https://dx.doi.org/10.22161/ijaers.79.40 *ISSN: 2349-6495(P) | 2456-1908(O)*

Teaching Mathematics: Low Performance in Mass Evaluations

Fábia Maria de Souza[1], Roberto Grün[2], Hélio Raymundo Ferreira Filho[3]

[1]PhD in Production Engineering, Federal University of São Carlos (UFSCAR), Professor at the State University of Pará (UEPA), Belém, PA, Brazil
[2]PhDin Social Sciences, State University of Campinas (UNICAMP), Professor at the Federal Universityof ABC (UFABC), São Paulo, SP, Brazil
[3]PhD in Management Sciences, University Pierre Mendès-France (UPMF), Professor at the State University of Pará (UEPA), Belém, PA, Brazil

Abstract**—** *External performance evaluation processes of students in Brazilian schools have shown low retention and/or learning of knowledge provided for in the legislation. More precisely in the area of Mathematics, some indices have decreased in the latest evaluations, such as the National High School Examination (ENEM in Portuguese) and the* Programme *for* International Student Assessment *(PISA). This reality requires deep reflection, structured on research and dialogues between peers and agents, and to do this, data must be collected. In order to understand the results of the mass evaluation processes of Brazilian education, quantitative research was carried out using secondary data collection techniques. The results indicate that the evaluation processes show an insufficiency in the students performance averages, and Mathematics is the area of knowledge with the lowest indexes, both in internal (such as ENEM) and external (such as PISA) evaluations.*

Keywords**—Evaluation, ENEM, Mathematics, PISA.**

I. INTRODUCTION

Education is considered the mainspring for human, social and economic development of any nation (IAQUINTO, 2014). Owing to this, the education system should aim to offer society systematized education as a strategy for progress at all these levels.

According to the International Commission on Education for the Twenty-first Century prepared for the United Nations Educational, Scientific and Cultural Organization (UNESCO) and entitled Learning: The Treasure Within, the educational process "consists of allowing each individual, without exception, to make their talents and their creative potential fructify, which implies, on the part of each one, the ability to assume their own responsibility and carry out their personal project"(UNESCO, 2010, p.10). This means that, within schools, students can develop their skills and they are used in order to ensure greater mobility, especially in the profession they choose.

The Brazilian educational system was consolidated and (re)structured in such a way as to promote the disarticulation between the country's economy and the objectives of education, which functioned according to "predilections and economic configurations: the country's economic axis was changed, the main activities generating labor were changed and, as a consequence, the profile of the required worker was changed" (OLIVEIRA; CALDEIRA, 2016, p.197).

The Brazilian Ministry of Education (MEC) has presented proposals with this aim, as over the last 10 years, it has matured ideas and discourse to develop competences, increasing the time spent by students at school, in the perspective of improving basic education. These paths have culminated in laws but have not yet had an impact on practical implementations or on improving student performance.

Among the aforementioned laws are the Normative Interministerial Ordinance no. 17, of April 24, 2007, which addresses the student's length of stay in school (BRASIL, 2007); the High School Curriculum Reform, through the National High School Curriculum Parameters of 2007 (BRASIL, 2006); Law no. 13.005, of June 25, 2014, which approves the National Education Plan (BRASIL, 2014); and Provisional Measure no. 746, of September 22, 2016, a recent specific high school case, which institutes the Policy to Promote Implementation of Full-Time High Schools (BRASIL, 2016a).

https://dx.doi.org/10.22161/ijaers.79.40 ISSN: 2349-6495(P) | 2456-1908(O)

As can be observed, there are doubts concerning the need for improvements in high school. Unfortunately, it seems that students see schools as meaningless and unattractive, not developing their educational potential, therefore their skills, a situation that can be seen in the results of the ProgrammeforInternational Student Assessment (PISA), Basic Education Development Index (IDEB in Portuguese) and the National High School Examination (ENEM in Portuguese).

In Brazil, the educational conditions for intellectual learning are obsolete, since the guidelines of a class society still prevail, which are very close to noble young people´s education from the latifundium of Imperial Brazil and the Colony. Nevertheless, considering the contrary discourse and the advances that have occurred, intellectual learning of excellence is reserved for the elite (FRIGOTTO; CIAVATTA, 2011).

The Basic Education Assessment System (SAEB in Portuguese) indices point to this lack of development of the minimum skills of 600 points, according to the international standard: less than 10% of students in public schools reach the adequate minimum education level (SCHWARTZMAN; CASTRO, 2013), and, on completing the two stages of basic education, they are unable to reach the minimum proposed education level, that is, the average student in all spheres of education (private and public) who performed well, reaching the minimum average. This means that:

- in elementary school, among ninth graders, considering public and private schools, only 14.7% reached the minimum or above average level in Mathematics, a percentage that reached 26.2% in Portuguese; considering only public schools, the percentage dropped to 10.4% in Mathematics and 22% in Portuguese;
- in high school, in the 2014 ENEM assessment, among third grade school leavers, analyzing them only in mathematics performance and considering public and private teaching, only 11% learned the minimum; analyzing only the results of public school students, this percentage fell, unfortunately, to 5.8%.

Table 1 shows the number of schools per sphere, as well as the number of students enrolled in the third grade of high school versus the number of students who took ENEM:

Table 1 –Students who enrolled and took ENEM in 2014 by sphere of education

Sphere	State	Private	Federal	Municipal	General Total
Numberofschools	8,990 (57.5%)	6,215 (39.7%)	326(2.1 %)	109 (0.7%)	15,640(100 %)
Students enrolled in the third grade of High School in 2014	1,024,255(74.7%)	304,927(22.3%)	31,533(2.3%)	9,805(0.7 %)	1,370,520(100%)
Students enrolled in the third grade in 2014 and who took ENEM in 2014	685,173(69 .6%)	263,889(26.8%)	27,296(2.8%)	7,412(0.8 %)	983,770(10 0%)

Source: adapted from data in the 2014 ENEM spreadsheet of Brazil (2015a).

According to data from the National InstituteforEducational Studies and Research"Anísio Teixeira" (INEP), in the 2014 ENEM, among the 8,990 state schools, which were analyzed in the research supported by this article, only 34 (0.38%) reached or exceeded the basic minimum average of 600 points, considered by PISA to be the minimum performance for a student to have significantly acquired knowledge (INEP, 2015a).

In the last IDEB (BRASIL, 2015c), the data did not change and showed little improvement and very modest growth, whereby learning rates were below five points. This indicates that the overall average of students when completing the teaching stages was:

a) in elementary education:

- private: 6.2 in 2011; 6.5 in 2013; 6.8 in 2015
- public: 3.7 in 2011; 4.1 in 2013; 4.5 in 2015

b) in high school:

- private: 5.8 in 2011; 6.0 in 2013; 6.3 in 2015
- public: 3.4 in 2011; 3.6 in 2013; 4.0 in 2015

https://dx.doi.org/10.22161/ijaers.79.40 ISSN: 2349-6495(P) | 2456-1908(O)

Regarding Enem, the overall average was also not much different. However, the MEC announced on the Portal do Brasil that the results of the examination increased the average of schools in general in the "comparison between 2013 and 2014: the score of the Language and Codes test went from 508 to 528; Natural Sciences from 492 to 507; and Humanities from 537 to 565. However, there was a drop in the mathematics test score from 544 to 511"(PORTAL BRASIL, 2015).

Thus, it is clear that the situation has not evolved much over the years, which can be confirmed in the data made available by INEP in 2016 and widely published in newspapers, journals and magazines circulated widely in Brazil. Interesting examples of this mediatization are some reports from the magazine called Veja by columnist Castro (2016), who notes that "in mathematics, students only learn about 10% of what is expected". This is a comment that questions teacher training and the adoption of a single curriculum model for all high school students, contrary to the trend of developed countries, which adopt flexible curricula. Another key point to be observed is teacher training practices, which are directly reflected in the student's learning, and are therefore one of the biggest challenges in education: developing teaching practices that can be used for their needs.

Thus, the Brazilian educational field has legislation whose objectives are aimed at developing students' skills, although the performance concerning the evaluation processes, such as IDEB, PISA and ENEM demonstrate that these objectives are not being met.

II. METHODOLOGY

The work presented in this article followed a qualitative research approach as it draws on premises that aim to analyze and interpret rooted aspects, trying to describe the complexity of human behavior (MARCONI; LAKATOS, 2010), using an analysis of secondary data collection.

The collection "is a measurement process used to collect information during a highly structured interview" (COOPER; SCHINDLER, 2016, p. 221), and the secondary data refer to information already collected, systematized, tabulated and ordered, with or without analysts. to meet the research purposes, which are available to companies or even in the public domain (RICHARDSON, 2010; COOPER. SCHINDLER, 2016).

Some tertiary data were also used, which are related to tertiary sources, which although difficult to define, can be understood as those contained in bibliographies, dictionaries, almanacs, etc. (COOPER; SCHINDLER, 2016).

This research followed some steps: first, we sought to find outINEP (2015a, b, c) and OECD (2011; 2013) databases through an analysis; then the information was summarized from the obtained elements.

III. RESULTS

3.1 Teaching and performance in mass evaluations

Until mid-2017, the educational proposal for young people in basic education in Brazil consisted of policies that claim that their social agents are prepared for citizenship and work, based on developing capital resources.These resources are called competences, which are pointed out, conceptualized and classified in the National Curriculum Parameters (PCN in Portuguese), more specifically in the Introduction (BRASIL, 1997, p.47). The human capacities to be developed are cognitive, physical, affective, interpersonal and social, ethical and aesthetic, and can be analyzed in Table 1.

Table 1 – Human capacities and knowledge developed by social agents

Capacity	Influence	Knowledgedevelopment
Cognitive	Ways of representation and communication involving problem solving	Representation codes; interfering with language learning, mathematics, spatial, temporal and graphic representation, and reading images
Physical	Self-knowledge and using the body to express emotions	Overcoming stereotypes of movements, in games, in moving around safely
Affective	Motivation and self-esteem, sensitivity and adequacy of attitudes in social life	Understandingyourselfandothers
Interpersonal	Understanding, living and producing with others, noticing differences between people, contrasts in temperament,	Allowing yourself to put yourself in the other's shoes and reflect on your own thoughts. Cooperation practices that incorporate participatory forms, enabling joint positions to be taken.

https://dx.doi.org/10.22161/ijaers.79.40 *ISSN: 2349-6495(P) | 2456-1908(O)*

	intentions and moods	
Social Insertion	Noticing that you are part of a community, a class, one or more social groups and personally committing yourself to issues that you consider relevant to collective life	Necessary so that you can overcome individualism and act (in daily life or in political life) taking into account the collective dimension. Learning different forms and possibilities of social participation is essential for developing this capacity
Aesthetics	Producing art and appreciating different artistic productions	Allowing to produce and reproduce in different cultures and historical moments
Ethics	Possibility of governing your own actions and decision making based on a system of principles according to which, in different situations of life, the values and options involved are analyzed.	Developing this capacity enables us to consider and attempt to understand reasons, nuances, conditions, consequences and intentions, that is, it allows us to overcome moral rigidity, in judgment and personal performance, in interpersonal relationships and understanding social relationships

Source: adapted from Brasil(1997).

Thus, a complex educational system was considered, together with the development of the students' capacities and skills, interlinking informal and formal knowledge when redimensioning knowledge necessary for citizenship and the world of work. Thus, in the last half of the 1990s, basic education in Brazil took on the challenge of implementing and developing educational policies based on the development, acquisition and apprehension of skills.

According to the main international organizations and UNESCO, the PCN and the Law of Directives and Bases of Education (LDB in Portuguese) are consistent with the acquisition and development of resources and values necessary to hold cultural capital, inherent and announced in the practice of competencies, including technical and higher education.

3.2 The Basic Education Assessment System (SAEB)

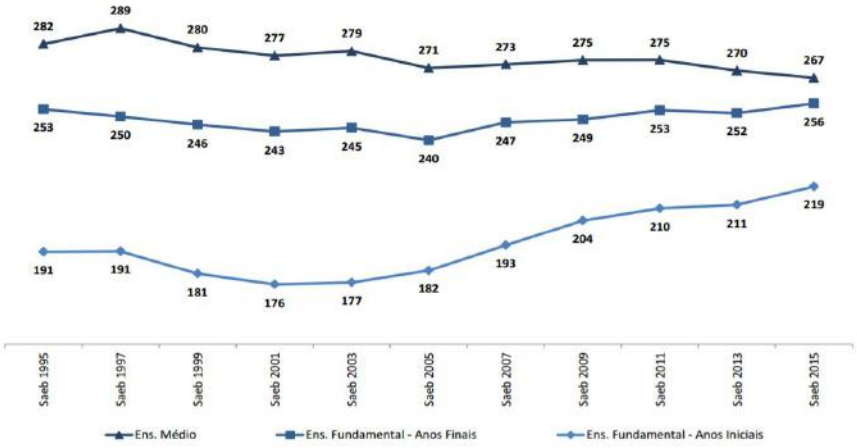
According to the Basic Education Census of the previous year (BRAZIL, 2015b), all Brazilian public schools with at least 20 students enrolled in the fifth or ninth grade of elementary school and in the third grade of high school participated in SAEB. According to Ministerial Decree no. 931 of March 21, 2005 (BRASIL, 2005), the system consists of two evaluation processes:

1. the National Assessment of Basic Education (ANEB), of universal character, which, when disclosed, is called SAEB (INEP, 2015c). It is done by large-scale sampling external to the public and private education systems and of biannual periodicity (BRASIL, 2005);
2. the National Evaluation of School Achievement (ANRESC), which is more extensive and detailed than ANEB and focuses on each school unit. It is known as ProvaBrasil (INEP, 2015c) and evaluates public primary schools (BRASIL, 2005).

Unfortunately, the indices are not encouraging. This can be seen in Graph 1, which presents data related to the Mathematics course provided by INEP (2016a):

Graph 1 - Evolution of Brazil's results in SAEB (1995 to 2015) - average proficiency in Mathematics

https://dx.doi.org/10.22161/ijaers.79.40 *ISSN: 2349-6495(P) | 2456-1908(O)*



Source: Inep(2016a).

It can be observed that the learning rate of Brazilian children and young people is extremely low. Schwartzman and Castro (2013, p.579) point out that less than 10% of students in public schools achieve adequate minimum training, which means that when they complete the basic education stages, they are unable to reach the proposed minimum training. Another instrument that also measures basic education in Brazil is the IDEB, which does not appear to have very different data either.

3.3 Basic Education Development Index (IDEB)

IDEB was created by INEP in 2007 and shows the initiative of bringing together two concepts in a single indicator: the students´ peak flow and average performance assessment. IDEB data was collected and calculated in two dimensions:

1. based on data concerning the school pass rate obtained in the School Census, that is, the average pass rate reported annually by schools;
2. based on student achievement averages in the SAEB and Prova Brasil assessments in Portuguese and Mathematics - students enrolled in the fifth or ninth grade of elementary school and in the third grade of high school.

These instruments also have low levels of learning, and represent the indexes made available by INEP (2016b) with the results of the high school IDEB. The average by state of the Brazilian educational field can be seen in Table 2:

Table 2 – IDEB: High School results and targets

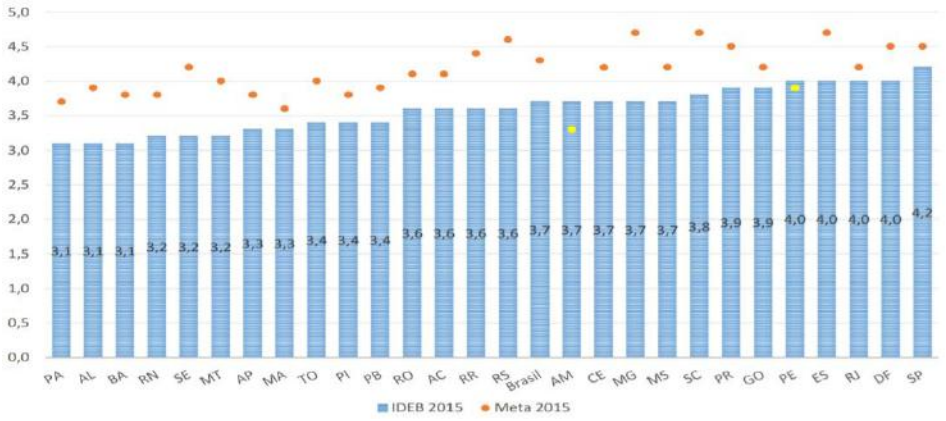
	IDEB Observed						**Targets**					
	2005	**2007**	**2009**	**2011**	**2013**	**2015**	**2007**	**2009**	**2011**	**2013**	**2015**	**2021**
Total	**3.4**	**3.5**	**3.6**	**3.7**	**3.7**	**3.7**	**3.4**	**3.5**	**3.7**	**3.9**	**4.3**	**5.2**
Administrative Dependence												
State	3.0	**3.2**	**3.4**	**3.4**	3.4	3.5	3.1	3.2	3.3	3.6	3.9	4.9
Private	5.6	**5.6**	5.6	5.7	5.4	5.3	5.6	5.7	5.8	6.0	6.3	7.0
Public	3.1	**3.2**	**3.4**	**3.4**	3.4	3.5	3.1	3.2	3.4	3.6	4.0	4.9

Source: Inep (2016b).

A bottleneck can be clearly seen, which is reflected in the Brazilian indices with the most diverse considerations and opinions. However, this situation is more serious in some states, as can be seen in Graph 2:

Graph 2– High School – IDEB and targets per federation unit (2015 total)

https://dx.doi.org/10.22161/ijaers.79.40 *ISSN: 2349-6495(P) | 2456-1908(O)*



Source: Brasil (2016c).

Analyzing the data in more detail, the presence of lower rates in the North and Northeast regions of Brazil can be observed, as well as higher rates in the South and Southeast regions. According to Gadotti (2014, p.12), the continuous reproduction of this dynamic coupled with the disarticulation of national education are the main reasons for negative results and inequality in educational opportunities.

Social structures should also be analyzed from this point of view, as they reflect within schools and, in most cases, the latter are passive, even because they abscond their attributions - which nevertheless contributes to the continuity of social inequalities and curtail opportunities for students. However, the teaching-learning process cannot be seen only as a final product, but also as a way in which the active and proactive subject receives a product, internalizes it and promotes feedback with their surroundings, which means that the final product needs education and is characterized as the sum of the whole (MACHADO; ALAVARSE, 2014).

Thus, evaluations are absolutely necessary knowledge, and are configured as a concrete and systematic expression of reality through the results obtained. In other words, evaluations, in general, are not just a management tool: they must be an instrument that improves democracy and qualifies public policies.

When relating the results of the Organization for Economic Cooperation and Development (OECD, 2013) and the economic development of countries, the best examples are among nations that until the mid-twentieth century were very dependent on others, but that have developed their educational fields qualitatively, investing heavily, creating and consolidating systems. These countries had a surprising trajectory, becoming great economic powers - such as in Japan, South Korea and China, countries in which young people, when evaluated in PISA 2012, led the ranking in Mathematics.

In the PISA classification (OECD, 2013), performance rates in the area of mathematical knowledge in Brazil are low. Young people in basic education in developed countries and with advanced technologies have rates well above those in developing countries (such as the Brazilian case) or with low development.

3.4 Programme for International Student Assessment (PISA)

PISA was created in 2000 by the OECD, carrying out a worldwide assessment periodically and obtaining a ranking of educational performance. In Brazil, it is coordinated by INEP itself, and it is coordinated nationally in the participating countries (INEP, 2015c). Every three years, PISA evaluates performance in Reading, Mathematics and Science of students aged between 15 and 16 years enrolled in regular education (public or private) in approximately 65 countries, with a varied focus.

In 2012, the examination focused on Mathematics, which represented the second cycle of the Program. In 2000, the focus was Reading, in 2003, Mathematics, and in 2006, Science, so that in 2009, a new cycle of the program began, focusing on Reading. In 2015, Sciences were again the focus of the assessment (INEP, 2015b).

The socioeconomic disadvantages of some students may induce them to link, from one generation to the next, the cycle of few academic achievements with poor job prospects. However, this situation can be regressed by enrolling in schools that offered them regular classes, with quality in learning, a situation rarely seen in public schools (OECD, 2011).

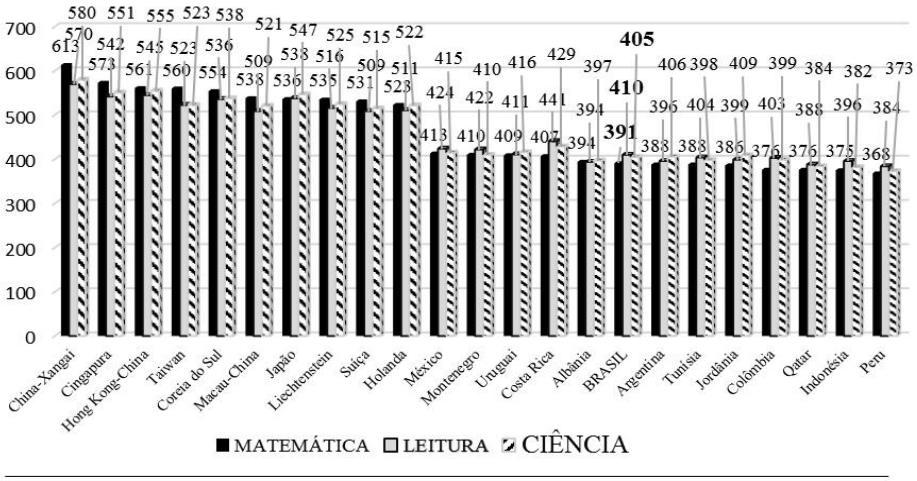
According to the publication PISA em Foco no. 5 (OECD, 2011, p.1), in Pisa 2009 “approximately one third of students from OECD countries were identified as resilient. In fact, most students from disadvantaged backgrounds in

https://dx.doi.org/10.22161/ijaers.79.40 *ISSN: 2349-6495(P) | 2456-1908(O)*

Korea and in the partner economies Hong Kong-China, Macau-China and Shanghai-China were considered resilient".

In the Education Ranking 2015, the first positions were held by Asian countries, such as Singapore, Hong Kong, South Korea, Japan and Taiwan, followed by European countries, such as Finland, Estonia, Switzerland and the Netherlands. At the other end are African countries, such as Ghana (last position) and South Africa (penultimate position) (OECD, 2015). Among 76 countries, Brazil is in 60th place, not far from the previous data, in 2012, when it occupied the 55th position, among the 65 participating countries, as shown in Graph 3:

Graph 3 – Ranking of Education in 2012 in PISA, of some countries



Source: OCDE (2013).

The difficulties or the unlikely elimination of the cycle of disadvantages in the implementation of curricula and in the educational field are well known. However, schools with concise and efficient educational practices induce and/or improve students' ability to deal with problems, overcome obstacles or withstand the pressure of situations, increasing their learning. Table 3 presents a comparison of the results in Mathematics (2003 to 2012) from PISA:

Table 3 – Comparison of PISA Mathematics results from 2003 to 2012 editions

	PISA 2003		**PISA 2006**		**PISA 2009**		**PISA 2012**		**Difference between 2003 and 2012**	
	Average	**Economic Status**	**Average**	**Economic StatusP**	**Average**	**Economic Status**	**Average**	**Economic Status**	**Average**	**Economic Status**
Brazil	356.0	4.8	369.5	2.9	385.8	2.4	391.5	2.1	35.4	5.4
Mexico	385.2	3.6	405.7	2.9	418.5	1.8	413.3	1.4	28.1	4.1
Portugal	466.0	3.4	466.2	3.1	486.9	2.9	487.1	3.8	21.0	5.3
South Korea	542.2	3.2	547.5	3.8	546.2	4.0	553.8	4.6	11.5	5.8
Spain	485.1	2.4	480.0	2.3	483.5	2.1	484.3	1.9	-0.8	3.4
USA	482.9	2.9	474.4	4.0	487.4	3.6	481.4	3.6	-1.5	4.9
Uruguay	422.2	3.3	426.8	2.6	426.7	2.6	409.3	2.8	-12.9	4.5

https://dx.doi.org/10.22161/ijaers.79.40 ISSN: 2349-6495(P) | 2456-1908(O)

Finland	544.3	19	548.4	2.3	540.5	2.2	518.8	1.9	-25.5	3.0
Argentina	-	-	381.3	6.2	388.1	4.1	388.4	3.5	-	-
Peru	-	-	-	-	365.1	4.0	368.1	3.7	-	-
Colombia	-	-	370.0	3.8	380.8	3.2	376.5	2.9	-	-
Chile	-	-	4114	4.6	421.1	3.1	422.6	3.1	-	-

Source: Inep (2012).

On December 2, 2016, the financial newspaper Valor Econômico reported that Brazil, in a list of 64 countries worldwide, has the second largest number of students with low performance in basic mathematics, science and reading (GUIMARÃES; MARCHESINI, 2016). In the general data, which considers the average performance in these areas, only 2.2% of Brazilian students are among the highest scores of PISA, at levels 5 or 6, while in Japan they are 25.8% and in Finland, 21.4%. In Brazil, specifically in mathematics, the average in 2015 was 377 points, against 490 points by the OECD, which indicates that 70% of Brazilians were below level 2.

Industrial and economic development of eastern countries, such as Japan, China and South Korea, according to research, is closely linked to their cultural and ideological contexts, with interference by the State, although the government and industry are in line with each other in terms of continuously searching for development models. Brazil is one of the countries with the lowest index of students without basic knowledge of Mathematics and is one of the last placed in a ranking of competences, according to what the OECD study (2015) points out. The 2015 PISA results indicate that 67.1% of Brazilian students aged 15 and 16 are below level 2 in Mathematics (FERNANDES, 2016).

In addition, it can be observed that the mathematical apparatus allows human intellect to extract data that can be transformed into information and construct theories, developing technologies that are increasingly accurate, refined and efficient. Once again, Brazilian students´ performance, even after completing basic education demonstrated in the measured data (including the instrument that evaluates only the final stage - high school -, as in the case of ENEM), is still very low.

3.5 National High School Examination (ENEM)

ENEM was created in 1998 aiming to evaluate students´ performance at the end of the basic education cycle, that is, at high school. A priori, the Examination aimed to contribute only to improving the quality of this level of education, and, as of 2009, it also started to be used as a selection mechanism for entering higher education (mainly in federal universities). ENEM scores may be the only selection phase of a university, which can also combine them with its own selection processes (INEP, 2015c). Students who complete or have completed high school can participate in the exam.

According to the MEC, about 500 universities already use the exam result as a selection criterion for entering higher education, either complementing or replacing their own entrance examination (BRASIL, 2016b). ENEM is also used as a selection criterion for students who intend to apply for a scholarship at the University for All Program (ProUni) and to obtain the high school leaving qualification (BRASIL, 2016b).

Regarding INEP (2014a), the Examination aims to assess the competences and skills developed by students at the end of basic education. This evaluation process is done through an essay and objective tests that evaluate the four areas of knowledge mentioned above. Schools should use the results of this instrument to help students and teachers, as well as managers and family members, to reflect on the students' learning and their response to everyone's expectations, as it is understood that knowledge gained over 10 years has been learnt.

Table 4 – Comparisons of the results of Brazil in ENEM from 2011 to 2015

Area	2011	2012	2013	2014	2015

https://dx.doi.org/10.22161/ijaers.79.40 *ISSN: 2349-6495(P) | 2456-1908(O)*

	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
Human Sciences	793.1	252.6	874.9	295.6	793.1	252.6	862.1	324.8	850.6	314.3
Natural Sciences	867.2	265	864.9	303.1	867.2	265	876.4	330.6	875.2	334.3
Languages	795.5	301.2	817.9	295.2	795.5	301.2	814.2	306.2	825.8	302.6
Mathematics	953	321.6	955.2	277.2	953	321.6	973.6	318.5	1.008.3	280.2

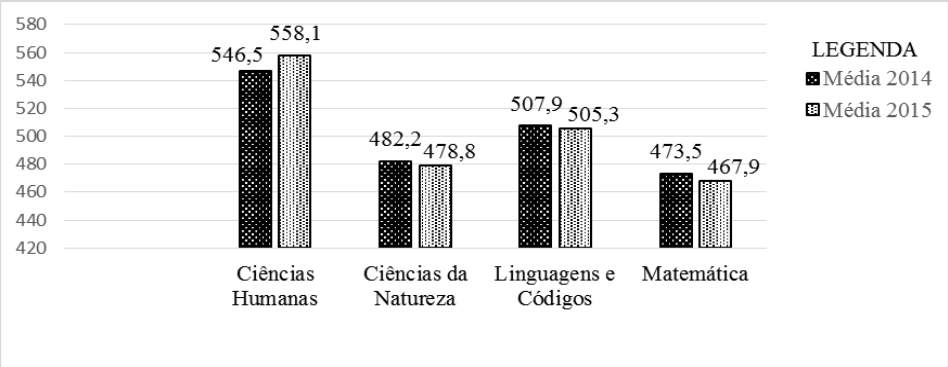
Source: adapted from INEP (2011; 2012; 2013; 2014a; 2015c), G1 Educação (2011; 2012a, b, c; 2013; 2014) and UOL Educação (2011; 2012; 2013; 2014).

Regarding the results of the evaluations of Brazilian students in ENEM, converging with the instruments of previous evaluations, they show the serious deficit and great disparity between the minimum and maximum averages, as can be seen in Table 4, which shows the last four results of the evaluations of Brazilian students in the examination:

However, when analyzing the 2014 and 2015 ENEM averages made available by INEP, the high rate of very low averages is well known. The averages equal to or above 600 points were reached by a few high schools, and the ones that reached the averages are, in the vast majority, from private initiatives, some federal and very rarely state ones.The state ones are those whose evaluations reached an average of 600 or more points, and which are applicable to a university or have partnerships with the armed forces.

Graph 4 shows the general average of ENEM in 2014 and in 2015:

Graph 4 - Averages of ENEM in 2014 and 2015



***Source**: adapted from INEP data (2014, 2015c)*

IV. FINAL CONSIDERATIONS

Based on these statistics and the cultural situations of Education in Asian countries, the relationship of the domain in the area of Mathematics with the economic development and technology of a nation can be considered, as the basis of the development of an organization mainly consists of the performance of their professionals, and this performance is due to the competence that professionals have.

It is important to note that it also concerns the degree of importance of this science for the production of knowledge and development of competences. In a general context, all areas of knowledge are involved, without interruption. However, considering concrete data, it is understandable why Mathematics, in the educational field, has been gaining prominence in recent years.

Based on the above, Mathematics or its related areas as knowledge can be addressed, which transcends practically all other areas. The great support from technologies is also somewhat prudent, mainly because this is the area of knowledge based on logical, accurate, rigorous and formal information, and which better enables us to reach a

https://dx.doi.org/10.22161/ijaers.79.40 *ISSN: 2349-6495(P) | 2456-1908(O)*

capacity to discern the researched essence.

It is also worth noting that the data discussed here allows us to emphasize the importance of research to change the reality of mathematics teaching in the Brazilian context: if the factors that lead to a low performance in large mass evaluations are better understood, new practices and tools for teaching and learning could be made possible.

REFERENCES

[1] BRASIL. Lei nº 13.005, de 25 de junho de 2014. Aprova o Plano Nacional de Educação – PNE e dá outras providências.**Diário Oficial da União**, Brasília, 25 jun. 2014. Disponível em: <http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2014/lei/l13005.htm>. Acesso em: 27 abr. 2017.

[2] _____. Lei nº 13.415, de 16 de fevereiro de 2017. Altera as Leis nº 9.394, de 20 de dezembro de 1996, que estabelece as diretrizes e bases da educação nacional, e nº 11.494, de 20 de junho 2007, que regulamenta o Fundo de Manutenção e Desenvolvimento da Educação Básica e de Valorização dos Profissionais da Educação, a Consolidação das Leis do Trabalho – CLT, aprovada pelo Decreto-Lei nº 5.452, de 1º de maio de 1943, e o Decreto-Lei nº 236, de 28 de fevereiro de 1967; revoga a Lei nº 11.161, de 5 de agosto de 2005, e institui a Política de Fomento à Implementação de Escolas de Ensino Médio em Tempo Integral. **Diário Oficial da União**,Brasília, 16 fev. 2017. Disponível em: <http://www.planalto.gov.br/ccivil_03/_ato2015-2018/2017/lei/L13415.htm>. Acesso em: 27 abr. 2017.

[3] _____. Medida Provisória nº 746, de 22 de setembro de 2016. Institui a Política de Fomento à Implementação de Escolas de Ensino Médio em Tempo Integral, altera a Lei nº 9.394, de 20 de dezembro de 1996, que estabelece as diretrizes e bases da educação nacional, e a Lei nº 11.494, de 20 de junho 2007, que regulamenta o Fundo de Manutenção e Desenvolvimento da Educação Básica e de Valorização dos Profissionais da Educação, e dá outras providências. **Diário Oficial da União**, Brasília, 23 set. 2016a. Disponível em: <https://goo.gl/PJ1egT>. Acesso em: 26 abr. 2017.

[4] _____. Ministério da Educação. **Avaliação internacional**. Inep participa da elaboração de itens para o Pisa de 2018. Brasília, 30 nov. 2015a. Disponível em: <http://portal.mec.gov.br/busca-geral/211-noticias/218175739/32421-inep-participa-da-elaboracao-de-itens-para-o-pisa-de-2018>. Acesso em: 3 maio 2016.

[5] _____. Ministério da Educação. **Enem – Apresentação**. Brasília: MEC, 2015b. Disponível em: <http://portal.mec.gov.br/enem-sp-2094708791>. Acesso em: 03 maio 2016.

[6] _____. Ministério da Educação. **Ideb –Apresentação**. Brasília: MEC, 2015c. Disponível em: <http://portal.mec.gov.br/secretaria-de-educacao-basica/programas-e-acoes?id=180>. Acesso em: 3 maio 2016.

[7] _____. Ministério da Educação. Portaria Ministerial nº 931, de 21 de março de 2005. O MINISTRO DE ESTADO DA EDUCAÇÃO, no exercício das atribuições estabelecidas pelo Art. 87 § único, inciso II da Constituição Federal e atendendo... **Diário Oficial da União**, Brasília, 22 mar. 2005. Disponível em: <http://download.inep.gov.br/educacao_basica/prova_brasil_saeb/legislacao/Portaria931_NovoSaeb.pdf>. Acesso em: 26 abr. 2017.

[8] _____. Ministério da Educação. Portaria Normativa Interministerial nº 17, de 24 de abril de 2007. Institui o Programa Mais Educação, que visa fomentar a educação integral de crianças, adolescentes e jovens, por meio do apoio a atividades sócio-educativas no contraturno escolar. **Diário Oficial da União**, Brasília, 26 abr. 2007.

[9] _____. Ministério da Educação. **Resultados do Índice de Desenvolvimento da Educação Básica – IDEB 2015**. Brasília, 2016b. Disponível em: <http://download.inep.gov.br/educacao_basica/portal_ideb/documentos/2016/apresentacao_ideb_08092016.pdf>. Acesso em: 27 abr. 2017.

[10] _____. Ministério da Educação. Secretaria de Educação Básica. **Orientações Curriculares para o Ensino Médio**: Ciências da Natureza, Matemática e suas Tecnologias (vol. 2). Brasília: MEC/SEB, 2006. Disponível em: <http://portal.mec.gov.br/seb/arquivos/pdf/book_volume_02_internet.pdf>. Acesso em: 26 abr. 2017.

[11] _____. Secretaria de Educação Fundamental. **Parâmetros curriculares nacionais**: introdução aos parâmetros curriculares nacionais/Secretaria de Educação Fundamental. Brasília: MEC/SEF, 1997.

[12] CASTRO, C. de M. Ensino Médio: Aleluia! **Revista Veja**, São Paulo, ed. 2.500, 19 out. 2016. Disponível em: <http://portal.mec.gov.br/index.php?option=com_docman&view=download&alias=49911-materia-veja-ensino-medio-19102016-pdf&category_slug=outubro-2016-pdf&Itemid=30192>. Acesso em: 27 abr. 2017.

[13] COOPER, D. R.; SCHINDLER, P. S. **Métodos de Pesquisa em Administração**. 12. ed. São Paulo: Editora McGraw-Hill, 2016.

[14] FERNANDES, D. Brasil avança em conhecimento básico de matemática, mas continua atrás em ranking. **BBC Brasil**, 10 fev. 2016. Disponível em: <http://www.bbc.com/portuguese/noticias/2016/02/160209_ocde_alunos_baixa_performance_pai_df>. Acesso em: 27 abr. 2017.

[15] FRIGOTTO, G.; CIAVATTA, M. PERSPECTIVAS SOCIAIS E POLÍTICAS DA FORMAÇÃO DE NÍVEL MÉDIO: AVANÇOS E ENTRAVES NAS SUAS MODALIDADES.**EDUCAÇÃO & SOCIEDADE**, CAMPINAS, V. 32, N. 116, P. 619-638, JU./SET. 2011.

[16] G1 Educação. Apenas 10% dos alunos aprendem o ideal em matemática no ensino médio. **G1**, São Paulo, 6 mar. 2013a. Disponível em: <http://g1.globo.com/educacao/noticia/2013/03/apenas-10-

dos-alunos-aprendem-o-ideal-em-matematica-no-ensino-medio.html>. Acesso em: 27 abr. 2017.

[17] _____. Brasil evolui, mas segue nas últimas posições em ranking de educação. **G1**, São Paulo, 3 dez. 2013b. Disponível em: <http://g1.globo.com/educacao/noticia/2013/12/brasil-evolui-mas-segue-nas-ultimas-posicoes-em-ranking-de-educacao.html>. Acesso em: 20 dez. 2014.

[18] _____. Enem 2014. **G1**, São Paulo, 5 ago. 2015a. Disponível em: <http://especiais.g1.globo.com/educacao/enem/2014/enem-2014-medias-por-escola/>. Acesso em: 2 dez. 2015.

[19] _____. Lista do Enem 2015: Notas das escolas. **G1**, São Paulo, 5 out. 2016. Disponível em: <http://especiais.g1.globo.com/educacao/enem/2015/enem-2015-medias-por-escola/>. Acesso em: 8 dez. 2016.

[20] _____. MEC divulga a nota do Enem 2012. **G1**, São Paulo, 28 dez. 2012a. Disponível em: <http://g1.globo.com/educacao/noticia/2012/12/mec-divulga-nota-do-enem-2012.html>. Acesso em: 2 dez. 2015.

[21] _____. MEC divulga a nota do Enem 2012. **G1**, São Paulo, 28 dez. 2012b. Disponível em: <http://g1.globo.com/educacao/noticia/2012/12/mec-divulga-nota-do-enem-2012.html>. Acesso em: 2 dez. 2015.

[22] _____. Os resultados do Pisa 2012. **G1**, São Paulo, 2012c. Disponível em: <http://infograficos.oglobo.globo.com/educacao/os-resultados-do-pisa-2012.html>. Acesso em: 14 ago. 2014.

[23] _____.Os resultados do Pisa 2012. **G1**, São Paulo, 2012d. Disponível em: <http://infograficos.oglobo.globo.com/educacao/os-resultados-do-pisa-2012.html>. Acesso em: 14 ago. 2014.

[24] _____. Resultado do Enem 2014 por escola é divulgado pelo Inep. **G1**, São Paulo, 5 ago. 2015b. Disponível em: <http://g1.globo.com/educacao/noticia/2015/08/resultado-do-enem-2014-por-escola-e-divulgado-pelo-inep-veja-lista.html>. Acesso em: 2 dez. 2015.

[25] _____.Saem notas do Enem 2011 por escola. **G1**, São Paulo,22 nov. 2012e. Disponível em: <http://g1.globo.com/educacao/noticia/2012/11/mec-divulga-notas-do-enem-2011-por-escola.html>. Acesso em: 20 nov. 2013.

[26] GADOTTI, M. Gestão democrática com participação popular no planejamento e na organização da educação nacional. In: CONFERÊNCIA NACIONAL DE EDUCAÇÃO, 2., 2014, Brasília. **Anais...** Brasília: Conae, 2014. p. 1-25. Disponível em: <http://conae2014.mec.gov.br/images/pdf/artigogadotti_final.pdf> Acesso em: 9 ago. 2014.

[27] GUIMARÃES, L.; MARCHESINI, L. No país, 70% dos alunos não sabem o mínimo aceitável em matemática. **Jornal Valor Econômico**, 2 dez. 2016. Disponível em: <http://www.valor.com.br/brasil/4796957/no-pais-70-dos-alunos-nao-sabem-o-minimo-aceitavel-em-matematica>. Acesso em: 17 abr. 2017.

[28] IAQUINTO, K. Múltipla escolha. **Revista Conjuntura Econômica**, Rio de Janeiro, v. 68, n. 7, jul. 2014.

[29] INSTITUTO NACIONAL DE ESTUDOS E PESQUISAS EDUCACIONAIS ANÍSIO TEIXEIRA – INEP. **Enem por escola**. Brasília: MEC, 2015a. Disponível em: <http://portal.inep.gov.br/web/enem/enem-por-escola>. Acesso em: 3 maio 2016.

[30] _____. Educação Básica. **Ideb**. Brasília, 20 out. 2015b. Disponível em: <http://portal.inep.gov.br/web/guest/ideb>. Acesso em: 27 abr. 2017.

[31] _____. **Sistema de Avaliação da Educação Básica**. Edição 2015. Resultados. Brasília: MEC/Inep, 2016a. Disponível em: <http://www.agenciabrasilia.df.gov.br/wp-conteudo/uploads/2016/09/analise-proficiencia-ensino-brasileiro-ideb-2015.pdf>. Acesso em: 18 abr. 2017.

[32] _____. **IDEB – Resultados e Metas**. Brasília, 5 set. 2016b. Disponível em: <http://ideb.inep.gov.br/resultado/>. Acesso em: 27 abr. 2017.

[33] _____. **Educação Básica**. Ideb. Brasília, 20 out. 2015c. Disponível em: <http://portal.inep.gov.br/web/guest/ideb>. Acesso em: 27 abr. 2017.

[34] _____. **Relatório Nacional PISA 2012 – Resultados brasileiros**. São Paulo: Fundação Santillana, 2012.

[35] _____. **Exame Nacional do Ensino Médio – Enem**. Brasília: 2014. Disponível em: <http://portal.inep.gov.br/web/enem/sobre-o-enem>. Acesso em: 12 ago. 2014a. mimeo.

[36] MACHADO, C.; ALAVARSE, O. M. Qualidade das escolas: tensões e potencialidades das avaliações externas. **Educação & Realidade**, Porto Alegre, v. 39, n. 2, p. 413-436, abr./jun. 2014.

[37] MARCONI, M. de A.; LAKATOS, E. M. **Fundamentos de metodologia científica**: técnicas de pesquisa. 7. ed. São Paulo: Atlas, 2010.

[38] OLIVEIRA, T. B.; CALDEIRA, A. M. de A. Interdisciplinaridade escolar no ensino médio: domínios epistêmicos como possibilidade para elaboração e avaliação de um trabalho coletivo. **Acta Scientiarum**, Maringá, v. 38, n. 2, p. 193-204, abr./jun. 2016.

[39] ORGANIZAÇÃO DAS NAÇÕES UNIDOS PARA A EDUCAÇÃO, A CIÊNCIA E A CULTURA – UNESCO. **Educação**: um tesouro a descobrir. Relatório para a UNESCO da Comissão Internacional sobre Educação para o século XXI. Tradução de Guilherme Teixeira. Brasília: Unesco, 2010.

[40] ORGANIZAÇÃO PARA COOPERAÇÃO E DESENVOLVIMENTO ECONÔMICO – OCDE. Como alguns estudantes superam as dificuldades do ambiente socioeconômico? **Em Foco**, n. 5, fev. 2011. Disponível em: <http://download.inep.gov.br/acoes_internacionais/pisa/pisa_em_foco/2011/pisa_em_foco_n5.pdf>. Acesso em: 11 nov. 2015.

[41] _____. **Resultados PISA 2009**: o que os estudantes sabem e podem fazer – Desempenho dos estudantes em Leitura. OCDE, 2013. Disponível em: <https://www.oecd.org/pisa/pisaproducts/pisainfocus/PISA

https://dx.doi.org/10.22161/ijaers.79.40 *ISSN: 2349-6495(P) | 2456-1908(O)*

%20EM%20FOCO%20N%C2%B025.pdf>. Acesso em: 15 ago. 2014.

[42] _____. **Ranking da Educação 2015**. OCDE: 2015.

[43] PORTAL DO BRASIL. **Média das escolas pelo Enem 2014 melhorou em três áreas do conhecimento**. ago. 2015. Disponível em: <http://www.brasil.gov.br/educacao/2015/08/media-das-escolas-pelo-enem-2014-melhorou-em-tres-areas-do-conhecimento>. Acesso em: 28 out. 2015.

[44] RICHARDSON, R. J. **Pesquisa social**: métodos e técnicas. 3. ed. São Paulo: Atlas, 2010.

[45] SCHWARTZMAN, S.; CASTRO, C. M. Ensino, formação profissional e a questão da mão de obra. **Ensaio**: Avaliação de Políticas Públicas em Educação, Rio de Janeiro, v. 21, n. 80, p. 563-624, jul./set. 2013.

[46] SOUZA, F. M. **Campo, *habitus*, competências e práticas de ensino dos professores de Matemática de escolas brasileiras do ensino médio estadual com bons resultados no Enem**. 2017. 308 f. Tese (Doutorado em Engenharia de Produção) – Programa de Pós-Graduação em Engenharia de Produção, Universidade Federal de São Carlos, São Carlos, 2017.

[47] UOL educação.Inep divulga cadernos de prova do Enem 2011. **UOL**, São Paulo, 24 out. 2011. Disponível em: <https://educacao.uol.com.br/noticias/2011/10/24/inep-divulga-cadernos-de-prova-do-enem-2011.htm>. Acesso em: 2 jun. 2015.

[48] _____. Inep divulga notas médias dos candidatos no Enem 2014. **UOL**, Brasília, 13 jan. 2015. Disponível em: <https://educacao.uol.com.br/noticias/2015/01/13/inep-divulga-notas-medias-dos-candidatos-no-enem-2014.htm>. Acesso em: 2 jun. 2015.

[49] _____. Inep divulga provas do Enem 2012; exame foi realizado em novembro. **UOL**, São Paulo, 13 jun. 2013. Disponível em: <https://educacao.uol.com.br/noticias/2013/06/13/inep-divulga-provas-do-enem-2012-exame-foi-realizado-em-novembro.htm>. Acesso em: 8 out. 2015.