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DIRECTORATE FOR BASIC EDUCATION ASSESSMENT | DAEB
BRAZIL IN PISA 2015
EXECUTIVE SUMMARY
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The opinions expressed and arguments employed herein do not necessarily reflect the official views of the Organization or of the governments of its member countries.
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This executive summary intends to present some results provided by the OECD documents and/or presented in the national report “Brasil no PISA 2015: Análises e reflexões sobre o desempenho dos estudantes brasileiros na avaliação” (Brazil in PISA 2015: analysis and reflections on the performance of Brazilian students at the assessment) produced by PISA team, in a partnership with the OECD Education Directorate. This document focuses on the analysis of the three cognitive areas assessed by PISA 2015.

PISA

International overview

- PISA is a triennial assessment of students aged 15 years and 3 completed months to 16 years and 2 completed months at the beginning of the assessment period, attending an educational institution in the participating country, as from the 7th grade.

- In 2015, 35 OECD countries took part in PISA: Germany, Australia, Austria, Belgium, Canada, Chile, Korea, Denmark, Slovakia, Slovenia, Spain, the United States, Estonia, Finland, France, Greece, the Netherlands, Hungary, Ireland, Iceland, Israel, Italy, Japan, Latvia, Luxemburg, Mexico, Norway, New Zealand, Poland, Portugal, United Kingdom, Czech Republic, Sweden, Switzerland and Turkey.
• Besides, 35 partner countries/economies, including Brazil, also participated in the assessment: Albania, Algeria, Argentina, Bulgaria, Qatar, Kazakhstan, Singapore, Colombia, Costa Rica, Croatia, United Arab Emirates, Georgia, Hong Kong, Indonesia, Jordan, Kosovo, Lebanon, Lithuania, Macao, Macedonia, Malaysia, Malta, Moldavia, Montenegro, Peru, Dominican Republic, Romania, Russia, Thailand, Taipei, Trinidad and Tobago, Tunisia, Uruguay and Vietnam.

• The cognitive domains assessed were: science, reading and mathematics. In 2015, PISA focused on science.

• In 2015, were also assessed collaborative problem solving skills and financial literacy.¹

• Fifteen countries/economies performed the test in paper-based mode (Albania, Algeria, Argentina, Kazakhstan, Georgia, Indonesia, Jordan, Kosovo, Lebanon, Macedonia, Malta, Moldavia, Romania, Trinidad and Tobago and Vietnam); the remaining 55 countries performed the test in a computer-based mode.

• PISA instruments (tests and questionnaires) provide three main kinds of results (OECD, 2016):
  o Indicators on the basic profile of students’ knowledge and skills.
  o Indicators derived from questionnaires that demonstrate how such skills are related to demographic, social, economic and educational variables.
  o Indicators on tendencies that follow student’s development and monitor educational systems over time.

National overview

• In 2015, Brazil selected students from 27 units of the Federation.

• After increasing the elementary school to nine years (Law number 11.274, of February 6th, 2006), all eligible students as from the 7th year were included in 2015 PISA.

• In a mutual agreement with the international consortium and due to logistic difficulties to apply for the assessment or due to the fact that certain populations do not have portuguese as their learning language, no PISA assessment cycle in the country was applied to eligible students from indigenous schools, rural area schools in the North region or international schools. For the same reasons, schools located in rural areas of the North region and international schools

¹ Results of Collaborative Problem Solving and Financial Literacy will be made available by OECD in 2017.
settlements, quilombola communities or sustainable conservation units have not been included in the PISA 2015 study.

- In Brazil, 23 141 students, from 841 schools took part in PISA 2015.
- For the first time PISA test in Brazil was delivered to all students via computer.
- The typical profile of a Brazilian student in PISA 2015 was: female (51.5%), enrolled in a secondary school (77.7%) from a state school network (73.8%) located in an urban area (95.4%) or in the countryside (76.7%).
- Although Amapá and Paraná states have not reached the minimum response rate required by PISA 2015, their results are reported here. However, we recommend that these data be considered with caution.

SCIENCE ASSESSMENT IN PISA

The PISA 2015 definition of Science literacy

For PISA, scientific literacy requires both the knowledge of concepts and theories, and the knowledge of common procedures and practices associated to the scientific investigation. A scientifically literate person should be prepared to participate in basic discussions on issues related to science, since he/she should be able to use knowledge and information in an interactive manner.

Source: OECD (2016a).

Assessment of scientific literacy in PISA

The performance of students is measured by tests comprised by units that represent a title and a stimulus that covers a number of associated questions (items). The 2015 assessment was totally performed in a computer-based format and the new science items were built in the electronic format, thus enabling preparing interactive units with stimuli as animated videos and some simulations, besides the standard units (stimuli by static material such as texts, images, graphs, tables, etc.).

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2 Groups of descendants of Afro-Brazilian slaves who escaped from plantations and founded settlements known as basic forms of active resistance which latter also helped to provide home to other minorities.
The tasks used to assess the students’ performance were developed based on categories/dimensions of the reference matrix as well as on response format and cognitive demand.

**Categories that describe the items devised for PISA 2015 science assessment**

<table>
<thead>
<tr>
<th>Dimensions of the reference matrix</th>
<th>Other categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific competencies</td>
<td></td>
</tr>
<tr>
<td>Explain phenomena scientifically</td>
<td>Content</td>
</tr>
<tr>
<td></td>
<td>Physical systems</td>
</tr>
<tr>
<td></td>
<td>Simple multiple choice</td>
</tr>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Personal</td>
</tr>
<tr>
<td>Evaluate and design scientific enquiries</td>
<td>Procedural¹</td>
</tr>
<tr>
<td></td>
<td>Living systems</td>
</tr>
<tr>
<td></td>
<td>Complex multiple choice</td>
</tr>
<tr>
<td></td>
<td>Average</td>
</tr>
<tr>
<td></td>
<td>Local/National</td>
</tr>
<tr>
<td>Interpret data and evidence scientifically</td>
<td>Epistemological¹</td>
</tr>
<tr>
<td></td>
<td>Earth and space system</td>
</tr>
<tr>
<td></td>
<td>Constructed response</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Global</td>
</tr>
</tbody>
</table>

Source: OECD (2016a).

Note: 1. Although different under the theoretical point of view, the procedural and epistemological knowledge categories are part of a single reference category.

PISA 2015 provides a global scale based on all science questions of the assessment whose metric is based on an OECD countries’ average of 500 points and on a standard deviation of 100 points. PISA 2015 scale is divided in seven proficiency levels. The description of each level defines the types of knowledges and skills required to complete the tasks. Students within level 1b of proficiency are probably capable of solving the tasks on this level, but have a low probability of solving the tasks of higher levels of the scale. Level 6 in the scale includes the most challenging tasks in terms of knowledge and skills. Students with proficiency values in this level have a high probability of completing the tasks in this and in the other levels of the scale.
The difficulty of science items for Brazilian students

- For Brazilian students, half the items in the 2015 edition were concentrated within the values of difficulty indices (Delta) 13.85 (corresponding to 41.6% of right items) and 16.55 (approximately 18.7% of right items).

- Only 15.8% of the items had a Delta indice lower or equal to 13 (reference value), i.e., approximately 3 in each 20 items presented a proportion of success equal or higher than 50%.

- The items of the competence “Interprete data and evidence scientifically” obtained the highest percentage of correct responses (33.7%), followed by the competence “Explain phenomena scientifically” (30.7%) and “Evaluate and design scientific enquiry” (26.3%).
• Items related to epistemologic knowledge were more difficult (Delta 16.8 and 22.1% of correct answers) than those relating to the other two types of knowledge. Even for students of countries with a better performance in the test the Delta value of the items on this kind of knowledge was above the average in the scale. On the other hand, the items related to content knowledge had, in average, the lowest Delta values and, therefore, a higher average of correct answers (32.6%) of Brazilian students.

• Regardless of the average in the countries’ general performance, the differences of difficulty in relation to the three content knowledge systems (physical, life and Earth and space) were relatively small. In Brazil, the Delta values for these items are close to 15, with a very slight variation as to the percentage of correct answers: 31.5%, 30.0% and 30.6% for the Earth and space, living systems, and physical systems items, respectively.

• Items related to personal content were considered to be easier for Brazilian students than those regarding local and global contexts. The difficulty level of the first ones was 14.67, with 33.8% of right answers, while those dealing with global contexts presented a Delta of 15.44, thus reflecting a reduction of about 7 score points in the percentage of success. This tendency was also observed in several countries and in the Brazilian units of the Federation, although the differences have shown a huge variation.

• Brazilian students have had more difficulty in open questions, followed by those of complex and simple multiple-choice. In Brazil, the difference between the difficulty level of open questions (16.34) and that of simple multiple-choice items (13.71) resulted in a reduction of 22.8% in the percentage of correct answers.

• The cognitive demand (mental process necessary to solve the task of an item) is strongly related to the difficulty of the item. Thus, items of high cognitive demand (those which require analyzing complex information or data, synthesis or evaluation of evidences, justification and argument based on several sources or planning strategies to solve a problem) present a higher difficulty for students, including those in countries with a better performance. For Brazilian students, the Delta value of such items has presented an average of 16.03 (22.4% of correct answers), while in those of low cognitive demand, the index value was 13.95, 40% of correct answers in average.

• In PISA, an unanswered item (skip a response) followed by another item with a valid response is considered an error. Brazilian students have skipped, on average, responses on 7.2% of science items, which is relatively high if compared to other countries. In some Brazilian states, the average was higher than 10%. The comparison among items of similar characteristics with a high percentage of answers skipped and those whose responses were not skipped (more than 80% of valid answers) demonstrated
that, although it is difficult to establish a single pattern, the reasons related to the omission are basically the same related to high rates of difficulty (for example, open response, global context and other determining factors on the degree of cognitive demand required).

- We identified certain items that are the indicators of strengths and weaknesses of Brazilian students’ performance in science, if compared to some OECD and Latin American countries. Representing the strengths of Brazilian students, overall, are the items of the “Explain phenomena scientifically” competency, of content knowledge, simple multiple choice type answers. On the other hand, representing the weaknesses are those items of the “interpret data and evidences scientifically” competence, of procedural knowledge, open answers and complex multiple choices.

**Results of Brazilian students in science**

- The average score of young Brazilian students in the science assessment was 401 points, a substantially lower value than the average of OECD member countries’ students (493 points).

- The average performance of Brazilian youths in the state network was 394 points in 2015.

- Since it provides primarily the Elementary School, the municipal network shows a lower performance than that of the schools of other administrative areas (329).

- Students of the Federal network have had a better performance in science in PISA 2015, 517 points, outperforming the national average, although it is not statistically different from the average performance of students from the private system (487).
The Brazilian confidence interval of the average in science in PISA 2015 was (396;405).

The 10% Brazilian students with the worst performance in PISA 2015 had an average score of 291, and the 10% with best performance, scored 522.

By unit of the Federation, Espírito Santo had the best performance (435 points), and Alagoas, the worst (360).

The average performance of boys in science was higher than that of the girls in the majority of the Brazilian units of the Federation.

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**Average, standard error (between brackets), percentages (P10, P25, P75, P90) and by the confidence interval of 13 countries and Brazil, Science, PISA, 2015**

Source: BRASIL (2016).
• Slightly more than 40% of Brazilian students have reached at least level 2 of the scale, considered by OECD the basic proficiency level that enables learning and the full participation in the social, economic and civilian life of modern societies in a globalized world (OECD, 2016).

• The 10% of Brazilian students with higher scores in science obtained an average score of 522 points, value between levels 3 and 4 in the scale.
Summary description of the seven levels of the proficiency scale and percentage of Brazilian and OECD students in each level, Science, PISA 2015

<table>
<thead>
<tr>
<th>Level</th>
<th>Minimum score</th>
<th>OECD: Percentage of students in this level</th>
<th>Characteristics of the tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>708</td>
<td>OECD: 1.06% Brazil: 0.02%</td>
<td>At Level 6, students can resort to a series of intertwined physics, life science and Earth and space sciences scientific ideas and concepts and use content, procedural and epistemic knowledge to formulate hypothesis to explain new scientific phenomena, events and processes or to make assumptions. By interpreting data and evidences, they can discern among relevant and irrelevant information and may resort to knowledge obtained out of school. They can distinguish among arguments based on theories and on scientific evidence from those based on other factors. The students at Level 6 can evaluate competing projects of complex experiments, field studies or simulations and justify their choices.</td>
</tr>
<tr>
<td>5</td>
<td>633</td>
<td>OECD: 6.67% Brazil: 0.65%</td>
<td>At Level 5, students can use abstract scientific ideas and concepts to explain unusual and more complex phenomena, events and processes that involve multiple causal relations. They can apply more advanced epistemic knowledge to assess alternative experimental project, justify their choices and use theoretical knowledge to interpret information and make assumptions. Students at Level 5 can evaluate forms to explore a certain problem scientifically and identify limitations in the data interpretation, including sources and the effects of uncertainty of scientific data.</td>
</tr>
<tr>
<td>4</td>
<td>559</td>
<td>OECD: 19.01% Brazil: 4.22%</td>
<td>At Level 4, students can use more complex and more abstract content knowledge, provided or recalled, to build explanation of more complexes or little known events and processes. They can conduct experiments that involve two or more independent variables in limited contexts. They can justify an experimental project resorting to procedural and epistemic knowledge elements. Students of Level 4 can interpret data from a set of moderately complex data or from a little known context, reaching adequate conclusions that go beyond the data and justify their choices.</td>
</tr>
<tr>
<td>3</td>
<td>484</td>
<td>OECD: 27.23% Brazil: 13.15%</td>
<td>At Level 3, students can resort to content knowledge of moderate complexity to identify or formulate explanations of known phenomena. In more complex or less known situations, they can formulate explanations since they are provided with support or tips. They can resort to procedural and epistemic knowledge to make a simple experiment in a limited context. Students at Level 3 can distinguish between scientific and non-scientific questions and identify the evidence that supports a scientific statement.</td>
</tr>
</tbody>
</table>

Source: BRASIL (2016).
### Summary description of the seven levels of the proficiency scale and percentage of Brazilian and OECD students in each level, Science, PISA 2015

<table>
<thead>
<tr>
<th>Level</th>
<th>Minimum score</th>
<th>Percentage of students in this level</th>
<th>Characteristics of the tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>410</td>
<td>OECD: 24.80% Brazil: 25.36%</td>
<td>At Level 2, students can resort to everyday knowledge and to basic procedural knowledge to identify an adequate scientific explanation, interpret data and identify the question addressed in a simple experimental project. They can use basic or everyday scientific knowledge to identify a valid conclusion based on a simple set of data. Students at Level 2 demonstrate having basic epistemic knowledge when they can identify issues that may be scientifically investigated.</td>
</tr>
<tr>
<td>1A</td>
<td>335</td>
<td>OECD: 15.74% Brazil: 32.37%</td>
<td>At Level 1a, students can use basic content and procedural knowledge or everyday knowledge to recognize or identify explanations of simple scientific phenomena. With some support, they can make structured scientific investigations with at most two variables. They can identify simple causal or correlational relations and interpret data in graphs and images that require a low level of cognitive demand. Students at Level 1a can select the best scientific explanation for a certain data in global, local and personal contexts.</td>
</tr>
<tr>
<td>1B</td>
<td>261</td>
<td>OECD: 4.91% Brazil: 19.85%</td>
<td>At Level 1b, students can use basic scientific or everyday knowledge to recognize aspects of simple and known phenomena. They can identify simple patterns in sources of data, recognize basic scientific terms and follow explicit instructions to make a scientific procedure.</td>
</tr>
<tr>
<td>Below 1B</td>
<td>OECD: 0.59% Brazil: 4.38%</td>
<td>OECD does not specify the skills developed.</td>
<td></td>
</tr>
</tbody>
</table>

Source: BRASIL (2016).

- A small part (less than 1%) of Brazilian students reached the two highest levels of the scale, while in OECD countries this number exceeded 7%;
- While in Espírito Santo state 40.4% of students are below level 2, in Alagoas this percentage reaches 74.9%.
Brazil in PISA 2015

Executive Summary

Percentage of students per proficiency level in Brazil and in the units of the Federation, Science, PISA, 2015
Source: BRASIL (2016).

Historical series of Brazilian results in science

- No empirical evidences were found indicating statistically significant differences between the Brazilian students’ performance in science in PISA 2015 and the three previous editions of the assessment.

Evolution of the average proficiency of Brazilian students considering PISA linking errors – Science: 2006-2015
Source: BRASIL (2016).
• Comparing with 2006, we can observe a slight increase (4.3 percentage points) of Brazilian youths at Level 2 or above in PISA 2015, despite the increase of enrollments in the Basic Education.

<table>
<thead>
<tr>
<th>Year</th>
<th>Below Level 1b</th>
<th>Level 1a</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
<th>Level 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>28</td>
<td>33</td>
<td>24</td>
<td>11</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>20</td>
<td>35</td>
<td>29</td>
<td>13</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>20</td>
<td>35</td>
<td>30</td>
<td>12</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>5</td>
<td>20</td>
<td>32</td>
<td>25</td>
<td>13</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

**Percentage of Brazilian students per proficiency level in PISA – Science: 2006-2015**

Source: BRASIL (2016).

Note: 1. In 2015, Level 1a corresponds to Level 1 in PISA 2006.

**Interest, motivation, beliefs and other perceptions of students in their science learning processes**

• About 40% of Brazilian students that answered PISA questionnaires reported the intention to follow a professional career in areas related to science and technology such as Engineering, Health and Technology. The average in OECD countries is 24%.

• Although more than 30% of Brazilian students have declared to watch scientific programs and to use the internet to look for scientific subjects, less than 20% reported taking part in science clubs.

• Brazilian students with a better performance in the science test (percentile 90) obtained the best rates in self-efficacy (perception on its capacity to perform specific tasks that require scientific skills). Also, parents’ support and the sense of belonging to school have demonstrated to have a significant role in the performance of Brazilian students in science.
• More than 50% of Brazilian students that have reported in the PISA 2015 context questionnaire that they like reading also said they are interested or have fun when they learn about science issues in general.

• Brazilian youths are more interested in subjects such as: “How can science help us avoid diseases” or “The universe and its history”.

• In average, more than 80% of the students in Brazilian units of the Federation with valid responses on PISA 2015 questionnaires have declared that teachers help or give support to their learning in the majority or almost all the science classes.

• Almost half the students have also reported that in most classes their teachers change the mechanism of the science classes in which the majority of the students demonstrate to have problems, 44.2% said the teacher adapts the class according to the needs and knowledge of the group, and 41.6% have reported that the teacher provides individual support in the majority or all science classes.

THE READING ASSESSMENT IN PISA

The PISA 2015 definition of reading literacy

Reading literacy is understanding, using, reflecting on and engaging with written texts, in order to achieve one’s goals, develop one’s knowledge and potential, and participating in society.

Source: OECD (2016a).

Why is reading important for the youth active participation in society?

“Reading literacy” is intended to express the active, purposeful and functional application of reading in a range of situations and for various purposes. PISA assesses a wide range of students. Some will go on to university; some will pursue studies in preparation for joining the labor force; some will enter the workforce directly after completing compulsory education. Achievement in reading literacy is not only a foundation for achievement in other subject areas within the education system, but also a prerequisite for successful participation in most areas of adult life (Cunningham and Stanovich, 1998; Smith et al., 2000). Indeed, regardless of
their academic or labor-force aspirations, student’s reading literacy is important for their active participation in their community and economic and personal life.

**Reading literacy assessment in PISA**

The PISA reading literacy assessment is built on three major task characteristics to ensure a broad coverage of the domain, which are:

- situation – refers to the range of broad contexts or purposes for which reading takes place,
- text – refers to the materials that are read,
- aspect – refers to the cognitive approach that determines how readers engage with a text.

**Characteristics of the domain assessed**

<table>
<thead>
<tr>
<th>Situation</th>
<th>Text format</th>
<th>Text type</th>
<th>Aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal</td>
<td>Continuous</td>
<td>Description</td>
<td>Access and retrieve information</td>
</tr>
<tr>
<td>Public</td>
<td>Non-continuous</td>
<td>Narration</td>
<td>Integrate and interpret</td>
</tr>
<tr>
<td>Educational</td>
<td>Multiple</td>
<td>Exposition</td>
<td>Reflect and evaluate</td>
</tr>
<tr>
<td>Occupational</td>
<td>Mixed</td>
<td>Argumentation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Instruction</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interaction</td>
<td></td>
</tr>
</tbody>
</table>

Source: OECD (2016a).

**The difficulty of reading items for Brazilian students**

- In the Brazilian context, about 40% of the items are in a *Delta* lower than or equal to level 13 of difficulty, that is, every two in each five items have 50% or more of correct answers.
- As to the percentage of correct answers, the Brazilian average was 41.4%, below that obtained in OECD countries, such as Finland (65.5%), Canada (64.9%), Korea (64.4%), the United States (60.0%), Portugal (59.9%), Spain (59.8%) and Chile (51.9%).

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3. A detailed description of the characteristics of reading domain can be obtained in the PISA 2015 national report.
• Brazilian students have demonstrated to have a better performance dealing with texts representing personal situations (for example, e-mails, instant messages, diary-style blogs, personal letters, literary texts and informational texts) and lower performance dealing with public situations (for example, official texts and documents, official notices and news).

• Items with continuous texts were easier for Brazilian students. These texts are defined by their organization into sentences and paragraphs, typically found in argumentative texts, tales and novels, for example. On the other hand, items with a mixed format were more difficult for the students participating in PISA – presented an overall higher Delta. The mixed texts format is characterized by a prose explanation, along with a list, graph, table or diagram.

• Items involving the **access and retrieve of information** were easier for Brazilian students, while those involving **integrating and interpreting** were more difficult.

### Results of Brazilian students in reading

• The average score of 15-year-old Brazilian students in the reading assessment was 407 points, a value significantly lower than the average of OECD member country students (493 points).

• The average reading performance of Brazilian students in the state network was 402 points in 2015, while in the municipal network was observed an average performance of 325.

• Students at the Federal network had a better reading performance in PISA 2015, 528 points, outperforming the national average, although it is not statistically different from the average performance of private system students (493).
The confidence interval of the average at reading in Brazil in PISA 2015 was (402; 413).

The 10% of Brazilian students with worst performance in PISA 2015 had an average score equal to 279, and the 10% with better performance scored 539.

By unit of the Federation, Espírito Santo had the best performance (441 points) and Alagoas, the worst (362).

In all units of the Federation, girls performed better in reading than boys. Bahia was the unit of the Federation with the highest difference (34 points) and Mato Grosso do Sul, with the lowest (8 points).
In Brazil, 51.0% of students are below Level 2 in reading – level the OECD understands to be the required for a student to be able to fully exercise its citizenship. This percentage is higher in the Dominican Republic (72.1%) and lower in Canada (10.7%).

<table>
<thead>
<tr>
<th>State</th>
<th>Average</th>
<th>Standard Error</th>
<th>Percentiles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>407; 2.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Espírito Santo</td>
<td>441; 6.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paraná</td>
<td>433; 10.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minas Gerais</td>
<td>431; 12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distrito Federal</td>
<td>430; 7.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Santa Catarina</td>
<td>419; 9.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>São Paulo</td>
<td>417; 6.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goiás</td>
<td>416; 11.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mato Grosso do Sul</td>
<td>411; 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rio Grande do Sul</td>
<td>410; 11.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceará</td>
<td>409; 12.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acre</td>
<td>407; 10.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amazonas</td>
<td>407; 12.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roraima</td>
<td>403; 10.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mato Grosso</td>
<td>402; 5.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rio de Janeiro</td>
<td>400; 8.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pará</td>
<td>395; 19.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pernambuco</td>
<td>394; 9.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rondônia</td>
<td>393; 10.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amapá</td>
<td>385; 8.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paraíba</td>
<td>385; 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rio Grande do Norte</td>
<td>384; 7.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piauí</td>
<td>381; 12.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sergipe</td>
<td>379; 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maranhão</td>
<td>377; 15.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tocantins</td>
<td>376; 5.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bahia</td>
<td>372; 8.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alagoas</td>
<td>362; 12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Average, standard-error (between brackets), percentiles (P10, P25, P75, P90) and by confidence interval per unit of the Federation, Reading, PISA, 2015

Source: BRASIL (2016).
### Description and percentage of students in the seven reading proficiency levels in PISA 2015

<table>
<thead>
<tr>
<th>Level</th>
<th>Lower score limit</th>
<th>Percentage of students in this level</th>
<th>Characteristics of tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>698</td>
<td>OECD: 1.11% Brazil: 0.14%</td>
<td>Tasks at this level typically require the reader to make multiple inferences, comparisons and contrasts that are both detailed and precise. They require demonstration of a full and detailed understanding of one or more texts and may involve integrating information from more than one text. Tasks may require the reader to deal with unfamiliar ideas, in the presence of prominent competing information, and to generate abstract categories for interpretations. Reflect and evaluate tasks may require the reader to hypothesize about or critically evaluate a complex text on an unfamiliar topic, taking into account multiple criteria or perspectives, and applying sophisticated understandings from beyond the text. A salient condition for access and retrieve tasks at this level is precision of analysis and fine attention to detail that is inconspicuous in the texts.</td>
</tr>
<tr>
<td>5</td>
<td>626</td>
<td>OECD: 7.22% Brazil: 1.31%</td>
<td>Tasks at this level that involve retrieving information require the reader to locate and organize several pieces of deeply embedded information, inferring which information in the text is relevant. Reflective tasks require critical evaluation or hypothesis, drawing on specialized knowledge. Both interpretative and reflective tasks require a full and detailed understanding of a text whose content or form is unfamiliar. For all aspects of reading, tasks at this level typically involve dealing with concepts that are contrary to expectations.</td>
</tr>
<tr>
<td>4</td>
<td>553</td>
<td>OECD: 20.45% Brazil: 6.36%</td>
<td>Tasks at this level that involve retrieving information require the reader to locate and organize several pieces of embedded information. Some tasks at this level require interpreting the meaning of nuances of language in a section of text by taking into account the text as a whole. Other interpretative tasks require understanding and applying categories in an unfamiliar context. Reflective tasks at this level require readers to use formal or public knowledge to hypothesize about or critically evaluate a text. Readers must demonstrate an accurate understanding of long or complex texts whose content or form may be unfamiliar.</td>
</tr>
</tbody>
</table>

Source: BRASIL (2016).
### Description and percentage of students in the seven reading proficiency levels in PISA 2015

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>480</td>
<td>OECD: 27.91% Brazil: 16.19%</td>
<td>Tasks at this level require the reader to locate, and in some cases recognize the relationship between, several pieces of information that must meet multiple conditions. Interpretative tasks at this level require the reader to integrate several parts of a text in order to identify a main idea, understand a relationship or construe the meaning of a word or phrase. They need to take into account many features in comparing, contrasting or categorizing. Often the required information is not prominent or there is much competing information; or there are other text obstacles, such as ideas that are contrary to expectation or negatively worded. Reflective tasks at this level may require connections, comparisons and explanations, or they may require the reader to evaluate a feature of the text. Some reflective tasks require readers to demonstrate a fine understanding of the text in relation to familiar, everyday knowledge. Other tasks do not require detailed text comprehension but require the reader to draw on less common knowledge.</td>
</tr>
<tr>
<td>2</td>
<td>407</td>
<td>OECD: 23.24% Brazil: 25.00%</td>
<td>Some tasks at this level require the reader to locate one or more pieces of information, which may need to be inferred and may need to meet several conditions. Others require recognizing the main idea in a text, understanding relationships, or construing meaning within a limited part of the text when the information is not prominent and the reader must make low level inferences. Tasks at this level may involve comparisons or contrasts based on a single feature in the text. Typical reflective tasks at this level require readers to make a comparison or several connections between the text and outside knowledge, by drawing on personal experience and attitudes.</td>
</tr>
<tr>
<td>1a</td>
<td>335</td>
<td>OECD: 13.59% Brazil: 26.52%</td>
<td>Tasks at this level require the reader to locate one or more independent pieces of explicitly stated information; to recognize the main theme or author’s purpose in a text about a familiar topic, or to make a simple connection between information in the text and common, everyday knowledge. Typically the required information in the text is prominent and there is little, if any, competing information. The reader is explicitly directed to consider relevant factors in the task and in the text.</td>
</tr>
</tbody>
</table>

Source: BRASIL (2016).
### Description and percentage of students in the seven reading proficiency levels in PISA 2015

<table>
<thead>
<tr>
<th>Level</th>
<th>Lower score limit</th>
<th>Percentage of students in this level</th>
<th>Characteristics of tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1b</td>
<td>262</td>
<td>OECD: 5.23% Brazil: 17.41%</td>
<td>Tasks at this level require the reader to locate a single piece of explicitly stated information in a prominent position in a short, syntactically simple text with a familiar context and text type, such as a narrative or a simple list. The text typically provides support to the reader, such as repetition of information, pictures or familiar symbols. There is minimal competing information. In tasks requiring interpretation the reader may need to make simple connections between adjacent pieces of information.</td>
</tr>
<tr>
<td>Below 1b</td>
<td>OECD: 1.25% Brazil: 7.06%</td>
<td>OECD does not specify skills developed</td>
<td></td>
</tr>
</tbody>
</table>

Source: BRASIL (2016).

- By assessing Brazilian students by proficiency level, we can observe huge subnational discrepancies. While in Espírito Santo state 36.7% of the students are below level 2, in Alagoas state this percentage reaches 70.1%.
**Historical series of Brazilian results in reading**

- No empirical evidences were found indicating statistically significant differences among Brazilian students’ performance in reading since 2000.

![Graph showing historical series of Brazilian results in reading](image)

**Evolution of average proficiency of Brazilian students considering linking errors in PISA – Reading: 2000-2015**

*Source: BRASIL (2016).*

- Compared to 2000, we observe a slight increase (4.7 percentage points) of Brazilian students at level 2 or above in PISA 2015, despite the increased enrollment in Basic Education.

<table>
<thead>
<tr>
<th>Year</th>
<th>Below Level 1b</th>
<th>Level 1a</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
<th>Level 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>23</td>
<td>33</td>
<td>28</td>
<td>13</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>27</td>
<td>23</td>
<td>25</td>
<td>17</td>
<td>6</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>28</td>
<td>28</td>
<td>25</td>
<td>13</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>5</td>
<td>16</td>
<td>27</td>
<td>16</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>4</td>
<td>16</td>
<td>29</td>
<td>15</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>7</td>
<td>17</td>
<td>25</td>
<td>16</td>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Percentage of Brazilian students by proficiency level in PISA – Reading: 2000-2015**

*Source: BRASIL (2016).*

Note: 1. In 2015, Level 1a corresponded to Level 1 in PISA 2000.
The 2015 definition of mathematical literacy

Mathematical literacy is an individual’s capacity to formulate, employ and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to recognize the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged and reflective citizens.

Source: OECD (2016a).

Assessment of mathematical literacy in PISA

The definition of mathematical literacy in PISA 2015 may be understood regarding three interconnected aspects:

- Mathematic processes that describe what individuals do to relate a previous context of the problem with mathematics and, thus, solve the problem, and the capabilities underlying those processes,
- The mathematical content to be used in the items of the assessment, and
- The contexts in which students face assessment items.
Mathematical content categories: Quantity; Uncertainty and data; Change and relationships; Space and shape
Real world context categories: Personal; Societal; Occupational; Scientific

Mathematical thought and action
Mathematical concepts, knowledge and skills
Fundamental mathematical capabilities: Communication; Representation; Devising strategies; Mathematisation; Reasoning and argument; Using symbol, formal and technical language and operations; Using mathematical tools
Processes: Formulate; Employ; Interpret/Evaluate

A model of mathematical literacy in practice
Source: OECD (2016a).

Mathematical processes

Formulating situations mathematically

- identifying the mathematical aspects of a problem situated in a real-world context and identifying the significant variables
- recognizing mathematical structure (including regularities, relationships and patterns) in problems or situations
- simplifying a situation or problem in order to make it amenable to mathematical analysis
- identifying constraints and assumptions behind any mathematical modelling and simplifications gleaned from the context
- representing a situation mathematically, using appropriate variables, symbols, diagrams and standard models
- representing a problem in a different way, including organizing it according to mathematical concepts and making appropriate assumptions
- understanding and explaining the relationships between the context-specific language of a problem and the symbolic and formal language needed to represent it mathematically
- translating a problem into mathematical language or a representation
- recognizing aspects of a problem that correspond with known problems or mathematical concepts, facts or procedures
- using technology (such as a spreadsheet or the list facility on a graphing calculator) to portray a mathematical relationship inherent in a contextualized problem.

Source: OECD (2016a).
### Employing mathematical concepts, facts, procedures and reasoning

- devising and implementing strategies for finding mathematical solutions
- using mathematical tools, including technology, to help find exact or approximate solutions
- applying mathematical facts, rules, algorithms and structures when finding solutions
- manipulating numbers, graphical and statistical data and information, algebraic expressions and equations, and geometric representations
- making mathematical diagrams, graphs and constructions, and extracting mathematical information from them
- using and switching between different representations in the process of finding solutions
- making generalizations based on the results of applying mathematical procedures to find solutions
- reflecting on mathematical arguments and explaining and justifying mathematical results.

Source: OECD (2016a).

### Interpreting, applying and evaluating mathematical outcomes

- interpreting a mathematical result back into the real-world context
- evaluating the reasonableness of a mathematical solution in the context of a real-world problem
- understanding how the real world impacts the outcomes and calculations of a mathematical procedure or model in order to make contextual judgements about how the results should be adjusted or applied
- explaining why a mathematical result or conclusion does, or does not, make sense given the context of a problem
- understanding the extent and limits of mathematical concepts and mathematical solutions
- criticizing and identifying the limits of the model used to solve a problem.

Source: OECD (2016a).

### The difficulty of mathematics items for Brazilian students

- 11.6% of mathematics items have presented a Delta index lower or equal to 13, i.e., every item in each 9 had a proportion of correct answers equal to or higher than 50%. For Brazilian students, half the items in the PISA 2015 concentrated within the range 14.3 (corresponding to a percentage of correct answers of 37.3%) to 18.5 (about 8.5% of correct answers).

- The level of difficulty of mathematics items in PISA 2015 for Brazilian youths was higher than that of other Latin American countries. On average, the Delta index value for Brazil (15.72) was similar to that of Peru (15.69), Colombia (15.65), Costa Rica (15.39) and Mexico (15.26).
• Brazilian students had a better performance in items of the “quantity” category (amount in money, ratio and proportion and arithmetic calculations). It means that dealing with money or experiencing facts regarding arithmetic or proportion calculations is closest to students’ reality, than, for instance, those on space and shape.

• “Space and shape” was the content category with the highest Delta values. This subarea of mathematics assessment involves a wide range of properties found in several places in the physical and visual world. They deal, for example, with geometric notions such as perimeter or area, characteristics of spatial figures, etc. The dynamic interaction with real forms as well as with its representations has demonstrated to be a more difficult and time-consuming content for 15-year-old students in the PISA 2015 assessment.

• As to the context category, results have demonstrated that 15-year-old students deal better with mathematics directly involved with everyday activities, family or friends. Problems such as food preparation, games, personal health and personal finance are situations they “mathematize” easier and solve by themselves. Something similar occurs in the work/occupational world (provided it is accessible and compatible with the 15-year-old student), which is easily recognized by the youths such as, for example, professional decisions, quality control, work payment rules, etc.

• As to the process scope, the “formulate” category, obtained the highest level of difficulty according to the Delta index, in all Brazilian units of the Federation. There was a considerable difference regarding the “employ” category, the second category with the highest Delta value. The “interpret” category was the easiest for Brazilian students.

Results for Brazilian students in mathematics

• The average score of 15-year-old Brazilian youths in the mathematics assessment was 377 points, a significantly lower value than the average of OECD country members (490 points).

• The average performance in Mathematics in PISA 2015 by state network students was 369 and by municipal network students was 311, a statistically significant difference. Students of the federal network had a better performance, 488 points, but it is not statistically different from the average performance of private school students (463 points).
Averages, standard-error (between brackets), percentiles (P10, P25, P75, P90) and by average confidence interval of 13 countries and Brazil, Mathematics, PISA, 2015

Source: BRASIL (2016).

- The average confidence interval of Brazil in mathematics in PISA 2015 is (371;383).
- The 10% of Brazilian students with lower performance in PISA 2015 had an average score of 267, and the 10% with highest score, 496.
- Per unit of the Federation, Paraná was the state with the highest performance (406 points) and Alagoas, the one with lowest performance (339). However, we should stress that Paraná, as well as Amapá, did not reach the response rate required in PISA 2015, thus impairing a trustworthy analysis for that state.
- In almost all units of the Federation, the boys performance was higher than the girls’.
In Brazil, 70.3% of students are below level 2 in Mathematics – level the OECD understands to be necessary for a student to fully exercise his/her citizenship. This percentage is higher in the Dominican Republic (90.5%) and lower in Finland (13.6%).
Description and percentage of students at six mathematics proficiency levels in PISA 2015

<table>
<thead>
<tr>
<th>Level</th>
<th>Lower score limit</th>
<th>Percentage of students in this level</th>
<th>Characteristics of tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>OECD: 2.31% Brazil: 0.13%</td>
<td>At Level 6, students can conceptualize, generalize and utilize information based on their investigations and modelling of complex problem situations, and can use their knowledge in relatively non-standard contexts. They can link different information sources and representations and flexibly translate among them. Students at this level are capable of advanced mathematical thinking and reasoning. These students can apply this insight and understanding, along with a mastery of symbolic and formal mathematical operations and relationships, to develop new approaches and strategies for attacking novel situations. Students at this level can reflect on their actions, and can formulate and precisely communicate their actions and reflections regarding their findings, interpretations, arguments, and the appropriateness of these to the original situation.</td>
</tr>
<tr>
<td>6</td>
<td>669</td>
<td>OECD: 8.37% Brazil: 0.77%</td>
<td>At Level 5, students can develop and work with models for complex situations, identifying constraints and specifying assumptions. They can select, compare and evaluate appropriate problem-solving strategies for dealing with complex problems related to these models. Students at this level can work strategically using broad, well-developed thinking and reasoning skills, appropriate linked representations, symbolic and formal characterizations, and insight pertaining to these situations. They begin to reflect on their work and can formulate and communicate their interpretations and reasoning.</td>
</tr>
<tr>
<td>5</td>
<td>607</td>
<td>OECD: 18.60% Brazil: 3.09%</td>
<td>At Level 4, students can work effectively with explicit models for complex concrete situations that may involve constraints or call for making assumptions. They can select and integrate different representations, including symbolic, linking them directly to aspects of real-world situations. Students at this level can utilize their limited range of skills and can reason with some insight, in straightforward contexts. They can construct and communicate explanations and arguments based on their interpretations, arguments and actions.</td>
</tr>
</tbody>
</table>

Source: BRASIL (2016).
### Description and percentage of students at six mathematics proficiency levels in PISA 2015

<table>
<thead>
<tr>
<th>Level</th>
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<th>Percentage of students in this level</th>
<th>Characteristics of tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>482</td>
<td>OECD: 24.81% Brazil: 8.58%</td>
<td>At Level 3, students can execute clearly described procedures, including those that require sequential decisions. Their interpretations are sufficiently sound to be a base for building a simple model or for selecting and applying simple problem-solving strategies. Students at this level can interpret and use representations based on different information sources and reason directly from them. They typically show some ability to handle percentages, fractions and decimal numbers, and to work with proportional relationships. Their solutions reflect that they have engaged in basic interpretation and reasoning.</td>
</tr>
<tr>
<td>2</td>
<td>420</td>
<td>OECD: 22.55% Brazil: 17.18%</td>
<td>At Level 2, students can interpret and recognize situations in contexts that require no more than direct inference. They can extract relevant information from a single source and make use of a single representational mode. Students at this level can employ basic algorithms, formulae, procedures or conventions to solve problems involving whole numbers. They are capable of making literal interpretations of the results.</td>
</tr>
<tr>
<td>1</td>
<td>358</td>
<td>OECD: 14.89% Brazil: 26.51%</td>
<td>At Level 1, students can answer questions involving familiar contexts where all relevant information is present and the questions are clearly defined. They are able to identify information and to carry out routine procedures according to direct instructions in explicit situations. They can perform actions that are almost always obvious and follow immediately from the given stimuli.</td>
</tr>
<tr>
<td>Below 1</td>
<td></td>
<td>OECD: 8.47% Brazil: 43.74%</td>
<td>OECD does not specify skills developed.</td>
</tr>
</tbody>
</table>

Source: BRASIL (2016).

- By assessing Brazilian students by proficiency level, huge regional differences can be observed in PISA 2015. While in Espírito Santo state 59.1% of the students are below level 2, in Alagoas this percentage reaches 83.2%.
Percentage of students per level and unit of the Federation – Mathematics, PISA 2015

Source: BRASIL (2016).

Historical series of Brazilian results in mathematics

- The performance of Brazilian students in PISA 2015 was statistically lower in 2012, with a difference of 11 points. As highlighted by OECD, the main trajectory in PISA, however, is positive for Brazilian youths (who added 6.2 points, in average, in each successive PISA test, since 2003) (OECD, 2016).


Source: BRASIL (2016).
• Compared to 2003, we can observe a slight increase (5.0 percentage points) of Brazilian youths at level 2 or higher in PISA 2015, despite the expansion in the number of enrollments in Basic Education.

### Percentage of Brazilian students per proficiency level in PISA – Mathematics: 2003-2015

Source: BRASIL (2016).

### REFERENCES

BRASIL. Lei nº 11.274, de 6 de fevereiro de 2006. Altera a redação dos arts. 29, 30, 32 e 87 da Lei nº 9.394, de 20 de dezembro de 1996, que estabelece as diretrizes e bases da educação nacional, disposto sobre a duração de 9 (nove) anos para o ensino fundamental, com matrícula obrigatória a partir dos 6 (seis) anos de idade. Diário Oficial da União, Brasilia, DF, 07 dez. 2006. Seção 1, p. 1.


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