# ASSESSMENT OF THE IMPACT OF THE *JOVEM DE FUTURO* PROGRAM ON LEARNING

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## 1. Introduction

### 1.1. Educational Performance

Brazil has very well established educational goals. National goals are set for individual educational networks and schools. They refer to access to school, regarding both progress and conclusion, as well as to the establishment of learning minimums. Some of these goals are constitutional requirements, such as stated in Article 208 of the Federal Constitution, which establish compulsory and free basic education for all aged from 4 to 17 years. Others, such as the 20 goals of the National Education Plan (PNE), are government goals that complement and specify the constitutional provisions. There are also the 5 goals of the *Movimento Todos pela Educação* (All for Education Movement), which reflect the commitment and concerns of civil society.

Regarding access to education, Goal 3 of the PNE demands that: i) by 2016, we should have 100% of young people from 15 to 17 years old either attending or having already concluded Basic Education; ii) by 2024, we should have 85% of all young people from 15 to 17 years old who have not yet finished Basic Education, attending high school (net enrollment rate in High School). Nevertheless, in 2017, about 11% of young people from 15 to 17 years old, had not yet completed basic education, and were still out of school (See Table 1). Also in 2017, there were only 2/3 of the young people from 15 to 17 years old that had not yet completed basic education, were still attending high school. Since this net enrollment rate has been growing during the last decade by only 1.3 percentage points a year, keeping with the current rate we should achieve, by 2024, a rate of only 76%, well below the 85% established by the Goal 3 on the PNE.

In terms of completion, the goal is for 90% of 19-year-olds to have completed high school (Goal 4 of *Todos pela Educação – TPE*) by 2022. In 2017, only about 60% of 19-year-olds had already completed high school (see Table 1). That rate of progress has been well below 2 percentage points a year. Thus, at the current rate, by 2022 we will not even have reached a high school completion rate of 70% and, therefore, will be far below the established Goal 4 of the TPE.

**Table 1: Current situation and evolution of monitoring indicators of educational goals in Brazil**

| Goal | Indicator | Current situation | Progress in the last decade (2005-15) | Expected value for the term of the goal |
|---|---|---|---|---|
| **National Education Plan (PNE)** | | | | |
| Make school available to the entire population between 15 and 17 years old until 2016 (...) | Percentage of young people aged between 15 and 17 years who attend school or have already finished basic education[1] | 89% | 0.5 p.p. | 89% |
| (...) and increase, by the end of the term covered by this PNE [2024], net enrollment rate in high school to 85% | Percentage of young people aged between 15 and 17 years who attend high school or have already finished basic educationErro! Indicador não definido. | 66% | 1.3 p.p. | 75% |
| ***Todos pela Educação*** | | | | |
| By 2022, (...) 90% or more of young Brazilians, 19 years old, must have finished high school | Percentage of young people, 19 years old, who have finished high schoolErro! Indicador não definido. | 60% | 1.7 p.p. | 68% |
| By 2022, 70% or more of the students will have learned what is appropriate for their year [300 points on the SAEB scale in Portuguese Language] | Percentage of students in the 3rd year of high school with scores above the level considered appropriate according to SAEB[2] | 27% | 0.49 p.p. | 31% |
| By 2022, 70% or more of the students will have learned what is appropriate for their year [350 points on the SAEB scale in mathematics] | Percentage of students in the 3rd year of high school with scores above the level considered appropriate according to SAEB[2] | 7% | -0.36 p.p. | 4.8% |
| **Education 2030: Incheon Declaration – 2015 Action Framework (2015)** | | | | |
| Public spending on education must be between 4 and 6% of GDP and/or at least 15 to 20% of the total of public spending | Percentage of direct public investment in education in relation to GDP[2] | 6.0% | 0.17 p.p. | 8.8% |

Finally, the learning goal is that, upon completing high school, 70% of students will achieve proficiency levels deemed appropriate in the Portuguese language and in mathematics (300 points in the Portuguese language and 350 points in mathematics, on the SAEB scale). In this regard, the situation of the country is even worse. In 2017, less than 10% and 30% of students achieve appropriate learning levels in mathematics and in the Portuguese language, respectively, upon completing high school (See Table 1). This percentage has been declining in mathematics, and

[1] Data of the current situation, in 2017, estimated from the Continuous National Household Sample Survey (PNAD-C) and history of the recent years of the National Household Sample Survey (PNAD).
[2] Data obtained from the PNE Observatory portal (http://www.observatoriodopne.org.br). The current situation observed for the proficiency indicators refers to 2015 and, for the indicators regarding public investment in education, to 2014. For the latter, progress is calculated for the period from 2005 to 2014.

progress has been extremely slow in Portuguese (less than 0.5 percentage point per year). At the current rate, clearly, the goal of youth achieving appropriate learning will not be fulfilled.

In summary, all the evidence presented above and summarized in Table 1, below, shows that Brazil is not on track to achieve any of the educational goals established by the Federal Constitution, by the National Education Plan or defined by civil society.

In short, Brazil is not on the track to achieve any of the educational goals established by the Federal Constitution, by the National Education Plan or those defined by Civil society.

## 1.2. Spending and inefficiency

The poor educational performance could be justified by a society's corresponding lack of attention to education. This is certainly not the case, as the country already allocates 6% of its gross domestic product (GDP) to education, which represents about 18.4% of the Brazilian government's primary spending[3]. According to Resolution 14 of the 2015 Incheon Declaration, public spending on education must be between 4 and 6% of GDP and/or at least 15 to 20% of the total public expenditure. Therefore, Brazilian expenditures on education are perfectly aligned with the international norm.

Given the magnitude of public spending on education, the educational performance that Brazil could achieve is much higher than the one achieved so far. Graph 1 shows that mathematics learning of 15-year-old students in Brazil, as demonstrated on the PISA, is 64 points (0.64 standard deviation) below what is expected from countries with the same per-student spending as Brazil. This degree of inefficiency in the use of educational resources is certainly very high. No other PISA participating country has such a degree of inefficiency. Inevitably, this high degree of inefficiency has serious consequences for Brazilian educational performance. For example, if student learning of mathematics at the end of high school was 0.64 standard deviation higher, Brazil would have 14 percentage more of these students with appropriate learning.[4]

There are also indications that the inefficiency in the use of Brazilian educational resources is increasing. Unlike the slow pace at which educational progress has been taking place in the country, public spending on education has been growing at greatly accentuated rates. Per student spending in basic education grew in real terms by more than 25%, and no other country for which information is available had a growth rate in educational spending higher than Brazil (see Graph 2). The country certainly is not being able to translate the greater availability of financial resources into greater

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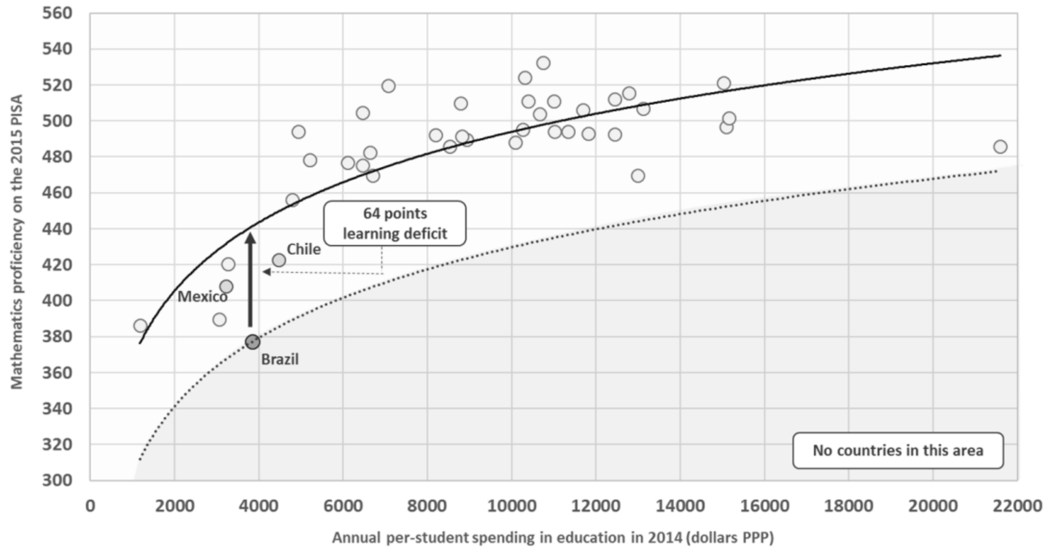
[3] Estimate of the percentage of total public investment in education, in relation to social public spending (SPS) in 2014 published by INEP/MEC.

[4] We know that 7.3% of Brazilian students perform appropriately in mathematics on the PISA. Considering that the performance of these students follows a standard cumulative normal distribution $\varphi(x)$, where $x$ is the normalized grade, we then have the appropriate normalized grade given by $\varphi^{-1}(0.073) = -1.45$. If we increase the learning of all students by 0.64 standard deviations, we would have $\varphi(-1.45 + 0.64) = \varphi(-0.81) = 0.208$. That is, the percentage of students with appropriate learning would be 20.8%, corresponding to a 13.5 percentage point increase.

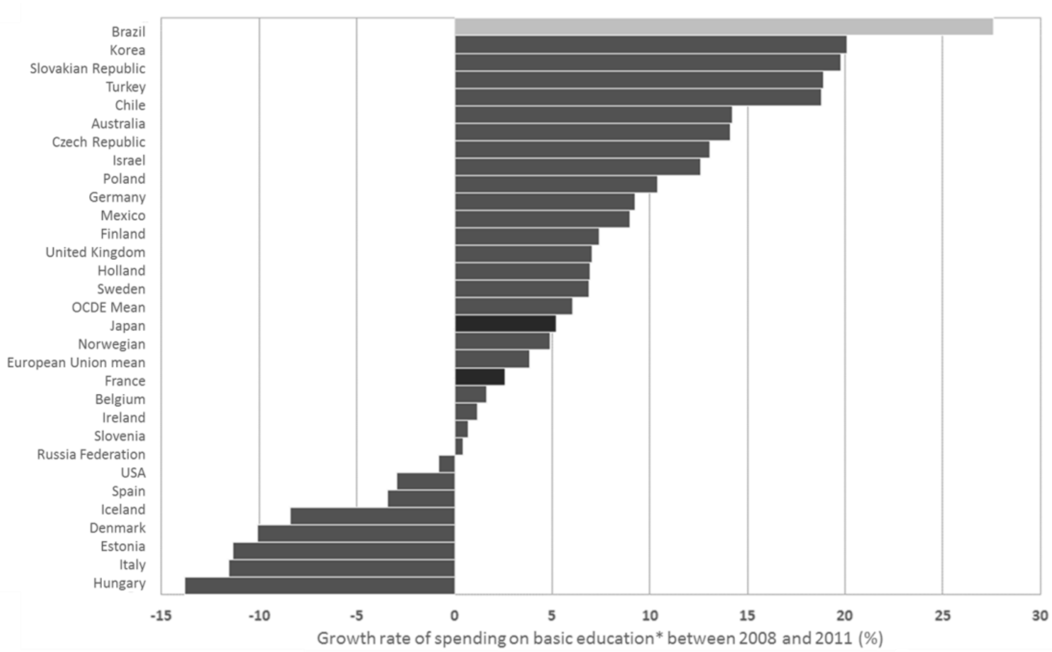
access, progress or student learning and, therefore, inefficiency in the use of public resources seems to be growing sharply.

**Graph 1: Relationship between performance in mathematics on the 2015 PISA and annual per-student spending in 2014**




Source: Data published in OECD (2016) and OECD (2017).

**Graph 2: Growth rate of spending on basic education* between 2008 and 2011**




* Basic education is considered to be to elementary, secondary and non-university post-secondary (or non-tertiary) education; that is, levels 1, 2, 3 and 4 of the International Standard Classification of Education.
Source: Data from 33 countries taken from the report *Education at a Glance 2016: OECD Indicators* (2016), Table B1.5a.

## 1.3. Inequality and inefficiency

Brazilian educational performance is not only very limited, but also extremely unequal. Brazilian educational inequality can be documented in many different forms. One alternative is to show the strong relationship between the probability of a 19-year-old youth having already completed high school and the degree of vulnerability of their family. At age 19, most youths, more than 80%, in affluent families have already completed high school, whereas less than 30% achieve this goal in the most vulnerable families (see Table 2). Another alternative to illustrate this high degree of inequality is to contrast the learning of mathematics among public schools. Graph 3 shows that the learning in the Teotônio Ferreira Brandão school is 1.8 standard deviations higher than in the Professor Clóvis Renê Calabrez school. While student performance in the first school is average according to PISA, outperforming students in the United States, student performance in the second school is similar to that of countries with the worst performance on the PISA.

**Table 2: Educational indicators based on family vulnerability level**

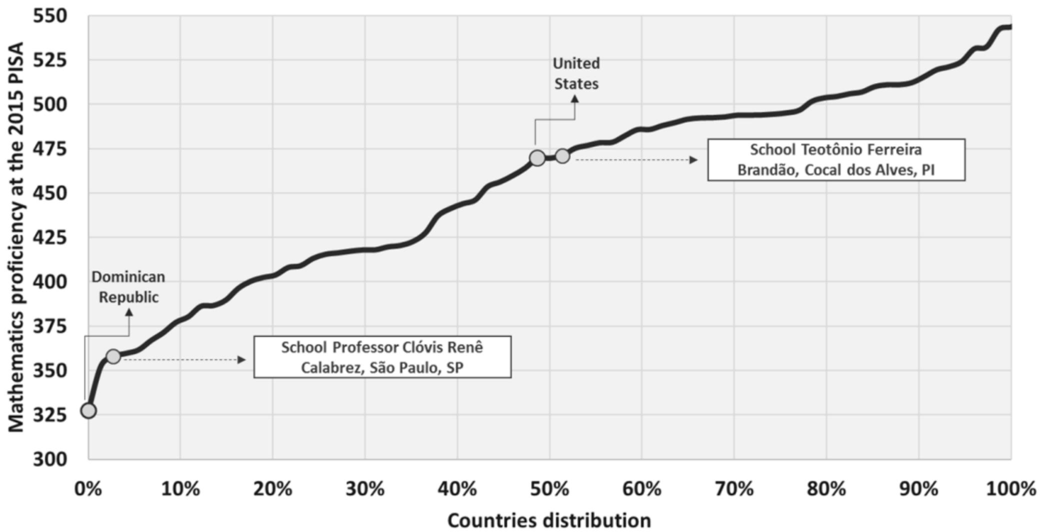
| Indicator | The 10% most vulnerable | The 10% most affluent | Gap |
|---|---|---|---|
| Percentage of young people who have completed high school at 19 | 28.3% | 82.7 % | 54.5 p.p. |
| Per-student spending | R$ 4,805.61 | R$ 7,710.28 | 160% |
| Degree of inefficiency in the use of educational resources in percentage of standard deviations | -71% | 68% | 139 p.p. |

Source: Estimates obtained from data from the *Pesquisa Nacional por Amostra de Domicílio* (PNAD), SIOPE and INEP.

The Teotônio Ferreira Brandão school, which has the best performance, is located in the municipality of Cocal dos Alves in Piauí (PI), one of the poorest areas of the country; whereas the Clóvis Renê Calabrez school, with the worst performance, is located in the municipality of São Paulo (SP), in the richest region of the country. This huge difference in learning must be related to differences in learning opportunities. It is certainly inconceivable that a public school system would allow adolescents in different areas to have access to educational opportunities so differentiated.

In a decentralized educational system such as the Brazilian one, in which there are more than 5 thousand independent educational networks, the inequality of educational opportunity can result from undesirable disparities in the availability of resources. Actually, Brazilian educational decentralization leads to huge differences in per-student costs. Table 2 shows that per-student costs for the tenth most privileged is more than 60% higher than for the tenth most neglected.

**Graph 3: Distribution of countries according to their performance in mathematics on the 2015 PISA and comparison with the performance of Brazilian schools in the final years of elementary school**




Note: In order to compare the learning results of Brazilian schools with the international performance found in the 2015 PISA, we converted the observed performance for those schools on the 2015 *Prova Brasil* in the final years of elementary school at a rate given by the performance of Brazil on the 2015 PISA and the mean performance of Brazilian municipal schools on the *Prova Brasil* $\left(377/_{250} = 1.51\right)$.
Source: Data from the 2015 PISA published by the OECD and data from the 2015 *Prova Brasil* published by INEP.

It is surprising, nevertheless, that these huge differences in per-student spending offer little explanation for the learning differences among educational networks. Table 3 shows that almost 90% of learning differences among municipal education networks at the end of elementary school are due to differences among networks with the same per-student spending. In other words, most of the unacceptable inequality of opportunity in Brazil does not result from differences in the amount of per-student resources allocated, but in how these resources are allocated (degree of efficiency in the use of resources). Therefore, as shown in Table 2, student learning in the schools of the most inefficient networks (10% worst) is 1.4 standard deviations below student learning in the schools of the most efficient networks (10% best); this difference is two times higher than what could be achieved if Brazil had the performance expected from a country with this per-student spending[5] (Graph 1).

[5] Graph 1 shows that Brazil has an educational performance 0.64 standard deviation below what could be achieved. Thus, the gap of 1.4 among the most and the least efficient municipal networks is 2.1 (1.4/0.64) times greater.

**Table 3: Results obtained with the performance regression in mathematics in the final years of elementary school in 2015 based on the logarithm of municipal per-student spending in 2016**

| Indicator | Value |
|---|---|
| Coefficient | 26.4 |
| Coefficient of the logarithm of municipal per-student spending | 25.9 |
| Percentage of variance due to differences in per-student spending ($R^2$) | 12% |
| Percentage of variance between networks with the same per-student spending ($1-R^2$) | 88% |

Note: 3120 observations, at the municipality level, were used.
Source: authors.

## 1.4. Management and efficiency

“Management” can be understood as a set of activities aimed at improving the use of available resources. That is, activities whose goal is to achieve bigger and better results with the same resources, or to achieve pre-established results with the use of fewer resources. In this case, "management" and the promotion of efficiency would be closely related: the primary objective of any “management” activity would be to achieve efficiency gains.

Since institutions allocate a significant amount of resources to improve management, it is expected that management actually influences efficiency and productivity, or at least these institutions expect that. Despite having theoretical reasons and wide observational and anecdotal evidence that management should promote efficiency and productivity, evidence that specific management actions are effective in promoting greater efficiency and productivity is rare. A remarkable exception is the study of Bloom et al. (2013) that proves, based on an experimental assessment, that access to management assistance actually has an impact on productivity.

However, it is still necessary to verify whether improvements in management can also promote greater efficiency and productivity in the public provision of education. Theoretically, this is the goal. According to Lück (2009, p. 24), school management aims to "promote the organization, mobilization and articulation of all the material and human conditions required to ensure the advancement of socio-educational processes of schools, geared towards the effective promotion of student learning ".

Unfortunately, there are few studies that corroborate this assumption empirically. An important exception is the studies of Fryer (2014, 2017). Fryer (2017), based on an experimental assessment, found that student learning in schools in which the director had access to a 300-hour management training program was 10% to 20% of a standard deviation above that of students in schools in which the director did not have access to this management training. Other recent studies have also found evidence that improvements in school management can be as important for efficiency and productivity as in other sectors of the economy. For example, Fryer (2014), also based on an experimental assessment, found evidence that the adoption, by public schools, of good management practices of high-performance charter schools has a significant impact, from 15 to 20% of a standard deviation, on student learning.

## 1.5. Scope

From the above, it follows that there is solid evidence that the inefficiency in the use of resources is one of the central determinants of the poor and unequal Brazilian educational performance and that there are theoretical reasons, and some evidence, that actions aimed at promoting better management can be effective to achieve greater efficiency and productivity in the public provision of education. Therefore, it seems unquestionable that, for Brazil to achieve better educational performance, it is necessary to include programs aimed at improving the management of educational networks and schools in its educational policy. Consistent with this perspective, several initiatives aimed at promoting improvements in management have been adopted in the country. Among them are the *Escola de Gestores do Ministério da Educação*, the *Formar* of the Lemann Foundation and the *Jovem do Futuro* of *Instituto Unibanco*. It is still necessary to verify whether these specific actions are indeed effective in promoting greater efficiency and, consequently, better educational performance.

Bloom et al. (2015) took a step in this direction in a study investigating the relationship between the management skills of school directors and student mathematics learning in Brazilian schools. This study found a significant association between management and learning, with the increase of one standard deviation in the management skills of directors being associated with an increase of 10% of a standard deviation in student mathematics learning. It is worth noting that the relationship found for Brazil is much lower than that obtained worldwide. The worldwide result points to an increase of one standard deviation in the management skills of directors being associated with an increase of 24% of a standard deviation in student learning.

Based on an experimental assessment, the overall objective of this study is to investigate the ability of the *Jovem de Futuro* program to promote student mathematics and the Portuguese language learning in schools that adopt the program. This overall objective was disaggregated into three interrelated specific objectives. First, the study aims to assess whether the program has an impact on student learning and the magnitude of this impact. Second, the study seeks to verify to what extent the magnitude of the impact is substantively relevant, given the dimension of the Brazilian educational problem. Finally, the study seeks to verify to what extent the magnitude of the impact is sensitive to local conditions where the program was implemented, and to what extent the innovations adopted throughout one decade (2007-2017) of program implementation were able to increase the magnitude of its impact.

## 2. Jovem de Futuro

The *Jovem de Futuro* is a program of the *Instituto Unibanco*[6] aimed at promoting better educational management through the adoption of results-oriented management. The program, originally focused on school management, has progressively expanded its operation and influence to all levels of the educational system: from the Department of Education to school management, necessarily having to pass through regional administrations. The strategy of the program is based on changes of mindset, management training and the adoption of best practices.

The program was initially implemented in 2008 and has been implemented and improved continuously since then. Currently, in its third version, in order to influence in the form of school management, the program uses four instruments that complement each other. The first instrument consists of a management training program focusing on results. It includes 68 classroom hours for department technicians, regional leaders and supervisors; 48 classroom hours and 120 distance hours for school managers and pedagogical coordinators. This is the hour-load of the most current version of the program, in its 3rd generation.

Second, the program equips managers with goals, protocols and management practices that facilitate, stimulate and promote expertise in the four classic management phases: (i) participatory planning, geared toward achieving results (goals) and strongly based on evidence; (ii) monitoring the implementation of the plan; (iii) assessment and analysis of the results obtained; and, (iv) identification of adjustments, necessary route changes and redesign of actions.

Third, and of vital importance for the functioning of the program, *Jovem de Futuro* establishes the role of the supervisor. The supervisor is an external agent to the school, who aims to monitor and advise the school on the four management phases.

Finally, *Jovem de Futuro* establishes a formal management circuit, including times for exchanging experiences among schools within the same regional jurisdictions having a set and synchronized calendar. In addition to the management circuit, the program also adopts a corresponding management circuit involving the jurisdictions and the central body of the Department of Education.

*Jovem de Futuro* is a program traditionally oriented toward high school of the state educational networks. Although it can be adapted to other stages of education, since its initial design it has been adopted only in public state high schools. Adopted for the first time in 2008, in 45 schools in the metropolitan regions of Belo Horizonte and Porto Alegre, this program has already reached 3 thousand schools in over 11 state networks.

The expansion of this program is characterized by three overlapping phases (see Table 4). The first phase, also called the 1st generation, was characterized essentially as a pilot phase. During this phase, from 2008 to 2015, the program was adopted by 197 schools in five urban areas in four

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[6] http://www.institutounibanco.org.br/sobre/

states.[7] In this first phase, or 1st generation, the program: (i) was addressed only to school management, (ii) was more focused on changes of mentality than on the provision of management instruments and (iii) had a much higher level of *Instituto Unibanco* intervention during the implementation than in the following phases. Each participating school received management assistance directly from *Instituto Unibanco*, as well as financial support of R$100 per student per year for the implementation of the action plan.

The second phase, or 2nd generation, started in 2012 in three state networks (Mato Grosso do Sul, Goiás and Pará) and expanded in 2013 to two others (Ceará and Piauí), including a total of 1.5 thousand schools. This phase included training programs and instruments for setting goals, protocols and management practices which were better structured than those used in the first phase. The support given by *Instituto Unibanco* to schools became indirect, through the training and use of network supervisors. In addition, the financial support for the implementation of the action plan of the schools became the responsibility of the public sector, more specifically the Ministry of Education, through PROEMI. Due to fiscal constraints, this financial support was precarious during the early years (2012 to 2015), having been formally eliminated in 2015. Although the support had occurred through State Departments of Education, the focus remained on the promotion of improvements in school management.

Finally, the third phase of the program, or 3rd generation, started in 2015 in three states (Pará, Piauí and Espírito Santo), and two years later was expanded to Rio Grande do Norte. About 1.3 thousand schools are or will soon be assisted by the program. Unlike the previous phases, the scope was broadened to encompass the promotion of improvements both in school management and in the central and regional management of state education networks. In this phase, the protocols, procedures and trainings have become even more structured and formalized, and a synchronized management circuit that operates at all levels of management was implemented.

[7] The initiative was adopted in the metropolitan regions of the capitals by the state networks in Minas Gerais, Rio Grande do Sul, Rio de Janeiro and São Paulo. It was also adopted in São Paulo in the urban cluster of Vale do Paraíba, formed by São José dos Campos and Jacareí.

**Table 4: Number of schools benefitting from the *Jovem de Futuro* program by entry year**

| Location | Number of schools assisted according to entry year and location | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | Total |
| Belo Horizonte | 20 | | | 24 | | | | | | | | 44 |
| Ceará | | | | | 100 | 124 | 169 | 46 | | 211 | 3 | 653 |
| Espírito Santo | | | | | | | | 151 | | 66 | 40 | 257 |
| Goiás | | | | | 179 | 120 | 281 | | 74 | 10 | 16 | 680 |
| M.G. do Sul | | | | | 99 | 96 | 76 | | | | | 271 |
| Pará | | | | | 131 | | | 22 | 3 | 68 | 25 | 249 |
| Piauí | | | | | 73 | | | 134 | 4 | 115 | 197 | 523 |
| Porto Alegre | 25 | | | 21 | | | | | | | | 46 |
| Rio de Janeiro | | 15 | | | | 15 | | | | | | 30 |
| Rio Grande do Norte | | | | | | | | | | 143 | | 143 |
| São Paulo | | 41 | | | | 36 | | | | | | 77 |
| All locations | 20 | 81 | | 45 | 582 | 391 | 526 | 353 | 81 | 613 | 281 | 2973 |

Key:

- Implementation of 1st Generation
- Implementation of 2nd Generation
- Implementation of 3rd Generation

## 3. Program implementation and assessment possibilities

*Jovem de Futuro* is being implemented with two characteristics that enable and facilitate impact assessment. These characteristics both facilitate the achievement of the internal validity assessment, as well as simplify the task of testing and estimating the mean magnitude of the impact[8].

[8] As is always the case with experimental assessments, the design does not help much in obtaining estimates of other characteristics of the distribution of the impact beyond its mean, such as the median impact or the standard deviation of the impact.

## 3.1. Progressive implementation

The first of these characteristics is the progressive nature of the implementation model adopted. In each of the locations where the program was adopted, the schools entered the program gradually, with the start of the assistance being distributed over a few years. In each state, assistance was given to the last schools entering the program from one to four years after the first ones.

Thus, depending on the location, over the course of two to four years after the first schools had been assisted, the assisted and non-assisted students and schools coexisted. Therefore, it is possible to contrast the performance of these two groups. There is an assessment window that goes from the moment the first schools adopted the *Jovem de Futuro* up to the time that the program was adopted in the last schools.

As we have seen, the implementation took place in three phases over a decade (2008-2018), and has not been implemented in a synchronized way in the state networks. Therefore, the assessment windows not only differ in size (number of years), but also occupy different positions in the calendar.

## 3.2. Selection of the entry order of schools by a drawing

The second characteristic of the implementation model, important for impact assessment, is how the entry order of the schools was determined. For a significant number of participating schools, the year the program started was defined by a drawing. Table 5 shows the number of schools that had or are scheduled to have the program, and how many of these schools were chosen to enter the program through a drawing.

The selection by drawing of when the program will be implemented allows an impact assessment of experimental nature to be conducted during the assessment window. Within this window, the schools chosen by drawing to adopt the program only after the end of the window are potential control schools for those chosen, also by drawing, to join the initiative immediately.

Although the process that was used to define the order of entry of schools varies from state to state[9], in all of them, for at least some of the participating schools, the moment to join the program was determined by a drawing. In general, the moments in which the schools taking part in the drawing were going to be assisted by the program were distributed throughout the first four years of the implementation of the program in the state[10].

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[9] In addition to the number of different geographical groupings, there are several differences among the states for the formation of these groups. These differences will be addressed in Table 8.

[10] One of the characteristics of the program is that all the schools participating through a drawing will join the program at any time during the four years following the drawing. Although there were cases in which the program was discontinued, and some schools which should have participated in the program, did not participate. Originally the program was designed to be implemented in three years, although in some cases, this period was extended to four years.

**Table 5: Number of schools by participation in the drawing and assistance in the *Jovem de Futuro* program**

| Location | Total number of schools that received the program and did not participated in the drawing | Total number of schools that received the program and participated in the drawing | Total number of schools that did not received the program and participated in the drawing |
|---|---|---|---|
| Belo Horizonte | 0 | 44 | 4 |
| Ceará | 284 | 369 | 9 |
| Espírito Santo | 45 | 212 | 9 |
| Goiás | 537 | 143 | 2 |
| M.G. do Sul | 172 | 99 | 26 |
| Pará | 123 | 126 | 11 |
| Piauí | 256 | 267 | 8 |
| Porto Alegre | 0 | 46 | 4 |
| Rio de Janeiro | 0 | 30 | 0 |
| Rio Grande do Norte | 0 | 143 | 0 |
| São Paulo | 1 | 76 | 4 |
| All the locations | 1418 | 1555 | 77 |

Table 5 shows that the time for adopting the program was not chosen randomly for all the schools. In some states, some schools were chosen without a drawing to start immediately; others were chosen to join in pre-determined years; and others were chosen not to participate at any time. Schools which did not join the program by drawing are not included in the impact assessment presented in this study. Of the 3 thousand schools that have joined the program, only 1.600 had the starting date defined by drawing. These are the only ones that can participate in the assessment. Table 6 shows the number of participating schools with starting dates determined by drawing according to location and the year that they joined the program, for those that have already started the program.

**Table 6: Number of schools by participation in the drawing and assistance in the *Jovem de Futuro* program by entry year**

| Drawing groups | Number of schools taking part in the drawing according to entry year and drawing group | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | Nunca entrou | Total |
| Belo Horizonte | 20 | | | 24 | | | | | | | | 4 | **48** |
| Porto Alegre | 25 | | | 21 | | | | | | | | 4 | **50** |
| São Paulo | | 40 | | | | 36 | | | | | | 4 | **80** |
| Rio de Janeiro | | 15 | | | | 15 | | | | | | 0 | **30** |
| Ceará | | | | | | 124 | 168 | 46 | | 31 | | 9 | **378** |
| Goiás | | | | | 118 | | | | 25 | | | 2 | **145** |
| M.G. do Sul | | | | | 99 | | | | | | | 26 | **125** |
| Pará (cycle I) | | | | | 25 | | | 6 | | 12 | 4 | 3 | **50** |
| Espírito Santo | | | | | | | | 151 | | 29 | 32 | 9 | **221** |
| Pará | | | | | | | | 42 | 3 | | 34 | 8 | **87** |
| Piauí | | | | | | | | 134 | 4 | 31 | 98 | 8 | **275** |
| Rio Grande do Norte | | | | | | | | | | 143 | | 100 | **243** |
| All the drawings | 45 | 55 | 0 | 45 | 242 | 175 | 168 | 379 | 32 | 246 | 168 | 177 | 1732 |

Key:

- Implementation of 1st Generation
- Implementation of 2nd Generation
- Implementation of 3rd Generation

## 4. Determination of the moment of assistance: drawing and groupings

### 4.1. Drawing

In each state, the determination of the first year of assistance for the schools included in the assessment could have been done on the basis of a single, initial drawing including all schools. As a result of this drawing, we would have determined, from the beginning, which schools would participate immediately in the 1st year of the program and which would participate from the 2nd, 3rd and 4th years, respectively. We call this procedure the "total initial drawing", in which the total refers to the fact that all schools included in the selection process participate in the initial drawing.

An alternative to the total initial drawing would be a series of drawings, which would begin with a drawing of all participating schools, to determine which ones would and which ones would not be assisted in the first year. At the end of the first year, we would have a new drawing limited to those that were not selected for assistance in the first year. This second drawing would determine which schools would be assisted in the 2nd year. Finally, at the end of the 2nd year, we would have a third drawing with the schools which had not been selected yet. It would determine which schools were going to be assisted in the 3rd and 4th years. We call this procedure "total sequential drawing".

In most cases which had the year of participation determined by a drawing, it was based on a single drawing. However, in the case of Ceará, the drawing model chosen was the sequential one.

## 4.2. Groupings

There are great advantages to organizing the participating schools in homogeneous groups before the drawing, and then drawing the order of assistance within each group. We call this procedure "drawing by group", which may be initial or sequential, according to the case. In any case, at every moment, independent drawings by groupings need to be made.

It is of fundamental importance to note that the groupings are always formed before the drawings and, when a sequential drawing process is adopted, the initial groupings are kept intact throughout the process.

Although drawing by groupings is more complex than drawing without groupings, there are two great advantages that justify it: equal opportunity and greater statistical efficiency. For these reasons, the definition of the time when each school in the assessment joins the program was determined by a drawing and preceded by the grouping of similar schools based on a set of selected characteristics.

From the point of view of equal opportunity, drawings within groupings are preferable. In this case, it is guaranteed that schools representing each of the groupings will be present both in the group that will participate immediately and among those schools that will have to wait for assistance. The process promotes greater equality of opportunity, since it functions as a quota system. When using a total drawing, we hope, but cannot guarantee, that all groups will be represented equally among those which will receive immediate assistance and those which will need to wait. The advantage of grouping is that it guarantees that this balance will certainly be achieved. When schools are grouped before the drawing, the distribution of schools by any of the characteristics that define the groups will necessarily be the same among those which will participate immediately and those that will have to wait.

## 4.3. Precision gain due to grouping

It is always possible to organize schools into groups seeking to maximize the inequality among groups and to minimize the inequality among schools in the same group. Thus, schools in the same group will be more homogeneous and, due to this greater homogeneity, the use of grouping before the drawing leads to an increase in the accuracy of impact estimates.

Consider the situation where there are *n* groupings, formed by $m_1$ schools to be assisted immediately and $m_0$ schools that need to wait. If $y_i$ denotes the result of interest, in the absence of the program for school *i*, then the variance of the mean ($\lambda^2$), among groupings of difference for this result among schools selected for immediate assistance and for future assistance, is given by:

$$\lambda^2 = \frac{1}{n}\frac{m_0 + m_1}{m_0 m_1}\tau^2$$

where $\tau^2$ denotes the variance of the intra-group result of interest that, to simplify the argument, we assume to be the same for all groups[11].

If a single drawing is conducted, the variance ($\delta^2$) of the difference between the mean of the result between the $n.m_1$ schools selected for immediate assistance and the $n.m_0$ schools selected for future assistance will be given by:

$$\delta^2 = \frac{1}{n}\frac{m_0 + m_1}{m_0 m_1}\sigma^2$$

where $\sigma^2$ denotes the variance of the result of interest for all schools.

Since the total variance can always be expressed as the sum of the intragroup variance and the variance among the groupings, that is:

$$\sigma^2 = \tau^2 + Var[\mu_g]$$

where $\mu_g$ denotes the mean of the result of interest in each of the groupings, it follows that $\delta^2 > \lambda^2$, except if, for every $g = 1, \ldots, n$, we have $\mu_g = \mu$. In this case, $Var[\mu_g] = 0$, (i.e., there is no inequality among groupings). Therefore, $\delta^2 = \lambda^2$ and there would be no advantage in grouping the schools before the drawing.

Usually, the pairing gain is given by the percentage of the variance of result of interest in the absence of the program, which is due to differences among groupings:

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[11] We arrive at this result from the definition that $\lambda^2 = Var\left(\frac{1}{n}\sum_{g=1}^{n}\left(\frac{1}{m_1}\sum_{i=1}^{m_1} y_{1gi} - \frac{1}{m_0}\sum_{j=1}^{m_0} y_{0gj}\right)\right)$ and from the hypotheses of intragroup independence and variance of the result of intragroup interest being $\tau^2$ for all groups.

$$\phi = \frac{Var[\mu_g]}{\sigma^2}$$

since

$$\tau^2 = (1 - \phi)\delta^2$$

**Table 7: Benefit of the grouping procedure on the precision of impact estimates**

| Generation/Location | Grouping benefit | |
|---|---|---|
| | Portuguese Language performance | Mathematics performance |
| 1st Generation | 69% | 60% |
| Belo Horizonte | 17% | 16% |
| São Paulo | 83% | 82% |
| Rio de Janeiro | 46% | 53% |
| 2nd Generation | 56% | 61% |
| Ceará | 6% | 9% |
| Goiás | 27% | 40% |
| M.G. do Sul | 26% | 34% |
| Pará – Cycle I | 34% | 43% |
| 3rd Generation | 90% | 77% |
| Espírito Santo | 73% | 64% |
| Pará | 89% | 69% |
| Piauí | 95% | 78% |
| All generations | 99% | 87% |

It is difficult to obtain estimates of this gain, as it requires estimates of the variance of the result of interest in the absence of the program, $y_i$, among schools in the same grouping. However, an approximation using baseline information can be easily obtained. Based on this approximation, we estimate that the use of grouping reduces the variance of the difference in the result of interest among the schools benefitted and those not yet benefitted by more than 80%, if we consider all localities together. The benefit obtained by the use of grouping for each location can be found in Table 7 above.

## 4.4. Procedures used to form groupings

As already mentioned, *Jovem de Futuro* was implemented in 11 Brazilian state school networks. In some networks, the grouping process took place in two stages. In the first stage, schools were grouped based only on their spatial location. However, in other networks, the process happened in a single stage with the direct formation of groupings based on similarity of a selected set of school characteristics. This is exactly the second stage of the networks that chose a two-stage procedure. As a rule, the set of selected characteristics for the formation of groupings varied by network, according to Table 8.

Table 9 presents (i) the number of schools and groupings formed in each location, (ii) how many jurisdictional divisions were used in the first stage of the grouping process when this occurred in two stages, and (iii) the distribution of groupings by size (number of schools).

As this table shows, a total of 1,7 thousand schools were organized into 533 groupings and had their time of joining the program determined by drawing. This indicates that, on average, each grouping is formed by about 4 schools. It is important to note that the number of schools in each grouping, as well as the number of schools designated for immediate and future assistance, vary substantially among networks and slightly within the networks. The number of schools in each grouping varies from two in Pará and Rio de Janeiro to twelve in Minas Gerais. In Goiás and Mato Grosso do Sul, the groupings typically had six or five schools each, respectively. In all states except Minas Gerais, a single school in each grouping was chosen to wait for assistance; all the others received immediate assistance. In Minas Gerais, each grouping had from four to seven schools in the control group, and five which received immediate assistance (see Table 9). These significant differences among states, regarding the number of schools, groupings and distribution of schools among those which received immediate assistance and those which had to wait, resulted much more from budget limitations and local specificities than from the design of the assessment itself.

**Table 8: Methodology of grouping by network and generation**

| Generation | Location | Regional stratum | Grouping by priority | Pairing method within group | Indicators used in the pairing[12] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $I_1$ | $I_2$ | $I_3$ | $I_4$ | $I_5$ | $I_6$ | $I_7$ | $I_8$ | $I_9$ | $I_{10}$ | $I_{11}$ |
| 1st | Belo Horizonte | Yes | No | Relative vector distance | ✓ | - | - | - | - | - | - | - | - | - | - |
| | Porto Alegre | Yes | No | Relative vector distance | ✓ | - | - | - | - | - | - | - | - | - | - |
| | São Paulo | Yes[13] | No | Contiguity matrix followed by relative vector distance | ✓ | ✓ | ✓[14] | - | - | - | - | - | - | - | - |
| | Rio de Janeiro | Yes | No | Relative vector distance | ✓ | ✓ | - | - | - | - | - | - | - | - | - |
| 2nd | Ceará | Yes | No | Mahalanobis distance | ✓ | - | - | ✓ | ✓ | - | - | ✓ | - | ✓ | - |
| | Goiás | Yes | No | Mahalanobis distance | ✓ | - | - | ✓ | ✓ | ✓ | ✓ | - | - | ✓ | ✓ |
| | M.G. do Sul | Yes | No | Mahalanobis distance | ✓ | - | - | - | ✓ | ✓ | ✓ | - | - | ✓ | ✓ |
| | Pará – Cycle I | No | No | Mahalanobis distance | ✓ | - | - | ✓ | ✓ | ✓ | - | - | - | - | ✓ |
| 3rd | Espírito Santo | Yes | Yes | Future note prediction[15] | - | - | - | - | - | - | - | ✓ | ✓ | - | - |
| | Pará | Yes | No | Future note prediction | - | - | - | - | - | - | - | ✓ | ✓ | - | - |
| | Piauí | Yes | Yes | Future note prediction | - | - | - | - | - | - | - | ✓ | ✓ | - | - |
| | Rio Grande do Norte | Yes | No | Future note prediction | - | - | - | - | - | - | - | ✓ | ✓ | - | - |

[12] Indicators used in the pairing:

$I_1$: Total number of students enrolled (total or per stage of Education)
$I_2$: Index of State Education Development
$I_3$: Type of location of schools (same region, contiguous regions, non-contiguous regions)
$I_4$: Geographic distance
$I_5$: Yield rates (passed, failed and / or dropped out)
$I_6$: IDEB
$I_7$: ENEM performance
$I_8$: Portuguese language and mathematics performance
$I_9$: INSE
$I_{10}$: Has a library or computer or science laboratory
$I_{11}$: Entering to any state program

[13] Used only in the urban agglomerate of Vale do Paraíba in São Paulo.

[14] Used only in the metropolitan region of São Paulo.

[15] Evolution of performance in prior years followed by prediction of future grade. Of the 271 schools participating in the randomization process for selection of the control and treatment groups: 232 schools were paired based on the prediction of performance variance for the 2014-2016 period; 20 were paired based on vulnerability; and 19, based on not having sufficient information for the 2014-2016 prediction and because they were not vulnerable, were paired randomly.

**Table 9: Number of schools participating in the drawing and groupings formed by network and generation**

| Generation | Location | No. of schools in the drawing | No. of jurisdictional regions | No. of groupings by type | | | | No. of schools in each grouping by assistance | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | TOTAL | Pairs | Trios | Others | Immediate | Future |
| 1st | Belo Horizonte | 48 | 4 | **4** | - | - | 4 | 5 | 4-7 |
| | Porto Alegre | 50 | 6 | **25** | 25 | - | - | 1 | 1 |
| | São Paulo | 80 | 3 | **40** | 40 | - | - | 1 | 1 |
| | Rio de Janeiro | 30 | 2 | **15** | 15 | - | - | 1 | 1 |
| 2nd | Ceará | 378 | 19 | **26** | - | - | 26 | 3 to 6 | 1 |
| | Goiás | 145 | 6 | **25** | - | - | 25 | 3 to 5 | 1 |
| | M.G. do Sul | 125 | 5 | **25** | - | - | 25 | 3 to 4 | 1 |
| | Pará – Cycle I | 50 | 1 | **25** | 25 | - | - | 1 | 1 |
| 3rd | Espírito Santo | 221 | 3 | **70** | - | 59 | 11 | 3 to 2 | 1 |
| | Pará | 87 | 4 | **42** | 39 | 3 | - | 1 to 2 | 1 |
| | Piauí | 275 | 5 | **136** | 133 | 3 | - | 1 to 2 | 1 |
| | Rio Grande do Norte | 243 | 16 | **100** | 56 | 43 | - | 1 to 2 | 1 |
| | All locations | **1732** | **74** | **533** | **333** | **108** | **91** | - | - |

## 4.5. Groupings used in the assessment

Each of the 533 groupings which participated in the drawing represents, throughout the assessment window, a potential opportunity to observe the performance of the schools benefited compared to the performance of those not benefited. Therefore, it is an opportunity to assess the impact of the program.

However, not all these groupings can be used in this way in the assessment. In order for a grouping to be used, it needs to allow treatment and control groups to be formed. To form a treatment group, the grouping must have at least one school that received assistance immediately after the drawing and remained assisted throughout the assessment window. To form a control group, the grouping must have at least one school that never received assistance or was assisted only after the end of the assessment window. In this study, we have adopted a three-year window, corresponding to the duration of high school in Brazil. Thus, for a group to be used, it needs to have at least one school that was assisted immediately after the drawing and for at least three consecutive years, and at least one school that never received assistance or was assisted only after the third year of the program in the network.

Even though in all 533 groupings that participated in the drawing, at least one school was chosen for immediate assistance for at least three consecutive years, in Rio Grande do Norte when this report was written, only one year had passed since the beginning of the assistance which occurred in 2017, see Table 4. For this reason, all 100 groupings in this state had to be excluded from the assessment.

The 25 first generation groupings in Rio Grande do Sul also had to be excluded due to the lack of reliable information on the results of interest: proficiency in mathematics and in the Portuguese Language. The state of Rio Grande do Sul, in the period when the program was implemented, did not have (and still does not) an annual system of external assessment for the 3rd year of high school.

In 60 of the 408 (533-100-25) remaining groupings, all schools received assistance before the end of the assessment window. In these groupings, it was not possible to form a valid control group for the three-year assessment window. This complication occurred in the 3rd generation in the states of Piauí and Espírito Santo. In Piauí, for 26 of the 136 groupings for which the moment of assistance was determined by drawing, it was decided that assistance should start at the beginning of the third year of the program (therefore, one year before the end of the assessment window) in all schools that had not yet been assisted. In Espírito Santo, the same decision was made, involving 34 of the 70 groupings. Thus, of the 206 (136 + 70) groupings formed in Espírito Santo and Piauí networks, 60 could not be fully used in the assessment, since all schools were being assisted during the assessment window. As these groupings were chosen by drawing, their exclusion does not pose any threat to the internal validity of the assessment. However, as the schools in these 60 groupings in the control group only adopted the program in the third year, the experience of schools in these groupings offers valid information about the impact of the first two years of the program. So, rather than excluding these groupings, we obtained estimates of the magnitude of the impact of three years of the program, combining an estimator of the magnitude of the impact of the first two years (using the 206 groups) with an estimate of the magnitude of the impact of the third year using only the 146 remaining groupings.

In summary, 185 (100+25+26+34 highlighted above) of the 533 groupings originally formed could not be fully incorporated into this assessment: 125 (100 + 25) needed to be excluded and 60 (26 + 34) were partly used to assist in the estimate of the magnitude of the impact of two years of the program. In addition to these, 27 other groupings could not be used due to lack of documentation, discontinuity of the program or school closure.

Consequently, we proceeded by using the experience of the 321 remaining groupings to estimate the magnitude of three years of impact of the program complemented with the experience of 60 groupings that allowed us to estimate the magnitude of two years of the impact of program.

# 5. Methodology

As we have seen, in each of the groupings used in the assessment, the order of assistance of the schools in the same grouping was determined by drawing. In addition, as we have seen, in each of these groupings there is at least one school that started receiving assistance at the beginning of the assessment window and another that never received assistance or received assistance after at least one year from the beginning of the program. Thus, for each grouping, it is possible to obtain an unbiased estimator of the magnitude of the program impact on any educational result of interest after *t* years from the beginning of the assistance of the grouping, provided that at least one school in the grouping never received assistance or received it only after $t$ years.

These estimates by grouping, although not biased, have low precision given the limited number of schools in each group. More accurate estimates, by education network, may be obtained from the mean of the estimates obtained for the various groupings that are part of the network. Finally, a global estimate for the set of networks can be obtained from the mean of the estimates obtained by network. In this section, we describe sequentially the methodology used to obtain these impact estimates according to grouping and network, and globally.

## 5.1. Estimating the impact by grouping

For the purpose of this assessment, we reset the origin of time by grouping, such that $t$ = 0 shows the moment immediately preceding the beginning of assistance (beginning of the assessment window). We considered the assessment window, *J*, as the first three years of the adoption of the program in a grouping. Thus, *J* = {0, 1, 2,3}. The purpose of this section is to obtain an unbiased estimator of the impact of *Jovem de Futuro* for each grouping for each point along the assessment window: that is, for each $t \in J$. As all the analyses in this section are performed by grouping, all notation should be correspondingly indexed by grouping. However, to simplify the explanation, we have omitted this indexer.

We considered as part of the group of beneficiaries, $B$, only the schools that received assistance since the beginning of the adoption of the program, $t = 0$. This set, therefore, does not vary during the assessment window and is not empty, $B \neq \emptyset$, for all useful groupings in the assessment. However, the set of schools that did not receive the benefit by time $t$, which we denote by $\bar{B}_t$, may vary over time and become empty during the assessment window. For a grouping to be useful to the assessment, however, at least some schools should not be benefited from the beginning. That is, we need at least that $\bar{B}_1 \neq \emptyset$. Note that $\bar{B}_t \subset \bar{B}_s$ whenever $t \geq s$. Inasmuch as some schools start receiving assistance during the assessment window, the set of schools which have not yet received the benefit effectively declines.

For each school, $i$, and moment, $t$, $d_{it}$ is an indicator that if this school were drawn to receive assistance at some point until (exclusive) $t$, $d_{it} = 1$; or, if it has been drawn to receive assistance in

$t$ or only in a moment after $t$, $d_{it} = 0$. Thus, we have $i \in \bar{B}_t$ only and if only $d_{i0} = 1$. The set of schools useful for the assessment of the impact of the program at moment $t$ is given by $\bar{B}_t \cup B$. Inasmuch as some schools can start receiving assistance during the assessment window, $\bar{B}_t \cup B$ can be strictly within the set of all schools in the grouping.

Furthermore, for each school, $i$, and year, $t$: we denote the progress in the result of interest throughout the year $t$ for this school by $y_{it}^{b}$, in case it has been benefitted (*b*) by the program immediately, i.e., $d_{i0} = 1$; and, we denote the progress in the same result for the same school along the same year by $y_{it}^{a}$, in case it only has access to the program after (*a*) the moment $t$, i.e., $d_{it} = 0$. It should be observed that progress in the result for this school throughout the year $t$, in case it has had access to the program in the middle of the window (i.e., in a moment, $s$ before $t$, but after the beginning of the assessment window, $t > s > 0$ and therefore $d_{it} = 1$, but $d_{i0} = 0$), is not defined here. It is not necessary to take these cases into consideration, given that schools that enter the program in the moment $s < t$ are no longer useful to the assessment of the impact of the program during the year $t$.

Based on this notation, the observed progress ($o$) in the result of interest for school $i$ during year $t$, $y_{it}^{0}$, among the schools useful for the assessment of the impact at the moment $t$, i.e., $i \in \bar{B}_t \cup B$, is given by

$$y_{it}^{o} = (1 - d_{it}) y_{it}^{a} + d_{it} . y_{it}^{b}$$

given that $i \in \bar{B}_t \cup B$.

Let us suppose that the magnitude of the impact of the program during the year $t$, $\beta_t$, is homogeneous. That is, the program influences the progress in the result of interest of all schools on the same magnitude it follows that $y_{it}^{b} = y_{it}^{a} + \beta_t$.

In this case, the difference between the mean progress during year $t$ achieved by $m_0$ schools drawn to participate immediately, $m_0 = \#B$, and the mean progress throughout the year $t$ of the $m_t$ schools drawn to participate only after $t$ years, $m_t = \#\bar{B}_t$, which we define as $\hat{\beta}_t$, is an unbiased estimator of the magnitude of the impact of the program throughout the year $t$, $\beta_t$. Indeed, as

$$\hat{\beta}_t = \frac{1}{m_0} \sum_{i \in B} y_{it}^{o} - \frac{1}{m_t} \sum_{i \in \bar{B}_t} y_{it}^{0}$$

$y_{it}^{o} = y_{it}^{a}$ se $i \in \bar{B}_t$ e $y_{it}^{o} = y_{it}^{b}$ se $i \in$ B, it follows that

$$\hat{\beta}_t = \frac{1}{m_0} \sum_{i \in B} y_{it}^{b} - \frac{1}{m_t} \sum_{i \in \bar{B}_t} y_{it}^{a}$$

as $y_{it}^{b} = y_{it}^{a} + \beta_t$, it follows that

$$\hat{\beta}_t = \beta_t + \frac{1}{m_0}\sum_{i \in B} y_{it}^a - \frac{1}{m_t}\sum_{i \in \bar{B}_t} y_{it}^a$$

and, therefore,

$$E[\hat{\beta}_t] = \beta_t + E[y_{it}^a | i \in B] - E[y_{it}^a | i \in \bar{B}_t]$$

Since, in each grouping, the time of assistance for the schools was chosen at random, it follows that

$$E[y_{it}^a | i \in B] = E[y_{it}^a | i \in \bar{B}_t] = E[y_{it}^a]$$

hence, $E[\hat{\beta}_t] = \beta_t$, as we wanted to demonstrate. In addition, we have

$$Var[\hat{\beta}_t] = \left(\frac{m_0 + m_t}{m_0 m_t}\right) Var[y_{it}^a]$$

Next, we move on to the methodology used to aggregate the estimates obtained by grouping. Hence, we started explicitly using the indexer by grouping. Thus, the estimator of the impact of *Jovem de Futuro*, during the *t* related to grouping *g*, is denoted by $\hat{\beta}_{gt}$.

## 5.2. Estimating the impact by educational network

We will denote by $E_{rt}$ the set of groupings of network $r$ which are relevant for the assessment of the impact of the program throughout the year $t$ in the assessment window, $t \in J$. This set comprises all groupings in network $r$ that participated in the drawing, for which there were schools at the end of year $t$ that had not yet received assistance, that is, groupings for which $\bar{B}_{gt} \neq \emptyset$.

Assuming that the magnitude of the impact of the program during year $t$ in the assessment window is the same for all groupings of the same network $r$, it follows that the mean, $\hat{\hat{\beta}}_{rt}$, of the estimators obtained for each grouping, $\hat{\beta}_{gt}$, is also an unbiased estimator of this magnitude.

$$\hat{\hat{\beta}}_{rt} = \frac{1}{n_{rt}} \sum_{g \in E_{rt}} \hat{\beta}_{gt}$$

here, $n_{rt} = \#E_{rt}$ denotes the number of groupings of network $r$ which are relevant for the assessment of impact of the program during year $t$.

Once non-biased estimators are obtained for the impact of the program for each network $r$ throughout each year $t$ in the assessment window, estimates of the impact of the program for each network $r$ throughout the assessment window, denominated $\hat{\hat{\beta}}_{r+}$, can be obtained simply by the sum

$$\hat{\hat{\beta}}_{r+} = \hat{\hat{\beta}}_{r1} + \hat{\hat{\beta}}_{r2} + \hat{\hat{\beta}}_{r3}$$

Inasmuch as the size and nature of the groupings in the same network are very similar, it follows that the covariance between $\hat{\hat{\beta}}_{rs}$ and $\hat{\hat{\beta}}_{rt}$, $Cov\left[\hat{\hat{\beta}}_{rs}, \hat{\hat{\beta}}_{rt}\right] = \sigma_{rst}$, can be obtained for all $s$ and $t$, such that $s \leq t$, through

$$\hat{\sigma}_{rst} = \frac{1}{n_{rt} - 1} \sum_{g \in E_{rt}} \left(\hat{\beta}_{gs} - \hat{\hat{\beta}}_{rs}\right)\left(\hat{\beta}_{gt} - \hat{\hat{\beta}}_{rt}\right)$$

therefore, an estimate of $Var\left[\hat{\hat{\beta}}_{r+}\right] = \tau_r^2$ can be obtained through

$$\hat{\tau}_r^2 = \sum_{s=1}^{3} \sum_{t=1}^{3} \hat{\sigma}_{rst}$$

### 5.3. Estimating the impact for the set of networks

Finally, we obtained the estimate of the magnitude of the impact of *Jovem de Futuro* for the set of educational networks, $\hat{\hat{\hat{\beta}}}$, through

$$\hat{\hat{\hat{\beta}}} = \frac{\sum_r h_r \hat{\hat{\beta}}_{r+}}{\sum_r h_r}$$

where,

$$h_r = \frac{1}{\hat{\tau}_r^2}$$

which follows that,

$$Var\left[\hat{\hat{\hat{\beta}}}\right] = \frac{1}{\sum_r h_r}$$

## 6. The magnitude of the impact of the program on learning

In this study, we estimate the magnitude of the impact of three generations of *Jovem de Futuro* on mathematics and Portuguese Language proficiency at the end of the third year of high school, using the experience of 9 Brazilian states. The assessment uses the experience of 321 groups to estimate the magnitude of three years of the impact of the program complemented with the experience of 60 groupings that allow us to estimate the magnitude of the impact of two years of the program.

197 schools in four states have benefited from the 1st generation of *Jovem de Futuro*. In all, 208 schools participated in the drawing[16], constituting 84 groupings (see Table 9). Effectively, 53 groupings and a total of 142 schools were used in the assessment. Estimates point to a magnitude of impact of 5 points on the SAEB scale for mathematics and 6 points on the SAEB scale for the Portuguese Language, with the hypothesis that each of these impacts is null and can be rejected individually even when a 5% probability of rejecting incorrectly that the intervention has no impact is assumed.

1494 schools in five states have benefited from the 2nd generation of *Jovem de Futuro*. In all, 698 schools participated in the drawing[17], constituting 101 groupings (see Table 9). Effectively, 88 groupings and a total of 631 schools were used in the assessment. In the case of the 2nd generation, as in the 1st generation, the magnitude of the estimated impacts on proficiency is 6 points on the SAEB scale both for the Portuguese Language and for mathematics. Although the numbers of states and groupings assisted in the two generations are similar, the number of schools is much higher in the 2nd generation, leading to a larger number of schools by grouping, on average, and, therefore, to more accurate estimates. For this reason, in the 2nd generation, the hypothesis that *Jovem de Futuro* does not have any impact on proficiency in mathematics and in the Portuguese Language can be rejected, even if it assumes a probability 1% error.

1382 schools in six states have benefited from the 3rd generation of *Jovem de Futuro*. In all, 826 schools participated in the drawing[18] for the assessment of this generation, constituting 348 groupings in four states (see Table 9). The number of schools assisted is more limited than that of 2nd generation. However, the number of groupings is much higher, given the use of smaller groupings, and approximately 2/3 of the groupings were formed by pairs. Of this total, nothing from the experience of Rio Grande do Norte, with its 243 schools organized into 100 groupings, was used since, at the time this study was conducted, we did not yet have three years of program exposure. Therefore, effectively, 240 groupings and a total of 566 schools in three states were used in the assessment. The estimates obtained for the 3rd generation point to a lower magnitude of the impact of *Jovem de Futuro*. The results show a 4-point impact on the SAEB scale in mathematics and a 3-point impact on the SAEB scale in the Portuguese Language. Although the number of schools in the 3rd generation assessment is similar to that of the 2nd generation, the number of groupings is higher in the 3rd generation, leading to more accurate estimates. At any rate, since the magnitude of the estimated impacts is lower, in the 3rd generation it is only possible to reject the hypothesis that

[16] Note that 12 schools participated in the drawing but did not receive the program at the end of the assessment window (see Table 6).

[17] Among the schools participating in the drawing, 78 entered the program in the 3rd generation and 40 did receive assistance (see Table 6).

[18] Note that 25 participated in the drawing, however have not received assistance yet (see Table ).

*Jovem de Futuro* has no impact whatsoever if we are willing to assume a 5% error in the case of the impact assessment on proficiency in mathematics and 10% in the case of the impact assessment on proficiency in the Portuguese Language.

The comparison of the three generations shows very similar results. Since, in the three generations, the standard error of the estimates of the magnitude of the impact is always around 1.5 points on the SAEB scale, differences of 1 to 3 points observed among the three generations do not allow rejecting the hypothesis that the impact is invariant even if we are willing to assume errors of up to 30%. The p-values of the equality tests of the estimates of the magnitude of the impact of the three generations is 64% for mathematics and 39% for the Portuguese Language.

Adding to the experience of the three generations, we obtain a 5-point magnitude impact on the SAEB scale on proficiency in mathematics and a 4-point impact on proficiency in the Portuguese language. As the standard error of the estimate is on the order of 1 and 2 points, respectively, on the SAEB scale, it is possible to reject the hypothesis that *Jovem de Futuro* has no impact on proficiency even if we are not willing to make a judgment error with a probability of less than 5%.

**Table 10: Impacts on performance in the Portuguese language and in mathematics by generation and location**

| Generation/Location | Portuguese Language | | | | Mathematics | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean Impact | No. of strata | Standard error | P-value (%) | Mean Impact | Nº of strata | Standard error | P-value (%) |
| All generations | 4.4 | 3 | 0.9 | 2 | 4.8 | 3 | 0.8 | 1 |
| 1st Generation | 5.5 | 3 | 2.1 | 4 | 5.3 | 3 | 1.7 | 3 |
| Belo Horizonte | 9.7 | 4 | 4.7 | 5 | 11.8 | 4 | 6.0 | 6 |
| São Paulo | 4.4 | 37 | 2.5 | 4 | 4.4 | 37 | 1.9 | 1 |
| Rio de Janeiro | 5.5 | 12 | 6.8 | 22 | 6.9 | 12 | 5.0 | 10 |
| 2nd Generation | 5.6 | 4 | 1.6 | 1 | 5.8 | 4 | 1.4 | 1 |
| Ceará | 7.9 | 25 | 2.4 | 0 | 7.1 | 25 | 2.3 | 0 |
| Goiás | 5.2 | 25 | 4.0 | 10 | 5.5 | 25 | 3.9 | 9 |
| M.G. do Sul | 3.1 | 23 | 3.4 | 19 | 4.0 | 23 | 2.1 | 3 |
| Pará – Cycle I | 2.0 | 15 | 4.6 | 34 | 10.1 | 15 | 4.7 | 2 |
| 3rd Generation | 3.1 | 3 | 1.4 | 6 | 3.7 | 3 | 1.2 | 3 |
| Espírito Santo | 2.5 | 70 | 2.4 | 15 | 4.7 | 70 | 2.9 | 6 |
| Pará | 4.8 | 39 | 2.8 | 5 | 3.5 | 39 | 2.1 | 5 |
| Piauí | 2.6 | 131 | 2.1 | 11 | 3.4 | 131 | 1.8 | 3 |

## 7. Relevance of the magnitude of the estimated impact

The estimates presented at the beginning of this study show that Brazilian educational performance could be 0.64 standard deviation higher if it were possible to achieve what other countries achieve with similar student spending.

As the standard deviations of the learning in mathematics and the Portuguese language in high school of the public network are, respectively, 40 and 48 points[19], and the estimates of the magnitude of the impact of *Jovem de Futuro* obtained in this study are, respectively, 5 and 4 points on the SAEB scale, it follows that, in multiples of a standard deviation, the magnitudes of the impact of *Jovem de Futuro* are 12% and 9% of a standard deviation.

An impact of this magnitude represents, on average, 11% of the total gains that we estimate could be expected with improvements in management. It shows that there is still much room for improvement in Brazilian educational performance through improvements in quality of management and reduction of inefficiency. Therefore, the evidence presented shows that *Jovem de Futuro* definitely does not seem to have exhausted the possibilities for achieving better educational performance through improvement in management.

Undoubtedly, *Jovem de Futuro* is only one educational management program that certainly does not aim to solve all the educational management problems in the country. However, how "successful" would it be to eliminate 11% of the existing inefficiency for a single program such as *Jovem de Futuro*? Several ways to address this issue seem to point in the direction that, given the magnitude of its impact, this program is one case of success. Next, we consider five alternatives for assessing this success.

In the first place, it can be emphasized that an 11% standard deviation is within the spectrum obtained by Fryer (2017) in estimating the magnitude of the impact on the learning of programs aimed at improving educational management.

A second approach would be to compare the magnitude of the impact of *Jovem de Futuro* with what a student typically learns during the three years of high school. In a typical Brazilian public school, the current learning of a student corresponds to 13 points on the SAEB scale in mathematics and to 17 points in the Portuguese language[20]. Thus, in a school that received assistance from *Jovem de Futuro*, the learning would be 18 and 21 points, respectively, therefore representing a significant learning increase of nearly 30%. Since a high school student costs about R$18 thousand[21], and the cost of three years of *Jovem de Futuro* is on the order of R$875 per student (INSTITUTO UNIBANCO, 2010), it follows that, with a cost increase of only 5%, the program is able to increase student

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[19] This standard deviation refers to the distribution of proficiency of high school students in the public network in Brazil according to the 2015 SAEB.

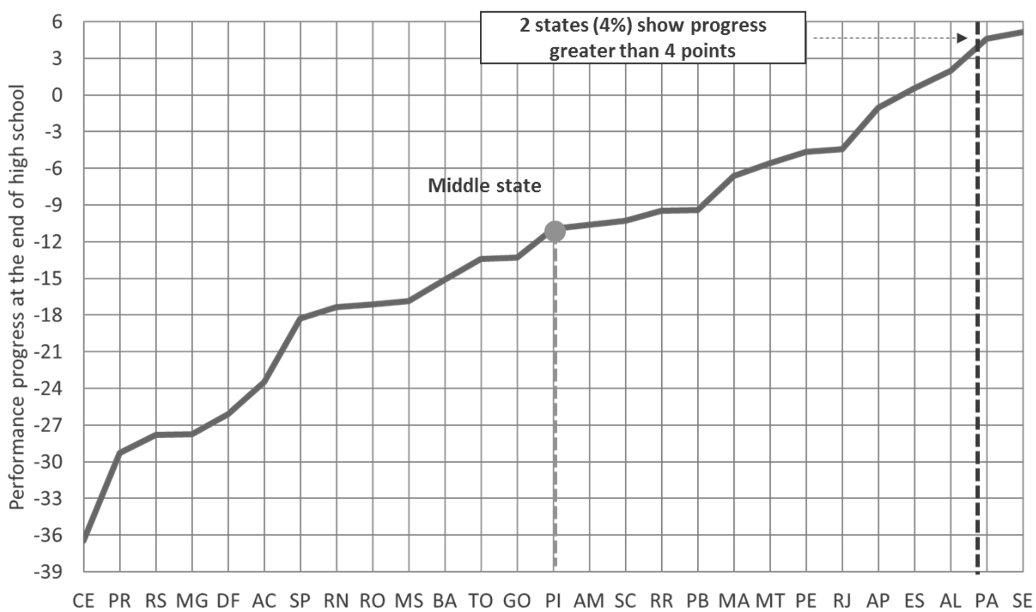
[20] This learning is obtained by comparing the mean performance observed in the final years of elementary school in 2013 and 2015, and the performance observed in high school in 2017.

[21] Estimate of Direct Public Investment in Education per student published by Deed/INEP.

learning nearly 30%. This shows that the marginal cost of learning promoted by *Jovem de Futuro*, R$219 and R$175 per additional learning point on the SAEB scale for the Portuguese and mathematics, respectively, is, on average, 6 times less than the average learning cost in high school: R$1.2 thousand per additional learning point on the SAEB scale.

Finally, another way to assess the relevance of the magnitude of the impact of *Jovem de Futuro* is to compare it to what other Brazilian states were able to achieve in the last decade. Graph 4 shows that, in most Brazilian states, there was a setback in the level of student learning. In only two of the 27 states in the country, progress in learning in high school in the last decade was 4 points higher on the SAEB scale. Thus, in relation to the progress that the country has been making, access to a program like *Jovem de Futuro* certainly leads to significant improvement.

**Graph 4: Progress in high school learning over a decade-long period by state**




Note: Learning is calculated by comparing the mean performance in the Portuguese language and in mathematics in high school with the mean performance in the final years of elementary school, in the SAEB from 2 years prior. Thus, progress is calculated by the difference between the observed learning from 2015 to 2013 and from 2007 to 2015, due to those years having available information.
Source: Estimates obtained from INEP data.

## 8. Conclusions and recommendations

The *Jovem de Futuro* was initially designed to promote improvements in school management through the incorporation of a results-oriented mentality. The program gradually incorporated the provision of structured protocols and practices, as well as results-oriented management focused on course correction and promoting the exchange of experiences among schools. In its third stage, the program increased its scope, turning its attention to emphasis on improvements in the management of the state network and its jurisdictions.

Although *Jovem de Futuro* aims at influencing multiple aspects of management, its main focus is on strategic planning, its execution, evaluation and course correction. Thus, *Jovem de Futuro* does not deal directly with aspects of governance, decentralization or aspects linked to the improvement of management routines.

Theoretically, actions designed to improve management should be able to promote greater efficiency. Although the available evidence on the effectiveness of this type of action is extremely limited, the available evidence (BLOOM et al., 2015; FRYER, 2014, 2017) is encouraging. It points out that actions appropriately designed to promote a better management tend to be effective in significantly reducing inefficiency in the use of educational resources.

Hence, the prospects of a program to promote improved management, as the *Jovem de Futuro*, could not be better in a country like Brazil, where the educational outcomes achieved are bad and uneven despite the high and growing public spending on education.

In this study, we estimate the magnitude of the impact *of Jovem de Futuro* on the proficiency of the students, in mathematics and the Portuguese language, at the end of high school. We found that the magnitude of the impact of this program is on the order of 4 and 5 points on the SAEB scale for the Portuguese language and mathematics, respectively, or 9% and 12% of a standard deviation.

The magnitude of this impact certainly (i) is within expectations, given the international evidence with similar programs (Fryer, 2014; 2017), (ii) leads to a more favorable cost-effectiveness ratio than the other expenses in education and (iii) represents immensely valuable help to an educational system where setbacks (drop in student learning) have become the rule.

However, compared to the total degree of inefficiency, 0.64 standard deviation, the magnitude of the impact of *Jovem de Futuro* is only a partial contribution. If adopted in all schools in Brazil, it could reduce existing inefficiencies by 11%, demonstrating that there is, in addition to this program, ample space for improved management to help improve educational performance.

In summary, *Jovem do Futuro* reveals that the inefficiency in the use of educational resources, which greatly affects Brazilian educational performance, can be combated effectively by initiatives aimed at improving management. At the same time, it shows that *Jovem de Futuro* should be seen only as a first step. As it is able to eliminate just 11% of the existing inefficiencies, it paves the way for other additional or broader programs that may make even greater contributions to the improvement of Brazilian educational performance.

Thus, if, on the one hand, this study demonstrates the feasibility and effectiveness of programs to improve educational performance through better management, on the other hand, it also demonstrates that much more still needs to be done in this direction.

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