEB scores in 2005 and 2017 for primary education and figure 6 plots the change between 2005 and 2017 for both levels. It can be observed that the Ceará state in the northeast region not only has a substantial improvement but also has the most municipalities among the highest scores in 2017. When education quality is controlled for socioeconomic conditions, as measured by the Human Development Index (HDI), Ceará has the best municipal primary and lower secondary system among all Brazilian states (Figure 7).⁸

⁷ Although primary education in Brazil is mostly provided by municipal governments, almost half of lower secondary education is still provided by the state governments in Brazil (except to Ceará and more recently other states), despite a long and continuing process of devolution of those schools from state to municipal governments.

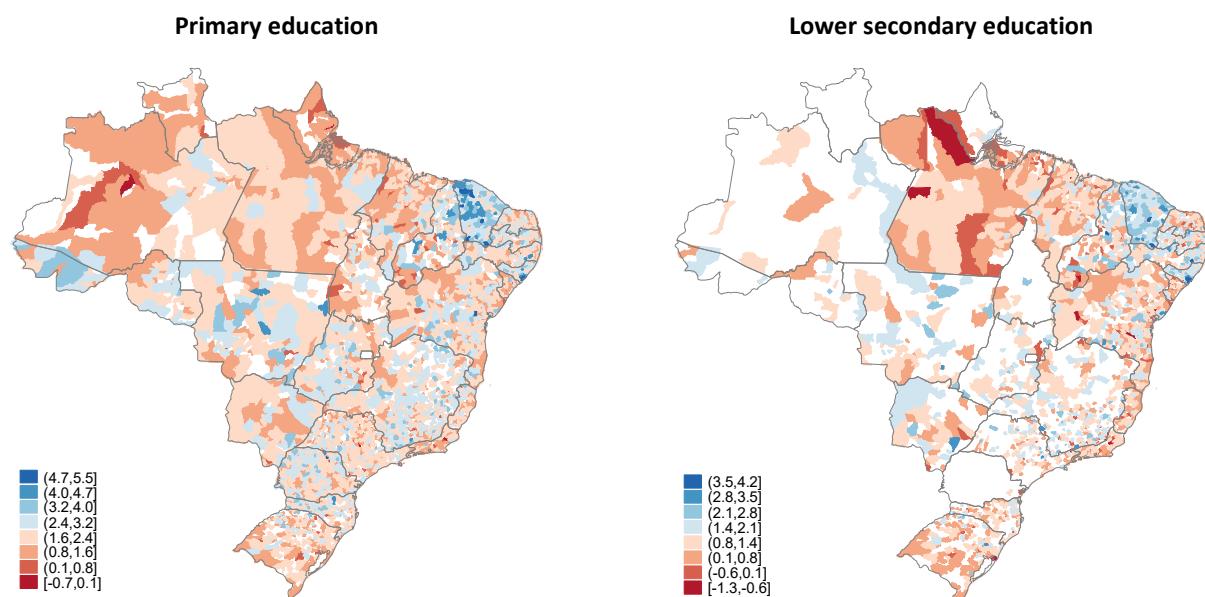
⁸ Figures A2 and A3 in annex 3 show the respective information for lower and upper secondary education.

Figure 5: Education quality measured by IDEB - Brazilian municipalities, 2005–2017, primary education



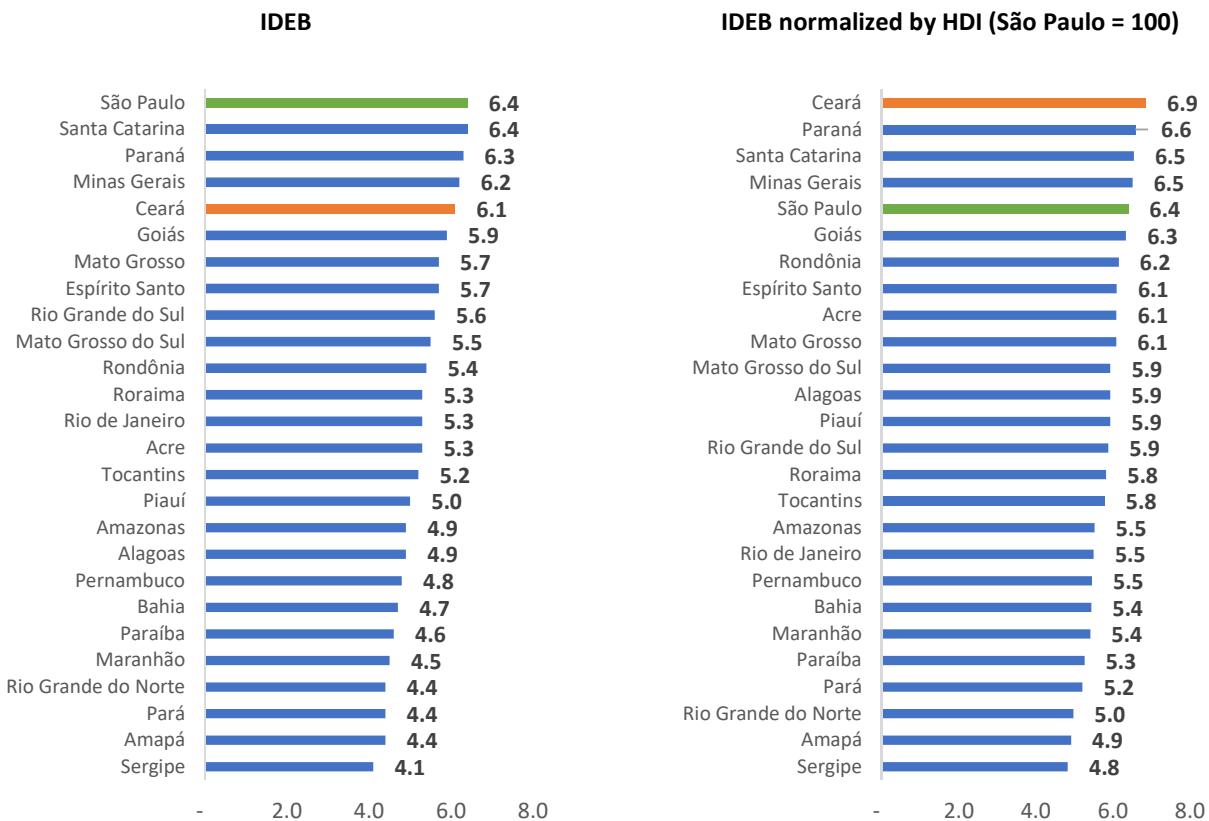
Source: World Bank with INEP/MEC data.

Figure 6: Change in education quality (IDEB) between 2005–2017 - Brazilian municipalities, primary and lower secondary education⁹



Source: World Bank with INEP/MEC data.

⁹ Blank areas mean that the municipality has only state schools for this level.

Figure 7: IDEB at primary education - municipal networks aggregated by state, 2017


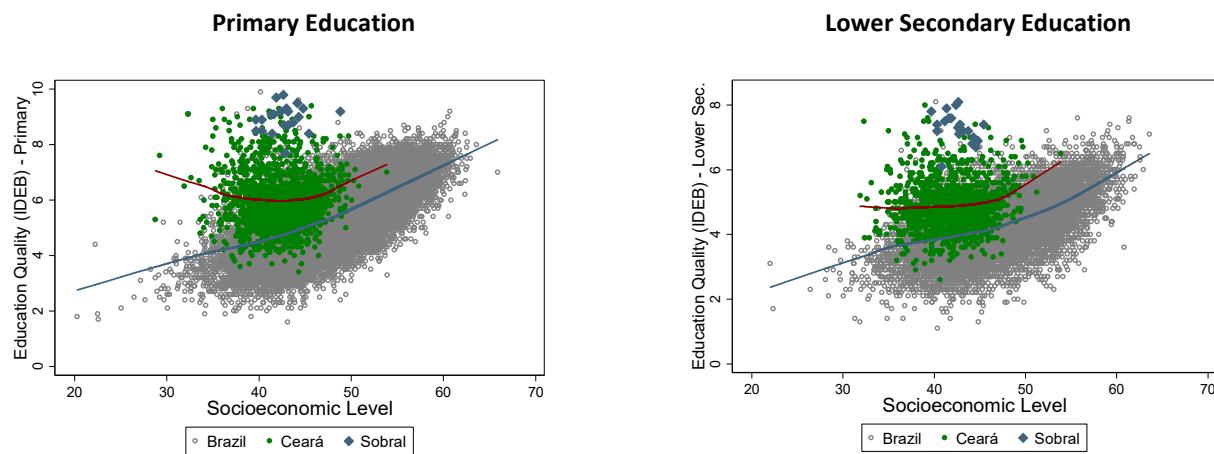
Source: World Bank with INEP/MEC data.

Despite Ceará having the 6th highest IDEB in upper secondary education among Brazil's states, the results are not as strong as those obtained in the lower levels of education. The state of Ceará had one of the most significant increases in education quality in the last decade in upper secondary education. However, as the average level of learning and student progression in upper secondary education is low for all states, with the highest IDEB score being slightly above 4 on a scale from 0 to 10 (see figure A3 in annex 3), it is clear that there is a national challenge in upper secondary education. There are specific barriers associated with the delivery of upper secondary education in Brazil. They mainly relate to the national curriculum (which has recently been reformed and is beginning to be implemented) and to the fact that implementing reforms in larger school networks is more challenging. (Public upper secondary education is mainly provided by the state governments, which usually have considerably larger schools networks). Specifically, for the case of Ceará, as it will be evident in the next sections, a key pillar of the education reforms in Ceará was a robust results-based incentive mechanism for the municipalities of the state, but the state government cannot incentivize itself financially.

Education outcomes for schools in Ceará are substantially higher than expected when considering their socioeconomic context. The distributions of IDEB scores for municipal schools for different levels of socioeconomic conditions of schools measured by the national socioeconomic index (INSE) are presented in figure 8, highlighting the schools in Ceará municipalities, including Sobral, which has the highest levels of IDEB in both primary and lower secondary education. All schools in Ceará have low levels of socioeconomic development, with most of them being in the upper half of the distribution of IDEB scores. A similar relationship can be observed when these variables are considered at the municipal level (see figure A7 in annex 3). A deeper look at the top 20 municipalities in Brazil with regard to IDEB in primary education reveals that all 10 Ceará

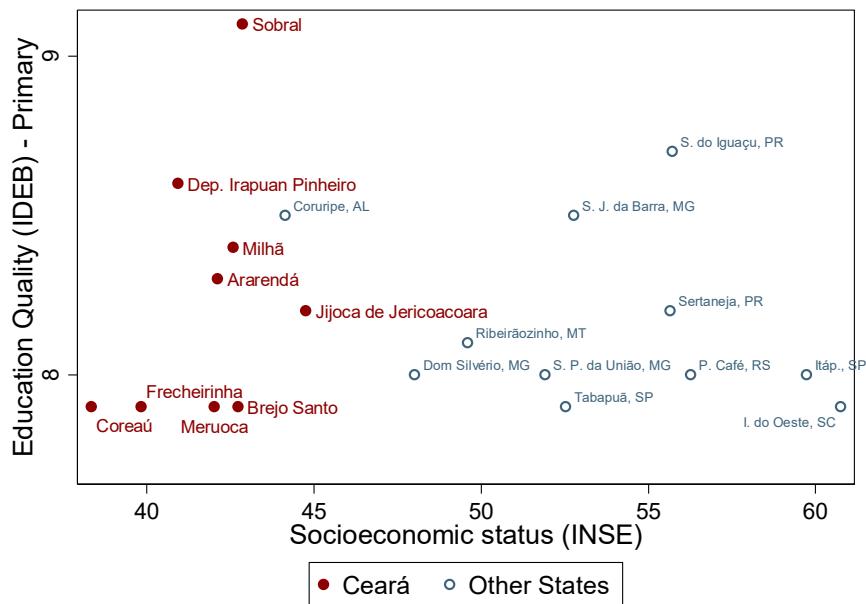
municipalities in this list have low levels of school socioeconomic index, in contrast with all other municipalities in the southern states of Brazil, with the exception of Coruripe in Alagoas. It is also worth noting that the only municipalities at the top of the national ranking of education quality in primary education with a socioeconomic index considered low are in Ceará: Coreaú and Frecheirinha, with all other Ceará municipalities in this list being considered medium-low and the ones of other states with higher categories of socioeconomic status (medium, medium-high, high, and very high).

Figure 8: Education quality measured by IDEB (2017) vs. socioeconomic status (INSE, 2015) - municipal schools - primary and lower secondary education



Source: World Bank with INEP/MEC data.

Figure 9: Top 20 municipalities in Brazil on education quality measured by IDEB (2017) vs. socioeconomic conditions (INSE, 2015) - municipalities (municipal school networks) - primary education

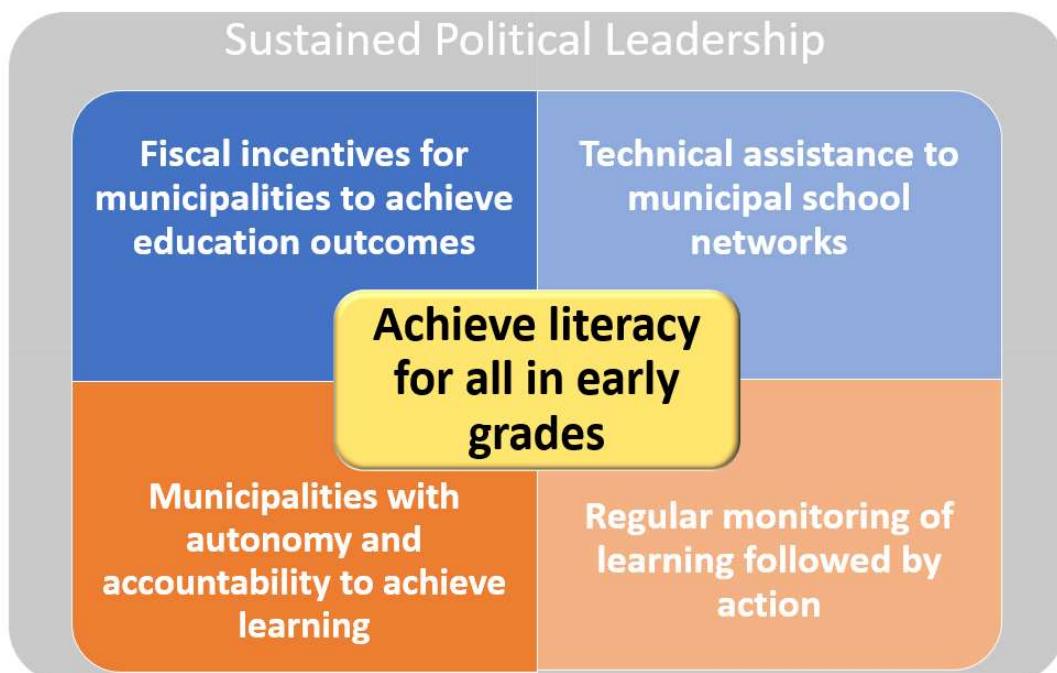


Source: World Bank with INEP/MEC data.

2. Education reforms in Ceará

The state of Ceará pioneered the use of results-based financing (RBF) as part of a comprehensive education reform program. Ceará initiated key education reforms that allowed it to considerably improve learning levels of students in primary and lower secondary education with a high level of efficiency in the use of resources. Its success is based on five interdependent pillars that are aligned with the global evidence of what works in RBF in education.¹⁰ The first two pillars are (a) financial incentives for municipalities to achieve established goals (RBF); (b) technical assistance (TA) for municipalities with difficulties to improve learning, with emphasis on literacy at the right age for all. The other three pillars, that can also be seen as enabling conditions are: (c) sustained political leadership to put learning at the center of education policy and implement substantial education reforms; (d) the devolution of primary and lower secondary schools to the management of municipal governments, providing a high degree of autonomy for municipalities to design and implement their education policies; and (e) the establishment of a solid and reliable monitoring and evaluation system that continuously measures key education outcomes, including student learning (figure 10). The following paragraphs describe each of those elements and the relationship between them, including a historic perspective of the sequence of the implementation of the reforms, summarized in figure 12.

Figure 10: Main education components of the educational policy of Ceará for primary and lower secondary education



Source: World Bank team based on the collected information and discussion with Ceará policy makers.

¹⁰ Lee, Ling Jessica Diana, and Octavio Medina Pedreira. 2019. *Results-Based Financing in Education : Learning from What Works (English)*. Washington, D.C.: World Bank Group.

The five pillars fundamentally depend on each other to generate impacts on learning. As countries around the world seek to achieve gains in education access and quality in short timeframes, it can be tempting to boil down the success of Ceará to a single reform, but reducing these programs of reform to a single element would be unwise, as the best evidence suggests that these factors have worked together to produce striking success. As the five pillars are outlined below, it will be clear that implementing each pillar without the existence of the others limit their impact on learning and for some of them, one can only exist if at least two of them are in place.

A. Fiscal incentives for municipalities to achieve education outcomes

Ceará revolutionized intergovernmental transfers to municipalities by placing education, health, and environment outcomes at the center of the redistribution mechanism, incentivizing positive behavior of the municipal governments in those sectors. A new state law was approved in 2007, changing how the state government would transfer the share of state consumption tax (*Imposto sobre Circulação de Mercadorias e Serviços - ICMS*) to municipalities. The law 14.023/2007 changed the distribution criteria of ICMS share that was based on population size and level of income of the municipalities (in line with what used to happen in all other Brazilian states) to become fully based on results in education, health, and environmental policies.¹¹ Among the three areas, education has the greatest importance, as it represents 72 percent of the entire allocation, whereas health accounts for 20 percent, and environment 8 percent. As a result, 18 percent of the total ICMS revenue received by a municipality derives from its improvements in education outcomes, such as student learning and progression through grades. For poorer municipalities, the size of the ICMS rewards can be more than half of all municipal total revenues. Another key element is that there is no restriction on what sector the ICMS resources can be applied (it is not tied to education expenditures), which encourages the mayor and administration areas to focus efforts on education improvement.

B. Technical assistance for municipal school networks

Also in 2007, Ceará implemented the Literacy Program at the Right Age (*Pacto pela Alfabetização na Idade Certa*, PAIC) combining actions to technically support municipal secretariats of education.¹² As primary and lower secondary education in Ceará was already by then mainly the responsibility of municipal governments, the program established education outcome targets in agreements made between the State Secretariat of Education (*Secretaria Estadual da Educação*, SEDUC) and municipal governments. SEDUC began to support the municipal secretariats of education, including teacher training focused on classroom practice. SEDUC also started producing literacy materials and promoting workshops for primary municipal teachers, including school visits to support implementation and share best practices. SEDUC also established a standardized student learning assessment to identify the baseline for each municipality and define targets. Additional support takes place at the school level

¹¹ According to the Brazilian Constitution (Art 158, 1988), 25 percent of the ICMS collected by states must be transferred to its municipalities. Three-quarters of the revenue (18.75 percent) must be distributed according to the municipality's contribution to the added fiscal value. The remaining quarter (6.25 percent) is defined by each state, generally based on population size and income level.

¹² PAIC benefited from the creation of the Ceará Committee for the Elimination of School Illiteracy in 2004, that involved several institutions, under the leadership of the State Legislative Assembly, after a diagnosis of illiteracy in the state, carried out by the United Nations Children's Fund {UNICEF}. UNICEF also financed the PAIC pilot, which took place in 2005–2006 in 56 municipalities in partnership with the state-section of the national union of municipal secretaries of education (UNDIME) and the association of mayors in Ceará (APRECE). In 2007, the new state administration took over the implementation of the program.

through the program *Escola Nota 10* which gives rewards to top schools providing TA to low-performing schools to improve education outcomes.

C. Sustained political leadership

The implementation of the education reforms in Ceará required strong political leadership. A fundamental pillar of the education policy in Ceará was placing the improvement of education quality at the heart of the general government agenda, with the understanding that it was a necessary condition for the socioeconomic development of the state.

Learning was elected as the ultimate goal of education policy, with universal literacy as the first key step. The prioritization of education by the state government had learning at the center of education policy, strategies, and actions, particularly for primary education. There was also a clear understanding of the importance of the policies being well-sequenced, assuring universal literacy at the right age as a fundamental step.

The focus on literacy was a logical first step from the pedagogical, policy making, and political perspectives. Strong literacy skills are the basis for student success. For policy making, it is a concrete step in education policy that strengthens middle management, promotes meritocracy, sets incentives, and structures external learning assessments, which ultimately enables other grades and subjects to build upon them. Politically, literacy targets provide short-term outcomes that can be achieved in one term of administration. The main reforms in Ceará were implemented in 2007 and results could be observed with the standardized state exams every year and with the equivalent national exams every two years.

A key role of the political leadership is to protect education from politics. A government electing education as priority also means that it should protect the school from politics. The state government of Ceará was clearly able to keep politics out of education. There is a strong indication that most of its interventions and support to the municipal secretariats of education did not vary across the state, with municipalities, with the political parties of the mayor. Similarly, at the municipal level, with the incentives created by the state government to improve education outcomes, the mayors increasingly started protecting their own education policies from politics, selecting secretaries of education and school principals using technical criteria instead of political ones.

The implementation of the education reforms required an open and transparent dialogue with all relevant counterparts that also created the grounds to the continuity of the education policy at the state and municipal levels. Implementing policy reforms requires dialoguing with organized groups that might oppose the changes if they see the changes as detrimental for them. The dialogue strategies used by the Ceará government during the period of the key reforms sought to involve all relevant counterparts and convince them that the reforms had learning as the ultimate goal and that in the end all education counterparts in the state would benefit from these reforms.

D. Municipalities with autonomy and accountability to achieve learning

This model of results-based financing with technical assistance was only possible in a decentralized management of primary and lower secondary education. According to the Brazilian constitution, municipalities in Brazil, regardless of size, have a level of administrative autonomy comparable to the ones observed in the states. That means that municipalities can establish their own policies in all sectors, including education, as long as they do not contradict national and state norms. It also means that every aspect of school management is under the

responsibility of the municipal secretariat of education, including the hiring and firing of teachers and principals, professional development of teachers and principals and the maintenance of the buildings. The devolution of primary and lower secondary schools to the management of municipal governments, that have a high degree of autonomy to design and implement their education policies, is a critical element of the education model of Ceará. Unlike most Brazilian states, virtually all public primary and lower secondary schools in Ceará are devolved to municipal governments. In 2007, municipal governments in Ceará had 98 percent of the public enrollment¹³ in primary education, whereas this figure for Brazil was 76 percent (figure 11). This scenario slightly changed in 2018, with 99.3 percent of primary education students attending municipal schools in Ceará and 83.5 percent in Brazil.¹⁴ The figures for lower secondary education follow the same pattern but at lower levels: in 2007, Ceará had 77 percent of enrollment in municipal schools and Brazil had 42 percent, while the figures in 2018 were respectively 96 percent and 50.5 percent.¹⁵ The decision to devolve the management of primary and early secondary education to municipalities established clear roles and responsibilities for each government level.

E. Regular monitoring of learning followed by action

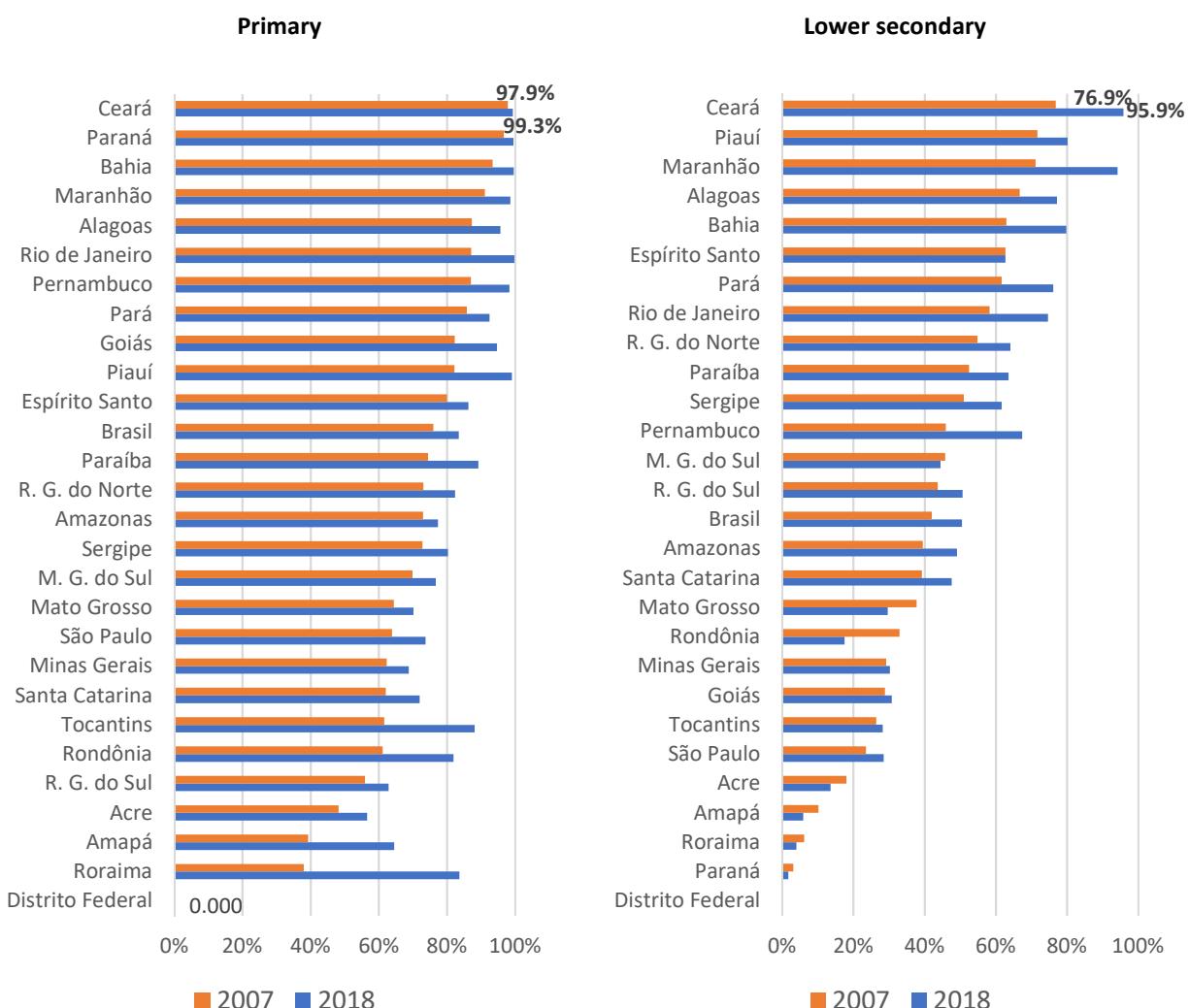
Measuring results is critical to establishing an RBF system and identifying the municipalities that need more support. The establishment of a solid and reliable monitoring and evaluation system that continuously measures key education outcomes—including student learning—was a key element established by SEDUC to assess student achievement on literacy by second grade (grades 5, 9 and 12 were already assessed) that was implemented in partnership with municipalities to all public schools. Results provide a diagnostic about literacy levels and support the establishment of learning goals, which is transmitted to teachers and schools through training and monitoring actions.

¹³ Excluding federal institutions, which are generally military schools and therefore cannot be devolved to municipalities.

¹⁴ In 2007, most of other states had autonomy rates in **primary** below 80 percent (and as low as 38 percent) but in 2018 all states have increased this rate, with 9 other states with figures above 90 percent (but still below Ceará): Bahia, Piauí, Maranhão, Pernambuco, Alagoas, Rio de Janeiro, Paraná, Goiás, and Pará.

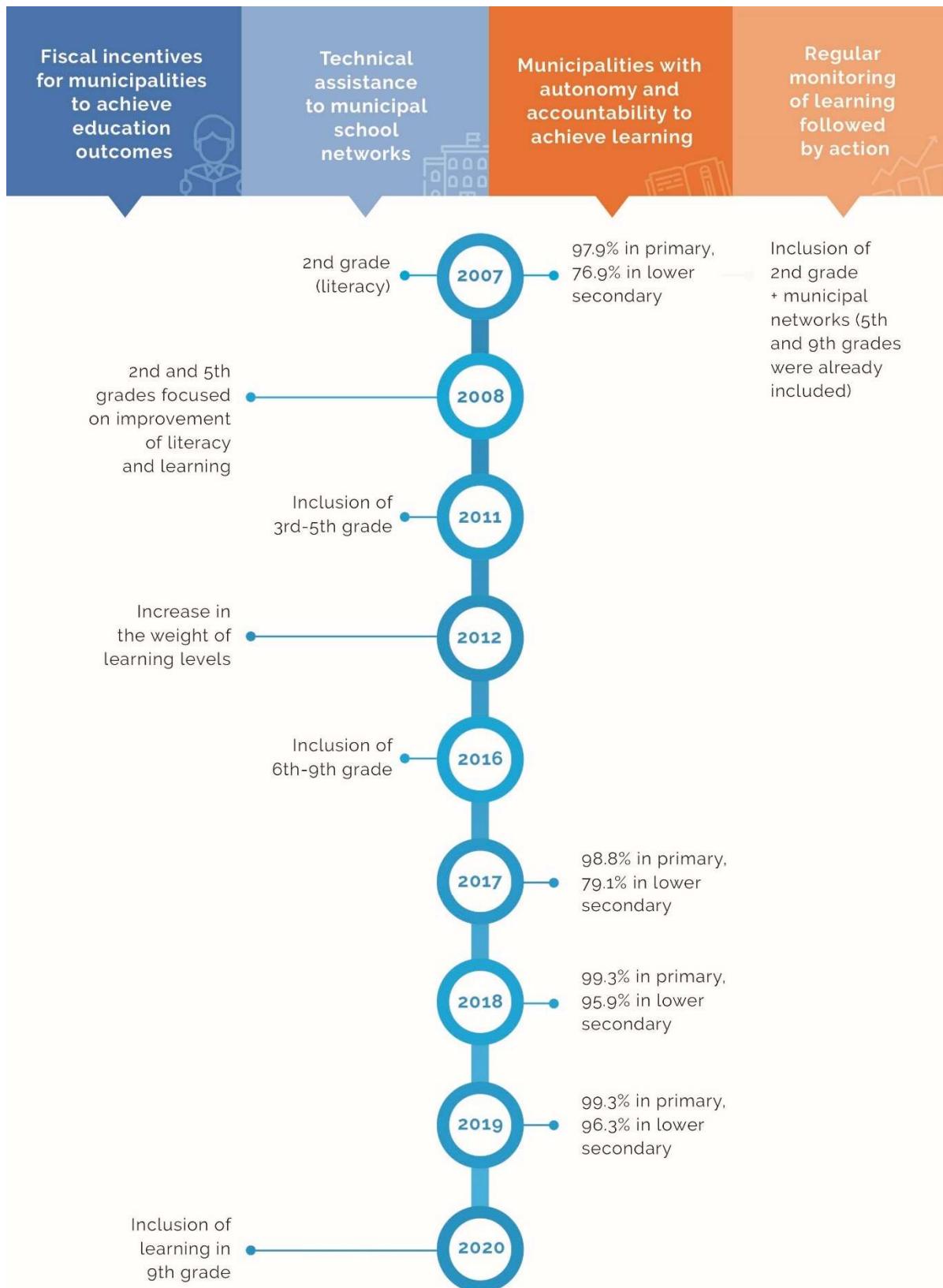
¹⁵ In 2007, all other states had autonomy rates in **lower secondary** below 50 percent (and as low as 3 percent) but in 2018 all states have had increased this rate, with two other states with figures above 80 percent: Piauí and Maranhão.

Figure 11: Percentage of public primary and lower secondary enrollment in schools managed by municipal governments, 2007, 2018



Source: World Bank with INEP/MEC data.

Figure 12: Timeline of the education reforms in Ceará



Source: World Bank team based on the collected information and discussion with Ceará policy makers.

3. Main elements of the results-based financing model in education of Ceará

Education financing in Ceará in the national context

Public education in Ceará benefits from the Brazilian education financing system that has mechanisms to mitigate inequalities in education spending across the country. While there is room for improvement in the national system to reduce disparities between and within states and increase efficiency, the contributions to subnational governments are substantial. Before 1996, differences in schooling coverage and tax revenues across jurisdictions created huge disparities in expenditure per student, despite the constitution establishing a minimum spending of 25 percent of revenues. To mitigate those imbalances, the Brazilian government established in 1996 the Fund for the Development of Primary and Lower secondary Education (*Fundo de Manutenção e Desenvolvimento do Ensino Fundamental e de Valorização do Magistério - FUNDEF*) that was followed by the creation of a similar fund including early childhood education (ECE) and upper-secondary education in 2007 (*FUNDEB*).¹⁶ FUNDEF increased the allocation of education funds in the poorest areas by pooling resources from taxes and transfers from municipal and state governments and redistributing them on a student-enrollment basis. The federal government also provides complementary funds for poorer states, reducing regional inequality in education spending. The resources are transferred automatically, without the need for political bargaining, and provide certain stability in the education budget. The average spending per student in Brazil varies substantially, with some municipalities spending levels comparable to countries in the Organisation for Economic Co-operation and Development (OECD), while others get higher education results by spending a considerably smaller fraction. This indicates there is substantial room for improving quality in an efficient manner.

Results-based financing in Ceará

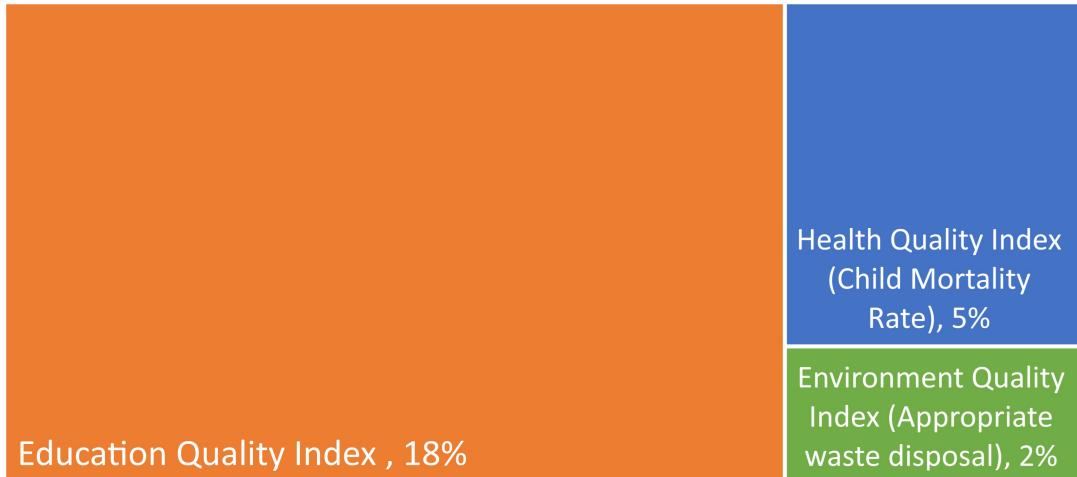
The state of Ceará innovated in linking the share of consumption tax revenue that is split among municipalities according to education performance, making education quality as a priority for mayors. The state consumption tax (ICMS) is one of the most important revenues for subnational governments. Collected by states, 25 percent of total revenue must be transferred to municipalities, 75 percent according to economic activity, and the remaining 25 percent (called ICMS-quota) is discretionary. Ceará was the first state to implement a performance-based criterion for ICMS-quota with education results as the main component (18 percent, in addition to a health indicator, 5 percent and environment indicator, 2 percent). The ICMS-quota represents a substantial share of the municipal budget in Ceará, making education improvements at municipal level a priority for the municipal governments, their secretaries of finance, and their mayors.

The formula that defines the amount received by each municipality rewards improvement in education outcomes. By considering clear indicators, the results-based mechanism promotes transparency and generates incentives for municipalities to improve results. The state government created an education quality index that considers the level and improvements in 2nd graders' literacy, 5th graders' performance on reading and mathematics, and the average pass rates from 1st to 5th grade. Higher rewards are given to municipalities with the highest levels and gains. The system also penalizes municipalities that increase inequality among schools or

¹⁶ More details on the Brazilian education financing in annex 1.

try to reduce the take-up rate in the exam of low-performing students. Figure 13 depicts the partition of funds in relation to the total revenue collected in Ceará.

Figure 13: Criteria for distribution of funds based on results in Ceará



Source: Legislation of Ceará State on ICMS transfers for municipal governments

The results-based financing mechanism in Ceará was inspired by a results-focused World Bank investment project with the state government. Starting in 2005, the World Bank supported the state government of Ceará through a sequence of multisector investment projects, with the financing linked to disbursement-linked indicators. The indicators were designed to achieve results in several sectors, including education, and this experience played a role in motivating the creation of a new lending instrument in the World Bank called Program for Results (PforR).¹⁷ The projects also helped to strengthen the capacity in the state government to identify indicators and targets and the rationale of conditioning disbursements on the achievement of targets for relevant indicators for the sectors supported by project was then replicated by the state government of Ceará—outside of World Bank projects—to redesign the redistribution of ICMS funds for the municipal governments.¹⁸

Despite the size of the transfer being linked to outcomes in education, health and environment, the municipal governments have the freedom to use these funds on any sector. A crucial element of Ceará's results-based financing mechanism in education is that they continue to be general transfers, in the sense that the mayors can use the value of transfers on any sector, even those not directly related to education, health, and environment. Such freedom provides incentives for improving outcomes for the whole municipal government, not only the secretariats related to the outcomes associated to the RBF mechanism, including the mayors and secretaries of finance.

¹⁷ World Bank. 2013. Brazil : World Bank Group country program evaluation, FY2004-2011 - approach paper (English). Independent Evaluation Group (IEG) approach paper. Washington, DC : World Bank Group. <http://documents.worldbank.org/curated/en/984111468232766057/Brazil-World-Bank-Group-country-program-evaluation-FY2004-2011-approach-paper>

¹⁸ World Bank. 2012. Brazil - Ceará Second Sector Wide Approach (SWAP) Inclusive Growth Project (English). Washington, DC: World Bank. <http://documents.worldbank.org/curated/en/614021468227634633/Brazil-Ceará-Second-Sector-Wide-Approach-SWAP-Inclusive-Growth-Project>

The design of an education quality index was decisive to engage municipalities and establish a focus on what elements of education should be improved. The education quality index sought to capture both the level (the share of students with appropriate skills) and improvements (the increase in skill levels between years). It also gives different weights to each of the three indicators, but always prioritized literacy. When the incentive was created, the formula gave more weight to improvements in literacy to stimulate municipalities with poor education outcomes. As the quality of education improved in the state, the formula was changed to give more weight to the levels of literacy at grade 2 and attainment at grade 5 (see figures 14a and 14b). The formulas of the mechanism are presented in annex 2.¹⁹

The incentive mechanism in Ceará was designed and adjusted over time to mitigate possible gaming behaviors from the municipal school networks, which required substantial technical capacity. The design and operationalization of the RBF mechanism in Ceará was led by the Economic Research Institute of Ceará (IPECE), a state government institution associated with the state planning secretariat and including highly qualified economists at the Ceará government. The team at IPECE was able to create a results-based financing framework that incorporated control mechanisms to discourage actions that could negatively affect the goals of the mechanism. For example, the formulas punish municipalities that have lower attendance of students in the exam or higher inequality between students in terms of test scores. So any strategy to avoid low performing students to sit for the exam or to focus on improving performance for only a subgroup of students is accounted negatively in the formula.

The incentive mechanism also has a strong emphasis on equity and provides learning opportunities to students. The results-based framework focuses on rewarding reductions on the percentage of students with learning below acceptable minimum level to incentivize pro-poor actions and has a greater focus on improvements (change) over time rather than levels, which allows municipalities at the bottom of the distribution of education outcomes to receive substantial transfers with little efforts to improve their education policies. Overall, the mechanism creates incentives for results-driven spending, with a positive competition environment, in which all municipalities are encouraged to believe that they can do well.²⁰ The mechanism also has elements to mitigate undesired behaviors (gaming) and induce equity in learning.

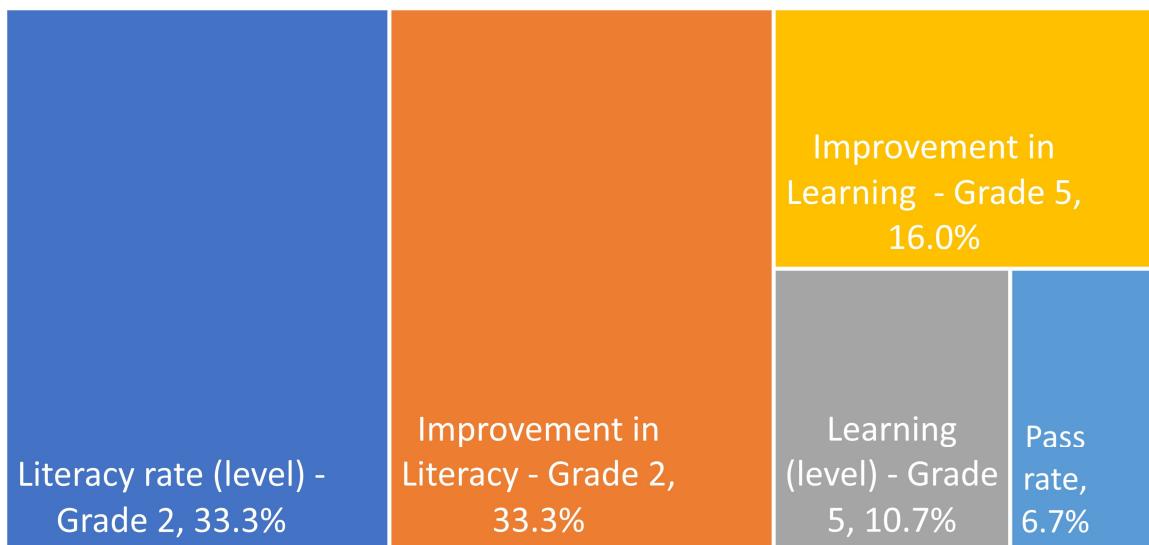
The sum transfers to the municipalities associated with education outcomes each year are above the equivalent of US\$100 million and for some municipalities, particularly the poorest, the transfer can be higher than one-third of the revenues from all sources. Every year the state government of Ceará transfers resources to the municipal governments upon the achievement of education outcomes, as described above, with the total amount of transfers reaching more than the equivalent of US\$100 million (figure 15). Depending on how well the municipalities performed on the key indicators and the size/level of income of the municipality, the transfer can reach more than one-third of the total revenues of the municipal government (figure 16).²¹

¹⁹ A decree issued in December 2019 included the 9th grade into the RBF mechanism in Ceará. Details on the weights were not defined by the time this report was published.

²⁰ More details in the background paper (forthcoming) that delves into the Ceará RBF.

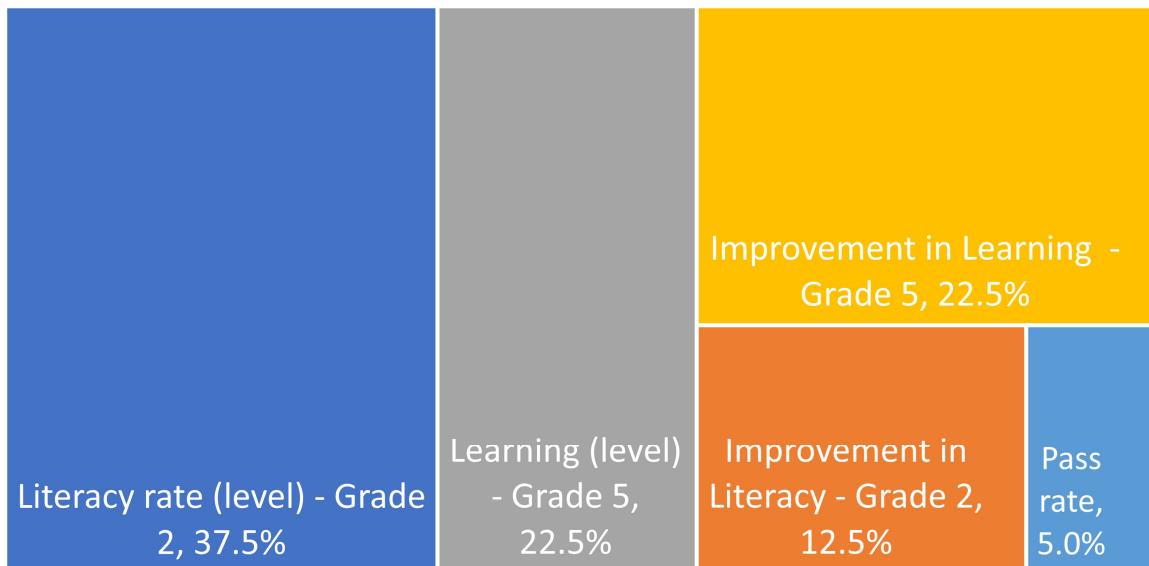
²¹ In previous years, the transfers based on results could reach up to 70 percent of total revenue for some poorer municipalities with very strong improvement in the indicators.

14a: Components of the Education Quality Index for distribution of funds based on results in Ceará (between 2008 and 2011)



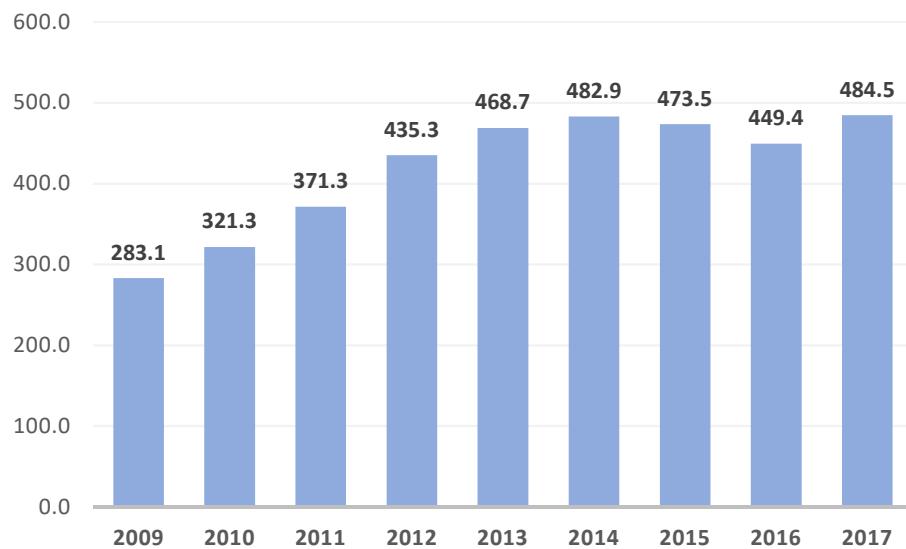
Source: Legislation of Ceará on the RBF mechanism between 2008 and 2011

Figure 14b: Components of the Education Quality Index for distribution of funds based on results in Ceará (between 2012 and 2019)



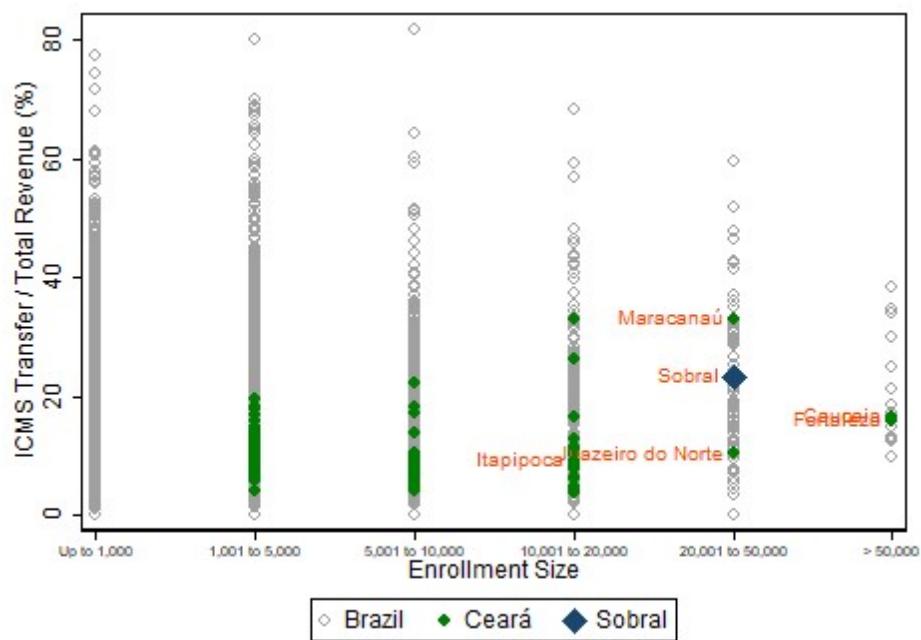
Source: Legislation of Ceará on the RBF mechanism between 2012 and 2019

Figure 15: Amounts transferred to municipalities in Ceará upon achievements of results, R\$, millions, (constant prices, 2017 = 100), (R\$1 = US\$4, October 2019)



Source: World Bank with IPECE data.

Figure 16: Relative size of consumption tax transfers in relation to total revenues of Brazilian municipalities, Ceará municipalities highlighted, 2017



Source: World Bank with IPECE data.

4. Key components of the technical assistance for the municipal secretariats of education in Ceará²²

The TA provided by the state government to the municipal secretariats of education has three fundamental components: (A) Providing literacy support to the municipalities; (B) Strengthening the governance of municipal secretariats of education and providing incentives to promote the exchange of best pedagogical practices; (C) Promoting the pedagogical use of student assessment results.

A. Providing literacy support to the municipalities

The state government provides municipalities with scripted learning materials. The municipal secretariats of education receive scripted materials with a well-defined pedagogical routine proposed for each class and clear guidance on the use of time. The materials are aligned with the state curriculum, which has a clear learning sequence, with prioritization of foundational skills, particularly literacy at the right age.

The municipal secretariats of education receive support to establish teacher training on literacy which is focused on classroom practice. Teacher training actions are focused on the usage of the structured material and the classroom routine and practices. Trainers deployed by the state government conduct regular training for the municipal secretariat of education staff to strengthen their teacher training activities. In municipalities with critically low literacy levels, the teachers are directly trained by the state government trainers. These actions also involved classroom observations by teacher trainers and are based on the pedagogical materials that teachers use in their daily routine.

The state secretariat of education provides TA to expand and improve the quality of ECE, as well as guide municipal governments to develop a curriculum focused on stimulation and school readiness. The state government offers training for teachers and administrative staff to develop an appropriate pedagogical curriculum for ECE. The support from the state government also facilitates financing to municipalities to build ECE, as well as pedagogical materials and equipment.

B. Strengthening the governance of municipal secretariats of education and providing incentives to promote the exchange of best pedagogical practices

The state government created a collaborative governance arrangement with solid monitoring and evaluation of municipal education policies. This governance for education in the state of Ceará is structured in three levels: (i) state-level teams, responsible for monitoring and supporting regional teams and also for hiring specialists to supplement this support; (ii) regional teams, responsible for close monitoring and training of the municipal administrative staff; (iii) municipal teams, responsible for training teachers and principals in their schools.

The municipal secretaries of education receive support from the state government to strengthen pedagogical management and the monitoring of learning. The TA aims at strengthening the municipal capacity in implementing and monitoring a structured literacy policy with solid pedagogical management. The state secretariat of education designed monitoring indicators and instruments to support schools and municipalities.

²² Many thanks to Maurício Holanda, Fátima Alves, Thiago Cardoso, and Matheus Assunção for important discussion and inputs to this section.

At the municipal secretary of education, the TA provided guidance on structuring processes including (i) elimination of multi-grade classes, (ii) effective use of the pedagogical time in each class over the school year, (iii) strengthening school management and autonomy, (iv) adoption of meritocratic criteria for selecting school principals, and (v) incentives for teachers working at literacy classes.

The state government implemented incentives for exchanging good practices on pedagogical management and encouraged a healthy competitive environment. With this purpose, Ceará designed a program named *Escola Nota 10* based on rewarding schools for engaging in knowledge exchange. At the end of every year, the *Escola Nota 10* gives to the best-performing teachers and their schools financial and social rewards. Complementary to that, the program also augments the support given to the poorest, low-performing schools, by encouragement that recognized high-performing schools assisting low-performing ones by sharing materials, organizing *in loco* visits, and programming new pedagogical activities. The full prize is received under the condition that the schools matched the participation in these activities. Additionally, if the low-performing school improves its performance in the following year, it also receives a complementary prize.

C. Promoting the pedagogical use of student assessments

Municipalities receive assistance to implement a learning diagnostic for each student at the beginning of the school year. The state prepares a diagnostic exam for language and mathematics, the protocols for applying it, and a digital platform for results collection. Municipalities are responsible for exam printing, application, and data enumeration on the digital platform. The platform displays a detailed learning diagnostic of students' skills, including their previous knowledge. The results are presented with disaggregation by classroom and student, and comprehends an important input for teacher training interventions and improvements on pedagogical practice.

The state government established an annual external learning evaluation at grade 2 (SPAECCE Alfa) to measure the performance of schools and municipalities toward the literacy target. At the end of every year this standardized student learning assessment is applied, providing municipalities information about each student's proficiency. This standardized assessment is also a key factor for evaluating state and municipalities' performance.

Support to the municipalities to establish learning evaluations regularly is an effective way to monitor learning and a pedagogical instrument to guide teacher practice in the classroom. The state government provides municipalities not only the instruments for applying learning evaluations regularly, but also training for the pedagogical use of these assessments. Regional coordinators from the state organize workshops and visits to municipalities to discuss and support learning monitoring within the municipal secretaries of education, which, in turn, support the pedagogical coordinators at schools. This cascade organization strengthens the pedagogical role at middle-management levels and empowers school coordinators, who aim to support teachers in each classroom. It is a shift from inspection to constructive intervention at schools. There is also an intense and growing involvement of the diverse actors from educational management in monitoring the results of evaluations.

5. Evidence on the factors that contributed to the success in education in Ceará

There is substantial evidence that the Ceará education model had a positive impact on education outcomes, particularly for the poorest students in the poorest municipalities. The evidence strongly indicates that education improvements in learning, school retention, and equity (in both spending and education outcomes) are strongly associated with the results-based framework established in Ceará that includes the following elements: (a) a focus on the low-performing schools and students; (b) an emphasis on rewarding improvements over levels; (c) freedom to use these rewards in any sector; and (d) TA to raise the perceived probability of achieving better results. The impact of RBF on student learning is identified in the short (Petterini and Irffi 2013) and medium term (Brandão 2014). Policy results are significant, even for municipalities that have initially lost resources and those with lower GDP per capita (Brandão 2014). Another study adopting different control groups and expanding analysis' range to years 1995–2009 indicates a positive impact (Carneiro and Irffi 2017). The intervention also contributed to reducing the achievement gap between poor and rich municipalities (Brandão 2014). A quasi-experimental study analyzed student learning and found a positive impact of TA to municipalities on student achievement (Costa and Carnoy 2015).²³

The existing evidence indicates that all pillars of Ceará's education model are critical and implementing only a subset of them would yield limited impacts on learning. An important aspect of Ceará's education model is the complementarity impact of pillars on learning. World Bank research points to strong synergies between pillars and strongly suggests that implementing the full package produces particularly higher impacts on learning than one pillar alone. For example, comparing schools at the border between Ceará and adjacent states, Lautharte, Oliveira, and Loureiro (2020) show that when the RBF + TA model was introduced in schools in Ceará, it produced an impact 2–3 times higher than when the same schools had only RBF in place. These results are valid for performance on Portuguese and mathematics for primary and lower secondary schools.²⁴

These impacts are pro-poor and socially desirable. After the introduction of RBF and TA, students are less likely to work outside home by 35 percent—no impact is observed during RBF only period. Girls are 5.6 percent more likely to be studying; students from lower socioeconomic background are more likely to be at school (proxied by the availability of a maid at home and number of bathrooms). In addition to being at school, students from lower socioeconomic backgrounds (proxied by mother's education) seem to have significantly higher improvements in mathematics and Portuguese scores than students from higher socioeconomic backgrounds. Similar conclusions are observed for nonwhite students relative to white students. Therefore, the RBF + TA model seems to be working to include and improve the performance of less-privileged students.

These results are not due to selecting better students. The evidence indicates that students are not selected in terms of application order—which could influence the interpretations because parents more involved in education would apply earlier. The incidence of schools accepting students using application order decreases by 66 percent in Ceará schools relative to counterparts. Instead, the selection of students is more often made by

²³ Costa, L. O., and M. Carnoy. 2015. "The Effectiveness of an Early-Grade Literacy Intervention on the Cognitive Achievement of Brazilian Students." *Educational Evaluation and Policy Analysis* 37 (4), pp.567-590; Brandão, Júlia Barbosa. 2014. *O rateio de ICMS por desempenho de municípios no Ceará e seu impacto em indicadores do sistema de avaliação da educação*. Tese de Doutorado; Petterini, Francis Carlo, and G.D. Irffi. 2013. "Evaluating the Impact of a Change in the ICMS Tax Law in the State of Ceará in Municipal Education and Health Indicators." *Economia* (Brasília) 14:171–184.; Carneiro, Diego, and Guilherme Irffi. 2018. *Problema do Risco Moral na Educação Básica: Um Modelo de Agente-Principal para a Distribuição de Recursos da Cota Parte do ICMS*.

²⁴ Lautharte, I., V. H. Oliveira, and A. Loureiro. 2020. "Education Incentives, Technical Assistance, or Both? Evidence from a Results-Based Financing to the Mayor in Brazil." World Bank, Mimeo.

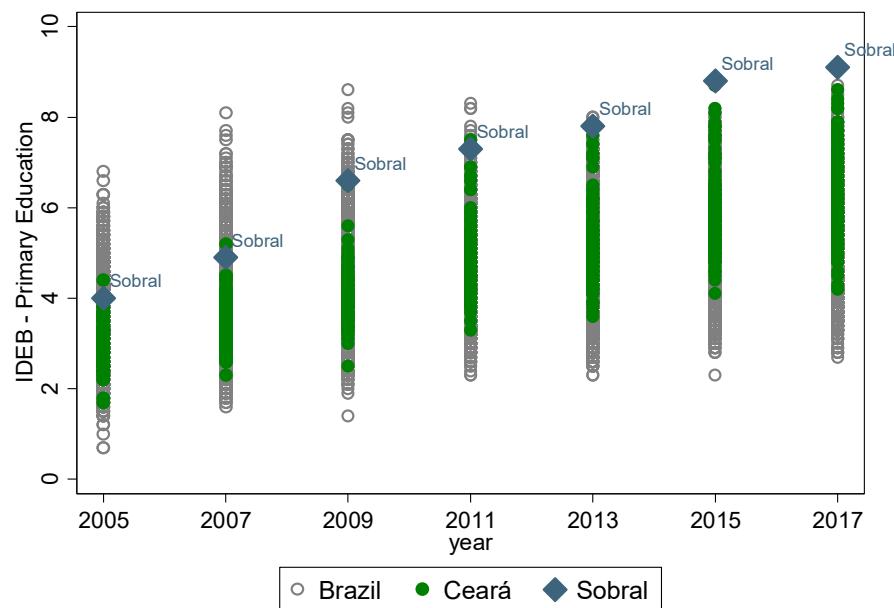
the geographic proximity between the school and student residence (increases approximately 20 percent). Thus, all improvements occurred with students coming from the same communities and environment as before the RBF was implemented.

But what has happened to foster all these improvements? One of the main mechanisms is related to principal autonomy and empowerment. There is a decrease by 14.3 percent in the selection of principals on a political basis after the implementation of the RBF mechanism. Principals became more experienced, either in years in education or the time spent in the same school. Estimates show that principals do not have significantly more Masters, or PhDs than others at the border; however, they have been receiving continuous training, 16.6 percent more than counterparts, and report significantly more that the training was useful for daily work (also 16 percent). For teachers this result repeats: masters and specialization are insignificant; for rising to the top the key was to provide simple, continuous training to principals and teachers. Principals in Ceará report receiving pedagogical projects from the municipal administration 30 percent more often than principals in schools across the border. The municipal financing to schools increases by 18 percent, and the absence of pedagogical books, provided by the city council, decreases almost 30 percent in Ceará. Importantly, these impacts occur only during RBF + TA periods. There is an increase in the involvement of local authorities along with better provision of pedagogical resources according to principals. Principals also report to be more active implementing strategies to fight against student absenteeism. Principals are significantly (9 percent) more likely to send a school staff to student households when they skip school. Another significantly more frequent strategy is to request parents to come to the school individually (4.81 percent). Teacher-principal relations also seem to be improving in the RBF + TA period. Teachers report participation in the decisions involving the school by 5.26 percent more often than control schools, almost 12 percent indicate that principals consider their ideas.

6. Sobral: The most successful municipality of the Ceará Model²⁵

The most successful municipality in Ceará in terms of education outcomes is also the one that inspired the model for the state. Ceará's education model for primary education was deeply inspired by the experience of Sobral, a 200,000-inhabitant municipality, which initiated key education reforms 10 years earlier. The municipality of Sobral in the state of Ceará has the best primary and lower secondary education in Brazil, despite adverse socioeconomic conditions. In the latest round of the national index that measures education quality in Brazil (IDEB), Sobral ranks number 1 among the 5,570 municipalities in both primary (grades 1 to 5) and lower secondary education (grades 6 to 9) rankings (figures 17 and 18). This is a highly substantial improvement since the beginning of the measurement of IDEB in 2005, when Sobral ranked in the 1,366th position with an IDEB of 4 in primary education, to reach a score of 9.1 in 2017, the highest in Brazil. There was also a substantial improvement in IDEB at the lower secondary level, with Sobral also reaching the top of the national ranking in 2017. IDEB scores for Sobral are higher than the average of private schools in São Paulo (figure 19).

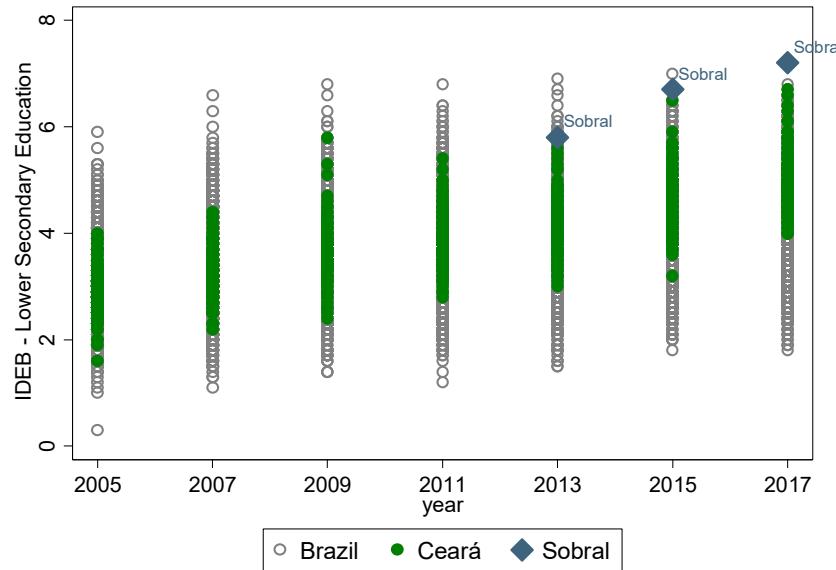
Figure 17: Distribution of education quality in primary education (grades 1 to 5) measured by IDEB - municipal school networks, 2005–2017



Source: World Bank with INEP/MEC data.

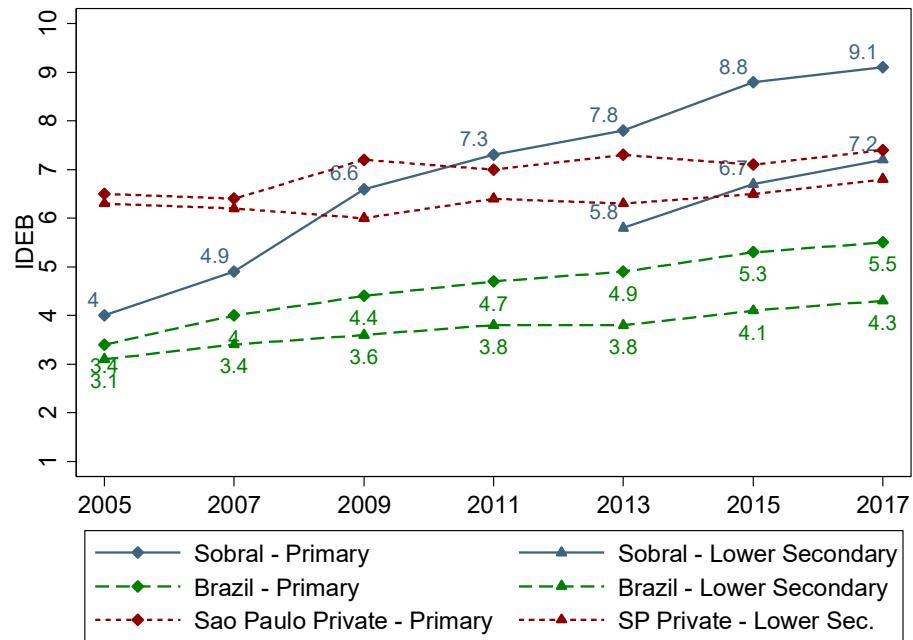
²⁵ The companion technical report "Achieving World-Class Education in Adverse Socioeconomic Conditions: The Case of Sobral in Brazil" provides more details on the education policy mode of Sobral.

Figure 18: Distribution of education quality in lower secondary education (grades 6 to 9) measured by IDEB - municipal school networks, 2005–2017



Source: World Bank with INEP/MEC data.

Figure 19: Education quality measured by IDEB, Sobral and Brazil (average of all municipal school networks), 2005–2017



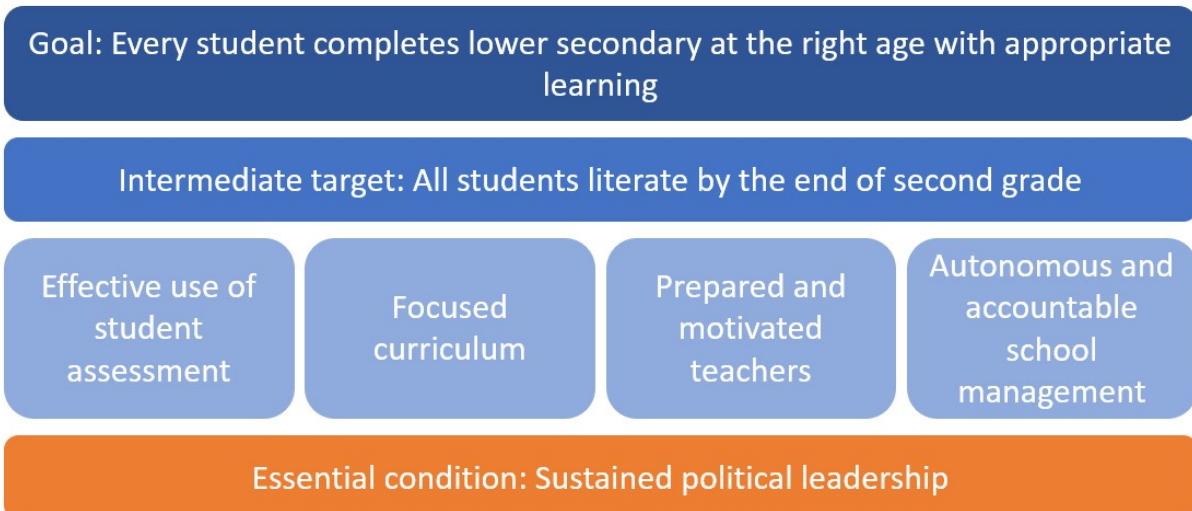
Source: World Bank with INEP/MEC data.

The current education policy in Sobral was established almost 20 years ago after a diagnostic revealed a system that was performing poorly. A diagnostic about education in Sobral in 2001, revealed that 40 percent of the

students at grade 3 could not read simple words, 32 and 74 percent of pupils in primary education and lower secondary, respectively, were overage, with 21 percent of children in lower secondary dropping out school. The diagnostic triggered a political decision to make deeper reforms in the system.

There are no silver bullets in the education policy in Sobral but a comprehensive approach that is composed of many programs, activities, and strategies that can be grouped into key pillars. The main elements that led Sobral to be the best education system in Brazil include a set of structured actions that reinforce each other in the goal of ensuring every student in the municipal network completes basic education at the right age and with appropriate learning. The political leadership in the municipality was able to place education at the top of the public agenda and establish a learning policy with a clear intermediate target—ensure all students are literate at grade 2. The target oriented the education system to establish a structured pedagogy based on (1) The effective use of student assessment, with regular monitoring of student learning through written and oral evaluations, using the results to reshape teachers' practices, setting learning goals and rewarding teachers, principals, and schools; (2) Focused curriculum, with a clear learning sequence and prioritization of foundational skills, particularly literacy at the right age, as well as a full alignment of curriculum with national, state, and municipal assessments, textbooks, and teacher training; (3) Prepared and motivated teachers, with focused and practical professional development of teachers to improve classroom management, as well as a structured routine for classes and classroom observation to guide teacher practice and financial incentives for teachers, with values linked to achieving student learning targets. The teacher support also includes scripted materials and lesson plans to support the classroom routine and improve the use of classroom time; (4) Autonomous and accountable school management with school principals appointed through a meritocratic and technical selection process, allowing a high level of school autonomy associated with results-based accountability. There are also financial incentives for principals, with values linked to reaching student learning targets of her/his school and substantial support from the secretariat of education to school management (figure 20).²⁶

Figure 20: Pillars of Sobral Education Policy



Source: World Bank team based on the collected information and discussion with Sobral policy makers.

²⁶ These elements follow the structure established by the WDR 2018, World Bank (2018).

7. Challenges and opportunities in replicating the Ceará Education Model

Education systems seeking to replicate the Ceará model require strong political leadership—and not just in the ministry of education. The education reforms in Ceará that allowed the 184 municipalities of the 9-million-inhabitant state to be at the top of education quality in primary and lower secondary education in Brazil were only possible because of the strong political leadership backing the education policies. The secretary or minister of education has a key role, of course, but substantial education reforms also affect society far beyond the education community, so it is also critical that other key political actors and—most importantly—the leader of the government both publicly and privately prioritizes education quality.

There is a high level of complementarity between financial incentives and technical assistance. All five pillars of the Ceará education model are critical and interdependent, including the RBF and technical assistance pillars, as discussed in section 5. Creating well-designed incentives for improving education outcomes without technical support can still improve the average education outcomes, but some municipalities can become discouraged and lag behind, with negative impacts on equity and undermining the overall benefits of such policy. Conversely, providing high-quality technical support without strong incentives for improvement can generate some gains, particularly for the municipalities with low capacity and poor education outcomes. However, for the municipalities that are doing slightly better, the engagement with technical teams willing to support can be reduced or not happen. Thus, any government seeking to replicate and adapt the Ceará education model should give the same level of importance for all five pillars, including both a well-designed results-based incentive mechanism and a solid technical support strategy.

A crucial element of Ceará's RBF mechanism in education is that it used general transfers not linked to education and provided incentives to use them to improve education. Education systems in general—and particularly in low- and middle-income countries—do not have resources that are not in use, so reallocating substantial resources without affecting the daily functioning of schools is difficult. Teacher salaries alone often consume 80 percent of education budgets in low-income countries (World Bank 2018). For that reason, a meaningful results-based mechanism in education may use general purpose transfers with incentives to improve education. By keeping the transfers general purpose, subnational governments retain the option to generate incentives associated with the improvement of education outcomes to leaders across their administrations, not just the minister of education.

A reform of the mechanism of transfers to subnational entities to make it results-based requires a solid buy-in from the secretaries of finance or planning, and ultimately the leader of the government. Because the creation of meaningful RBF in education requires reforming general purpose transfers to subnational governments, ministers of education willing to implement reforms inspired by the example of Ceará need to build a solid dialogue not only with their education counterparts but also with colleagues responsible for finance and planning, and ultimately with the president or prime minister of the country.

A necessary condition for establishing a results-based mechanism in education is the decentralization of school systems at the subnational level. The autonomy of subnational governments to manage their schools is a basic requirement for a system of incentives. Sobral managed its education improvements more directly because it is a small municipality, but most states and countries do not have the staff or capacity to do that. Ceará does not manage schools at the basic education level. But it does create incentives and provide support. Its flagship

literacy program—Literacy at the Right Age—provides a menu of options, which municipalities can draw from and adapt (with support from the state), rather than a single solution.

Establishing and managing an effective RBF mechanism requires capable staff. Political leadership figures centrally in the stories of Ceará and Sobral. It is essential. But the political leader cannot make monthly visits to every school or set detailed goals with every municipality. Part of political leadership in Ceará included developing a skilled bureaucracy to administer the program. This included both economics and finance professionals to design the RBF in a way that would avoid gaming and cheating, and education professionals to provide the extensive technical support.

Ultimately, the reason this report can tell the story of Ceará is because of a careful system of measurement—a monitoring and evaluation system. Ceará tried many reforms over the years, and careful monitoring of students, teachers, schools, and municipalities allowed it to learn what was working and what needed additional work. National monitoring in Brazil allows Ceará to see how much it has improved. A monitoring and evaluation system requires substantial investment in the face of many other pressing demands for education, but it completely pays off and merits the same level of importance as financing incentives, teacher professional development, and developing a focused curriculum.

Ceará and its municipalities still have much to learn. The state government of Ceará is seeking to improve the quality of upper-secondary education – a challenge for Brazil and most of Latin America and the Caribbean – as well as achieve the last-mile in stamping out illiteracy. But the gains of the last 20 years provide momentum for the way forward and demonstrate the power of fundamental principles—political leadership, clear goals, incentives, technical support, and careful monitoring—in achieving the next set of goals and guiding other states and nations toward literacy and academic success for all children.

Annex 1: Education Financing in Brazil

The financing of Brazil's pre-university education system is an intricate framework based on three main pillars. The financing of the public education system is shared by the federal, state, and municipality levels, with roughly similar percentages for the three levels of government.²⁷ The main sources of the Brazilian pre-university education financing are: the National Education Fund (*Fundo Nacional para Educação Básica*, FUNDEB) and Salary-Education Levy Tax (*Salário-Educação*), with the constitutional earmarking for education being an important element of the education financing framework in Brazil.²⁸

The Brazilian constitution (1988) establishes a minimum spending for education (from ECE to university level) in terms of the revenues for all three levels of government. The municipal and state governments must spend at least 25 percent of their respective revenue (taxes and constitutional transfers from the federal government), whereas the federal government must spend at least 18 percent. Federal education programs (such as textbooks, school feeding, transportation, and direct transfers to schools) and some expenditures in education with specific sources are not considered in the minimum spending rule, including the Salary-Education Levy Tax (*Salário-Educação*), that was established in 1964 and enshrined in the constitution and represents the second most relevant source of education financing in Brazil (about 20 percent of resources), after FUNDEB.²⁹

FUNDEB is the main funding source for public pre-university education. The law that established the Education National Fund (*Fundo Nacional para Educação Básica*, FUNDEB) requires state and municipal governments to pool 20 percent of a subset of their revenues (taxes and constitutional federal transfers) on the states' fund to finance pre-university education. FUNDEB funds are, therefore, the collection of 27 state funds plus federal support to the poorest states, which correspond to 10 percent of the sum of the 27 state funds. The redistribution of resources within the state is based on student enrollment of each school network (in all levels of pre-university education, including ECE) in the previous year.

FUNDEB was built upon a previous redistributive fund—FUNDEF—that targeted primary and lower secondary education. Before 1996, differences in schooling coverage and tax revenues across jurisdictions created huge disparities in expenditure per student, despite the constitution establishing a minimum spending of 25 percent of revenues. Situations like neighbor schools, one managed by the municipality, another by the state, having enormous differences in resources and attainment were common. To tackle those imbalances, the Brazilian government established in 1996 the Fund for the Development of Primary and Lower secondary Education (FUNDEF) for a 10-year fixed-term. FUNDEF increased the allocation of education funds in the poorest areas to be sponsored through a participatory fund in each state, composed by a set of state and municipal taxes and

²⁷ In 2014, municipal governments were responsible for 35.8 percent of all public expenditures in education (mostly focused on primary education), state government accounted for 36.2 percent (mostly used in upper-secondary education), and the federal government accounted for the remaining 28 percent (mainly spent on tertiary education through direct spending in federal institutions, student loans, direct transfers, or specific programs to support states and municipalities).

²⁸ The two other relevant sources are revenues of states and municipalities, as well as discretionary transfers from the federal government.

²⁹ Other important sources are the municipal and state owned resources beyond FUNDEB, discretionary expenditures by the federal government (Programa de Ações Articuladas - PAR), and other social contributions.

transfers.³⁰ The federal government provides complementary funds for poorer states. The fund targeted primary and lower secondary education, and distributed resources based on previous' year student enrollment.

FUNDEF and later FUNDEF have significantly contributed to increase education financing in poorer areas. Brazil considerably improved access, completion, and learning in all levels of pre-university education, particularly in primary and lower secondary education. FUNDEF/FUNDEB reduced the gap between rich and poor states and municipalities, but still there are substantial disparities among municipalities. The average spending per student is relatively large, but many states and municipalities are investing a value well below the average, while other municipalities have spending levels comparable to those of OECD countries to get the same education results. This indicates there is substantial room for improving quality in an efficient manner.

By increasing the minimum spending per student in poorer municipalities, FUNDEF created incentives for municipalities to raise student enrollment. By 2000, access to education for children ages 7–14 years was universal. The steepest growth happened in the north and northeast regions, where Ceará is located. Besides improving overall enrollment, the fund promoted a process of devolution of primary education from the state to the municipal government, as municipalities received students from state schools.

³⁰ Each state pulls resources from a 15 percent quota of the following taxes: States and Municipalities' Fund (FPE and PFM), consumption tax (ICMS), Industrialized Products' Tax proportional to exports (IPlexp), and exports' exoneration.

Annex 2: Formulas of the Results-Based Financing in Ceará

This section provides more details on the formulas originally used in the RBF mechanism in Ceará established in 2008.³¹ As explained in section 3, a quarter of the ICMS transfers to municipalities are made according to outcomes in education, health and environment, with the following weights:

$$Quota_m^{RBF} = 0.18 \cdot EQI_m + 0.05 \cdot HQI_m + 0.02 \cdot EI_m$$

Where: $Quota_m^{RBF}$ is the quota for each municipality m; EQI is the education quality index; HQI is the health quality index and EI is the environment index, as defined below.

EI is simply a dummy variable, indicating whether the municipality has an operational solid waste management system.

HQI is a simple average of the levels and improvements in infant mortality rate (IMR). After defining the distance of IMR to 100 as: $DMR_m = 100 - IMR_m$, HQI_m is defined as:

$$HQI_m = 0.5 \cdot \frac{DMR_m}{\sum_m DMR_m} + 0.5 \cdot \frac{\Delta DMR_m^N}{\sum_m \Delta DMR_m^N}$$

with $\Delta DMR_m^N = \frac{\Delta DMR_m - \Delta DMR_{min}}{\Delta DMR_{max} - \Delta DMR_{min}}$, so that it is a quantity between 0 and 1.

The original EQI has two components: 1. literacy (Literacy Quality Index, LQI) and 2. And Primary Education Quality Index, PQI), including student learning (language and math) and progression rates. Both component of EQI consider improvements and level of the indicators. The weights of both components have evolved, as explained in section 3, but the original weights were defined as described below.

For each municipality m the EQI is calculated as follows:

$$EQI_m = \frac{2}{3} \cdot LQI_m + \frac{1}{3} \cdot PQI_m$$

Regarding the Literacy Quality Index (LQI):

$$LQI_m = 0.5 \cdot \frac{LI_m}{\sum_m LI_m} + 0.5 \cdot \frac{\Delta LI_m^N}{\sum_m \Delta LI_m^N}$$

³¹ This section focus on the formulas included in the state government decree in 2008 provided the technical details of the new principles established by a law approved by the state assembly in 2007. A new decree issued by the end of 2011 made some changes in the weights of the formulas. For more details on the rationale for the key formulas and the evolution of the weights see <https://www.ipece.ce.gov.br/cota-parte-do-icms/> (in Portuguese). More details can also be found in Lautharte, I., V. H. Oliveira, and A. Loureiro. 2020. "Education Incentives, Technical Assistance, or Both? Evidence from a Results-Based Financing to the Mayor in Brazil." World Bank, Mimeo.

With $\Delta LI_m = LI_{mt} - LI_{mt-1}$, $LI_m^N = \frac{LI_m - LI_{min}}{LI_{max} - LI_{min}}$ and LI_m is the literacy indicator at grade 2 calculated as:

$$LI_m = \frac{\bar{L}_m}{1/2 \cdot \sigma_L^m} \cdot \frac{NA_m^{g2}}{NE_m^{g2}}$$

where \bar{L}_m and σ_L^m are respectively the average and standard deviation of the literacy assessment scores at grade 2 in municipality m, and NA_m^{g2} and NE_m^{g2} are respectively the number of pupils taking part of the assessment in grade 2 and total enrollment at the municipal network in grade 2.

Regarding the Primary Education Index (PEI):

$$PQI_m = 0.2 \cdot \frac{P_m}{\sum_m P_m} + 0.8 \cdot \left(0.4 \cdot \frac{TSI_m^N}{\sum_m TSI_m^N} + 0.6 \cdot \frac{\Delta TSI_m^N}{\sum_m \Delta TSI_m^N} \right)$$

With:

P_m is the progression rate of municipality m;

$$\Delta TSI_m = TSI_{mt} - \frac{TSI_{mt-1} + T_{mt-2} + TSI_{mt-3}}{3};$$

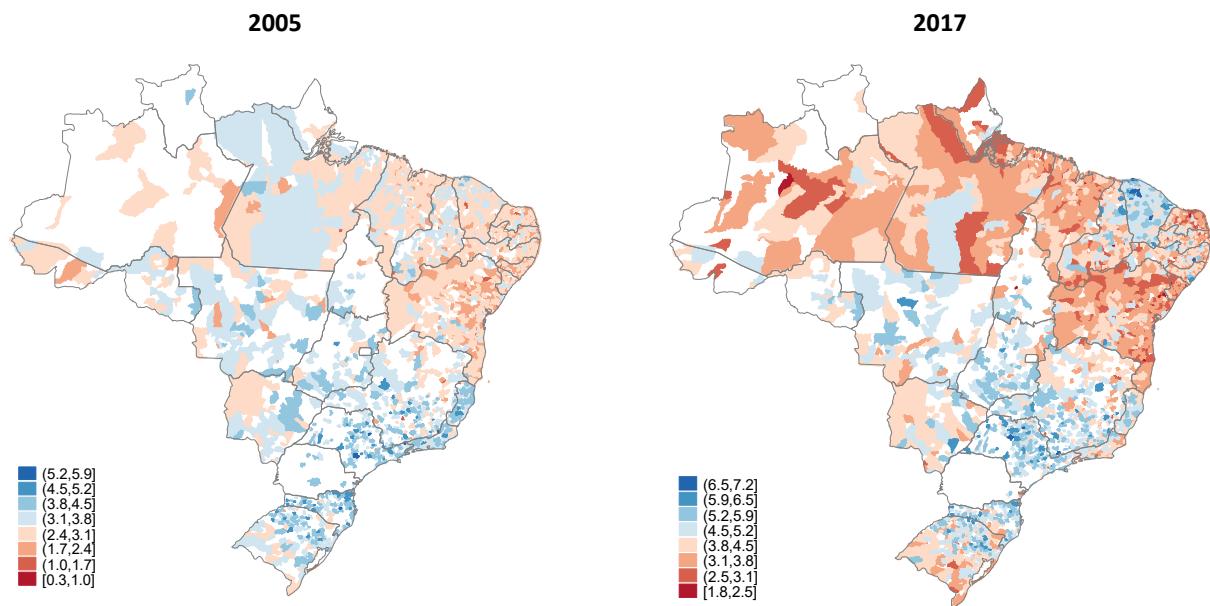
$TSI_m^N = \frac{TSI_m - TSI_{min}}{TSI_{max} - TSI_{min}}$ and TSI_m is the test score indicator at grade 5 calculated as:

$$TSI_m = \frac{\bar{TS}_m}{1/2 \cdot \sigma_{TS}^m} \cdot \frac{NA_m^{g5}}{NE_m^{g5}}$$

where \bar{TS}_m and σ_{TS}^m are respectively the average and standard deviation of the test scores at grade 5 in municipality m, and NA_m^{g5} and NE_m^{g5} are respectively the number of pupils taking part of the assessment in grade 5 and total enrollment at the municipal network in grade 5.

Annex 3: Additional Figures

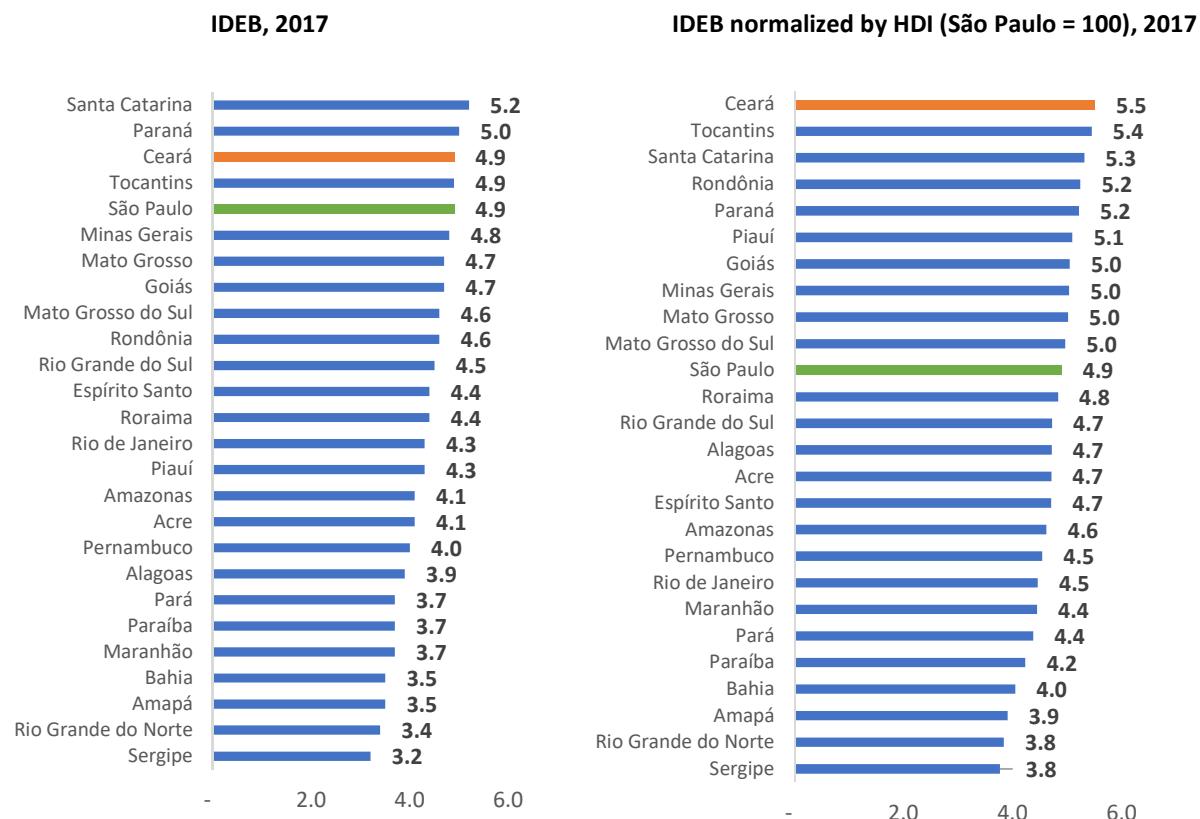
Figure A1: Education quality measured by IDEB - Brazilian municipalities, 2005–2017, lower secondary education³²



Source: World Bank with INEP/MEC data.

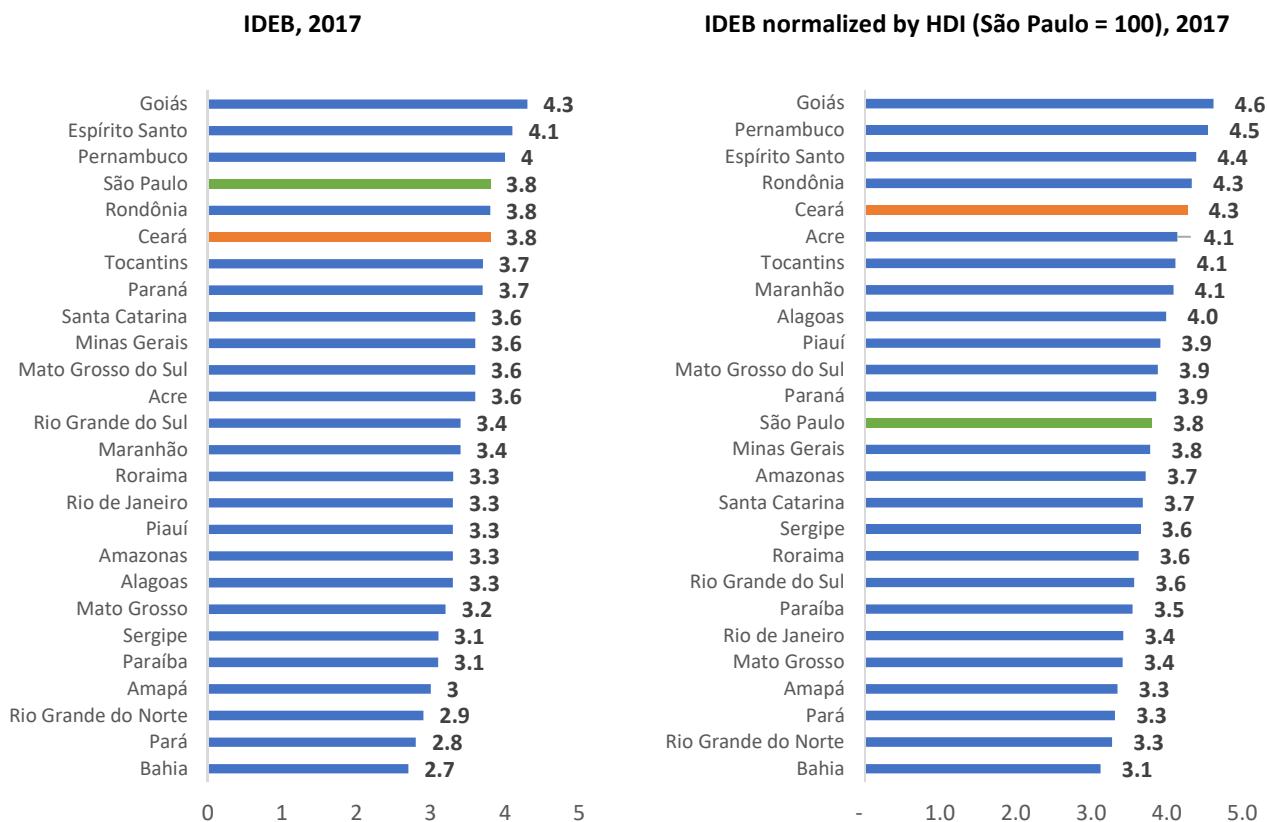
³² Blank areas mean that the municipality has only state schools for this level.

Figure A2: IDEB at lower secondary education - municipal networks aggregated by state, 2017



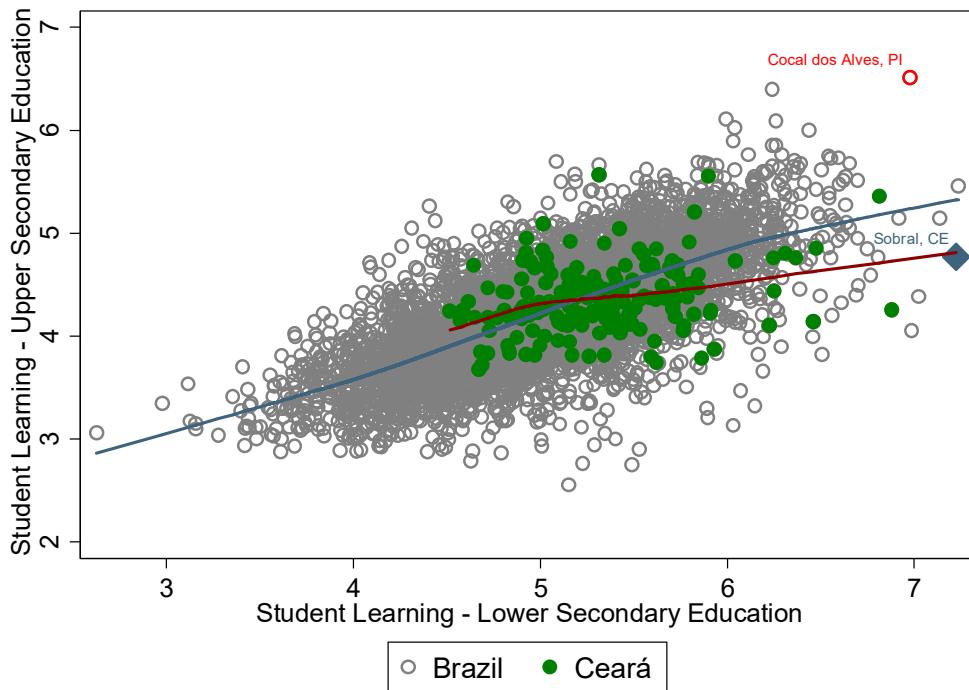
Source: World Bank with INEP/MEC data.

Figure A3: IDEB at upper secondary education – state school networks, 2017



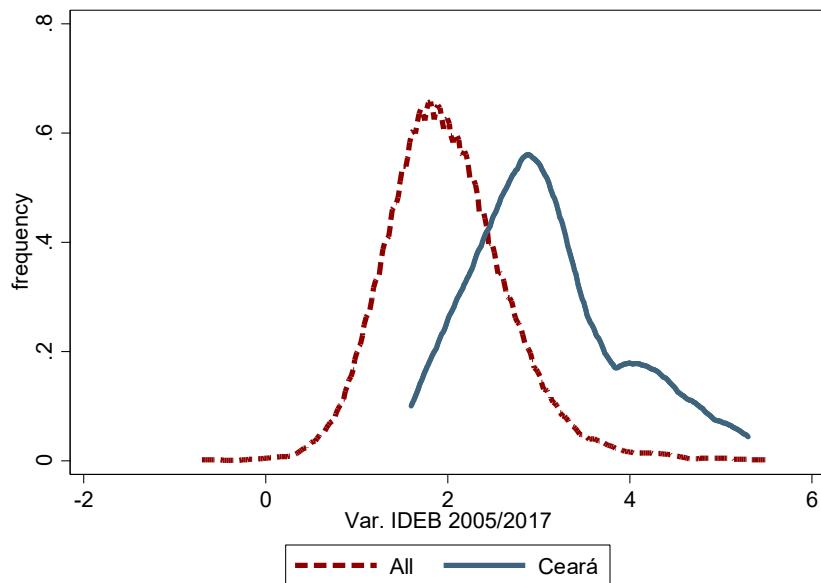
Source: World Bank with INEP/MEC data.

Figure A4: IDEB at lower secondary education vs. IDEB at upper-secondary education - public schools aggregated by municipality, 2017



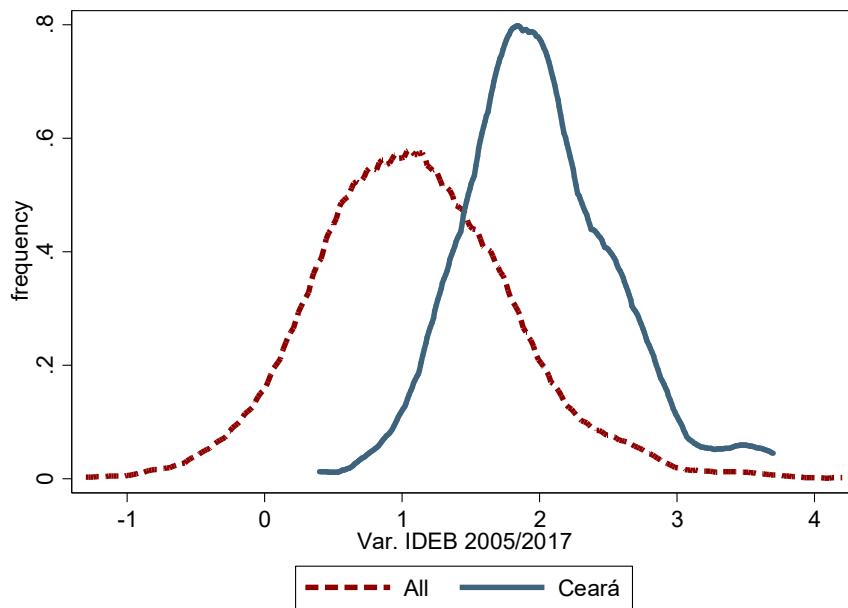
Source: World Bank with INEP/MEC data.

Figure A5: Distribution of change between 2005 and 2017 - IDEB at primary education - municipal networks



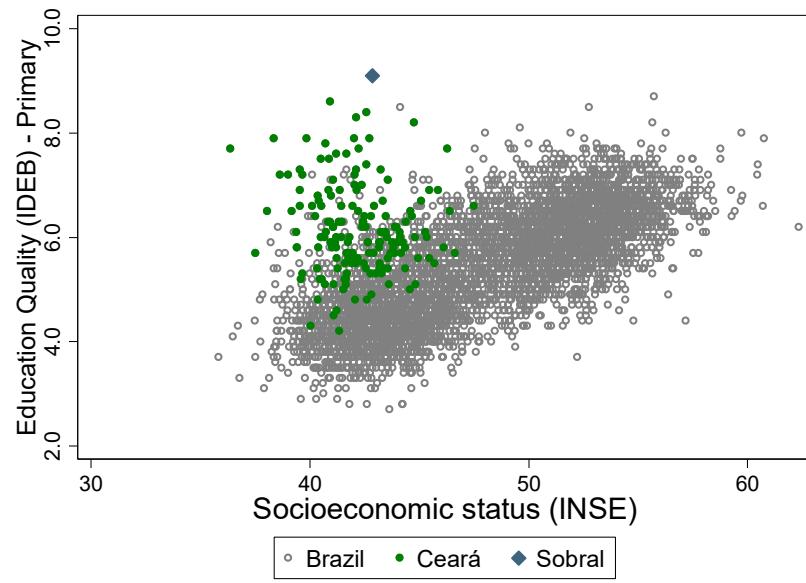
Source: World Bank with INEP/MEC data.

Figure A6: Distribution of change between 2005 and 2017 - IDEB at lower secondary education - municipal networks



Source: World Bank with INEP/MEC data.

Figure A7: Education quality measured by IDEB (2017) vs. socioeconomic conditions (INSE, 2015) - municipalities (municipal school networks) - primary education



Source: World Bank with INEP/MEC data.