

## SAEB AND ITS CONTRIBUTIONS RELATED TO MATHEMATICS PROFICIENCY: AN OVERVIEW OF THE FINAL YEARS OF ELEMENTARY SCHOOL IN THE PUBLIC NETWORK OF THE STATE OF RORAIMA

### O SAEB E SUAS CONTRIBUIÇÕES QUANTO À PROFICIÊNCIA EM MATEMÁTICA: UM PANORAMA DOS ANOS FINAIS DO ENSINO FUNDAMENTAL NA REDE PÚBLICA ESTADUAL DE RORAIMA

### SAEB Y SUS CONTRIBUCIONES A LA COMPETENCIA EN MATEMÁTICAS: RESUMEN DE LOS ÚLTIMOS AÑOS DE EDUCACIÓN PRIMARIA EN LA RED PÚBLICA DE RORAIMA

Solange Mussato\*

Diego de Araújo Almeida\*\*

Luzia Voltolini\*\*\*

Helena Rivelli de Oliveira\*\*\*\*

#### ABSTRACT

This article discloses an investigation in the context of the Education State Network of Roraima, particularly, in relation to the Basic Education Assessment System (SAEB). It presents, initially, a literature review about research which deals with the mathematics proficiency with 9th grade students of Elementary School. It aimed to analyze the performance in Mathematics - average proficiency and performance levels - of students in the final years of Elementary School of public state network of Roraima, in the 2015, 2017 and 2019 editions of SAEB. For this reason, a survey was carried out using data from SAEB, particularly, Mathematics proficiency data of 9th grade students from state public schools in Roraima. These data were organized into two groups: schools in the capital, only the urban area ones, and the schools in the countryside, being urban and rural non-indigenous. The results of this investigation indicate that, generally, the proficiency of the students in the final years of Elementary

\* Doutora em Ensino de Ciências e Matemática. Programa de Pós-graduação em Ensino de Ciências e Matemática da Universidade Luterana do Brasil (ULBRA). Professora na Secretaria de Estado da Educação e Desporto de Roraima (SEED/RR) e no Programa de Pós-graduação em Ensino de Ciências (PPGEC) da Universidade Estadual de Roraima (UERR). Endereço para correspondência: Rua Barão do Rio Branco, 1495, Centro, Boa Vista, RR, Brasil, CEP: 69301-130. E-mail: [solangemussato1@yahoo.com.br](mailto:solangemussato1@yahoo.com.br).

\*\* Mestre em Recursos Naturais. Programa de Pós-graduação em Recursos Naturais (UFRR). Professor na Secretaria de Estado da Educação e Desporto de Roraima (SEED/RR) Rua Barão do Rio Branco, 1495, Centro, Boa Vista, RR, Brasil, CEP: 69301-130. E-mail: [almeida8383@gmail.com](mailto:almeida8383@gmail.com).

\*\*\* Doutora em Ensino de Ciências e Matemática. Programa de Pós-graduação em Ensino de Ciências e Matemática da Universidade Luterana do Brasil (ULBRA). Professora na Secretaria de Estado da Educação e Desporto de Roraima (SEED/RR) e na Universidade Estadual de Roraima (UERR). Endereço para correspondência: Rua Barão do Rio Branco, 1495, Centro, Boa Vista, RR, Brasil, CEP: 69301-130. E-mail: [luvoltolini@hotmail.com](mailto:luvoltolini@hotmail.com).

\*\*\*\* Doutoranda em Educação. Universidade Federal de Juiz de Fora (UFJF). Analista de Formação em EaD no Centro de Políticas Públicas e Avaliação da Educação (CAEd) da Universidade Federal de Juiz de Fora (UFJF). Endereço para correspondência: Avenida Eugênio do Nascimento, 620, Dom Orione, Juiz de Fora, MG, CEP: 36038-330. E-mail: [helenarivelli@yahoo.com.br](mailto:helenarivelli@yahoo.com.br).

school, in mathematics, can be considered low, since they are mostly concentrated in levels 0, 1, 2 and 3. Moreover, it became clear some difference between the results obtained by students of schools in the capital and schools in the countryside, setting the results of schools in the capital in a slightly more favorable situation in relation to those of schools in countryside.

**Keywords:** Schools of Roraima. Elementary School. Mathematics Proficiency.

## RESUMO

Este artigo divulga uma investigação no contexto da Rede Estadual de Ensino de Roraima, particularmente, em relação ao Sistema de Avaliação da Educação Básica (SAEB). Apresenta, inicialmente, uma revisão de literatura acerca de pesquisas que tratam da proficiência em matemática com alunos do 9º Ano no Ensino Fundamental. Teve como objetivo analisar o desempenho em Matemática – proficiência média e níveis de desempenho – dos alunos dos anos finais do Ensino Fundamental, nas edições de 2015, 2017 e 2019 do SAEB. Para tanto, realizou-se uma pesquisa utilizando dados do SAEB, particularmente, os dados de proficiência em matemática de alunos do 9º Ano, das escolas da rede pública estadual em Roraima. Esses dados foram organizados em dois grupos: escolas da capital, apenas da área urbana e escolas do interior, sendo urbanas e rurais não indígenas. Nesse contexto, os resultados desta investigação indicam que, de modo geral, a proficiência dos alunos dos anos finais do Ensino Fundamental, em matemática, pode ser considerada baixa, uma vez que se concentra, em sua grande maioria, nos níveis 0, 1, 2 e 3. Além disso, evidenciou-se alguma diferença entre os resultados obtidos pelos alunos das escolas da capital e das escolas do interior, colocando os resultados das escolas da capital em situação um pouco mais favorável em relação aos das escolas do interior.

**Palavras-chave:** Escolas de Roraima. Ensino Fundamental. Proficiência Matemática.

## RESUMEN

Este artículo da a conocer una investigación en el contexto de la Red Estatal de Educación de Roraima, particularmente en relación al Sistema de Evaluación de la Educación Básica (SAEB). Inicialmente, presenta una revisión de la literatura sobre investigaciones relacionadas con la competencia en matemáticas con estudiantes de noveno grado en la escuela primaria. Su objetivo fue analizar el desempeño en Matemáticas - competencia promedio y niveles de desempeño - de los estudiantes de los últimos años de la Escuela Primaria en la red pública estatal de Roraima, en las ediciones 2015, 2017 y 2019 del SAEB. Por lo tanto, se llevó a cabo una encuesta utilizando datos de la SAEB, en particular los datos de competencia en matemáticas de los estudiantes de noveno grado de las escuelas públicas estatales en Roraima. Estos datos se organizaron en dos grupos: escuelas de la capital, solo en el área urbana, y escuelas del interior, siendo urbanas y rurales no indígenas. Los resultados de esta investigación indican que, en general, la competencia de los estudiantes de los últimos años de la escuela primaria, en matemáticas, puede considerarse baja, ya que en su mayoría se concentran en los niveles 0, 1, 2 y 3. Además, se cierta diferencia entre los resultados obtenidos por los alumnos de las escuelas de la capital y las escuelas del interior, colocando los resultados de las escuelas de la capital en una situación algo más favorable en relación a los de las escuelas del interior.

**Palabras clave:** Escuelas de Roraima. Enseñanza Fundamental. Competencia matemática.

## 1 INTRODUCTION

Assessing is a practice that permeates several areas and, particularly in the educational

area, it should preferably serve as a mechanism for diagnosing the situation, aiming at the advancement and growth of subjects, as pointed out by Luckesi (2005). Taking that into consideration, this study focuses the context of large-scale assessments in Brazilian basic education, which, in general, seek to understand the results that students have achieved throughout the development of this school level. Thus, they generate data on the current Brazilian education system.

These assessments are planned and carried out by the Anísio Teixeira National Institute of Educational Studies and Research (INEP), an agency linked to the Ministry of Education (MEC), which among its purposes, must:

[...] plan, develop, implement and organize, in the educational area, evaluation systems, statistics, performance tests, quantitative and qualitative research or any other methodology necessary for the production and dissemination of information on education systems (BRASIL, 2017, p. 01).

These assessments contribute significantly to governments, since they make it possible to identify whether public resources applied to educational policies are providing quality schooling, and to society, as they indicate the quality of the public educational service that is being offered to it (ARAÚJO; LUZIO, 2005).

Until June 2018, basic education was evaluated through several assessments, such as the National Literacy Assessment (ANA) and the National Assessment of School Performance (ANRESC), also known as *Prova Brasil*. However, at the end of that month, the Ministry of Education (MEC) announced that they would all be unified, establishing the Basic Education Assessment System (SAEB). In addition, this set of changes in the evaluation system provided for the inclusion of early childhood education, whose evaluation will be through questionnaires to be answered by teachers. With this, the SAEB, from 2019 onwards, started to cover all basic education, from daycare to high school.

More specifically, according to Art. 4, Decree N° 9.432 (BRASIL, 2018a), the SAEB is part of the National Policy for Assessment and Examinations of Basic Education, together with the National Exam for the Certification of Youth and Adult Ability (ENCCEJA) and the National High School Exam (ENEM). Also, according to Art. 5, Decree N° 9.432, “Saeb is a set of instruments that allows the production and dissemination of evidence, statistics, evaluations and studies regarding the quality of the stages that make up basic education [... ]” (BRASIL, 2018a, p. 1).

So, considering the importance of this evaluation system for basic education and, given the need to diagnose and understand the proficiency and the oscillations of the average performance in mathematics of students in the final years of elementary school in the state education system, to direct efforts of implementation of the new high school in the state of Roraima, the following guiding question was established for the research: What is the students' mathematics proficiency profile in the final years of elementary school in the state education system in Roraima?

The process of identifying answers to the research question involves, initially, the establishment of an objective according to the problem that permeates it. Thus, this research aims to analyze the performance in mathematics - average proficiency and performance levels - of students in the final years of elementary school in the state education system in Roraima, according to the results of SAEB 2015, 2017, and 2019.

It should be noted that Ordinance N° 649 (BRASIL, 2018b), when supporting the implementation of the new high School, emphasizes the importance of drawing up an “Implementation Plan” guided by a dense diagnosis. Thus, it is necessary to have a broad view of the current scenario of the education system, including the proficiency of students that will attend high school.

Therefore, to contemplate the objective of this research, we used the data presented in the most recent results of SAEB (2015, 2017, and 2019), referring to the final years of elementary school, in the public education system in Roraima regarding proficiency in mathematics. These data belong to INEP and are available for public consultation on the institute's webpage.

To obtain a more accurate picture of the reality that is sought to be understood, the data were organized into two groups: schools in the capital, only in the urban area, and schools in the interior, including urban and non-indigenous rural schools.

In this sense, the choice for this systematization from the organization in groups and, also due to the profile of students in the final years of elementary school, was based on the need to demonstrate, in more detail, students' proficiency in mathematics in the final years of elementary school, to subsidize and direct the actions for the implementation of the new high school in that education system from 2022 onwards. In addition, to identify the level of performance in mathematics of students that will enter high school, and how this can contribute to the decision-making process in the implementation of this important program.

The data analysis was carried out by employing a comparative process of the schools' proficiency score, considering the SAEB results in the last 3 evaluations. With this, we sought to portray the profile of students in the final years of elementary school of the two groups mentioned above, in relation to their proficiency in mathematics.

To provide a brief overview of what is proposed in this paper, it should be noted that it is structured in 5 sections, based on this introduction. The second section presents a brief literature review including research that investigated the performance of elementary school students in mathematics, based on SAEB data. In the third, the SAEB historical evolution is reported, including the process of elaboration of the questions of this evaluation and the application process. The fourth section presents the methodological process of the investigation and the results obtained by elementary school students in Roraima in mathematics, according to SAEB results in 2015, 2017, and 2019. In the fifth, the presentation and analysis of data is carried out, seeking answers to the research question. The closing section presents the authors' final considerations, in which the reflections on the results found are pointed out, in addition to the inquiries that resulted from this investigation process, thus suggesting new possibilities for investigations.

## 2 LITERATURE REVIEW

A literature review was carried out aiming to give visibility to the context of research aimed at understanding proficiency in mathematics, based on the SAEB results. For this purpose, the CAPES/MEC Journal Portal was used as a database. Articles published in Portuguese were selected, from 2011 to 2020, using the descriptors “proficiency”, “mathematics” and “SAEB”, together, contemplating the three terms at the same time.

The search resulted in 19 articles, whose abstracts were read in order to analyze which ones presented discussions about the research. When the need for a better understanding was felt, the methodology used was also analyzed. This first analysis made it possible to identify different situations of exclusion such as papers whose focus was on proficiency in Portuguese, specifically; those relating the mathematics teachers' profiles with the proficiency obtained by their students; analysis of the intertemporal change in school proficiency and the probability of progression by grade in Brazil; or other themes that were totally distant from our research focus. Finally, articles whose discussions were not directly related to the purpose of this investigation

were excluded. Thus, this search for literature resulted in four articles that were understood to have some proximity to the research.

Schneider and Gouveia (2011), in “School quality: an index proposal for the material conditions of schools based on contextual data from SAEB” presented results of a study that sought to build instruments to evaluate the education policy in the state of Paraná. In this context, they identified that public schools in Paraná have good conditions, in general, with a strong difference between those located in urban and rural areas. Specifically, in relation to the students' proficiency, a trend was noticed that the highest proficiencies achieved were from students in schools with better material and structural conditions.

Although the research by Schneider and Gouveia (2011) has as its object of study the proficiency of students obtained through the SAEB, it is far from what is proposed here, since it is not an investigation focused on the analysis of proficiency in mathematics with students from the final years of elementary school.

In “Longitudinal study on educational effectiveness in Brazil: comparison between contextualized results and added value”, Ferrão *et al* (2018, p. 267) sought to present

[...] contextualized and value-added analysis of results, through the application of multilevel regression models to the longitudinal data of Brazilian students that took the Prova Brasil 2011, in the 5<sup>th</sup> year of Elementary School (EF), and the Prova Brasil 2015, in the 9<sup>th</sup> year [...] of EF.

In that study, they sought to estimate the contribution that the Brazilian school, in the final years of elementary school, presents in relation to the promotion of progress or students' learning of Portuguese Language and Mathematics, in the period from 2011 to 2015 (added value); measuring the relationship between the students' prior knowledge and the learning evidenced during the analysis; and, also, to analyze and discuss the influence of those students' socioeconomic level on the learning evidenced during the analysis.

We could observe that although the study carried out by Ferrão *et al* (2018) was directly related to the promotion of students' progress or learning in mathematics, it ended up diverging from what is proposed here, as it also involved 5<sup>th</sup> grade students; did not use SAEB data and was developed considering the influence of socioeconomic level in the learning process of these students.

Among the four articles identified with some proximity to this research, two have a more significant convergence. These are studies by Santos and Tolentino-Neto (2015) and by Palermo, Silva and Novellino (2014).

In the research “What do SAEB data tell us about student performance in Mathematics?”, Santos and Tolentino-Neto (2015) analyzed the average math scores of students in the 5<sup>th</sup> and 9<sup>th</sup> grades of elementary school and 3<sup>rd</sup> year of high school in the state of Rio Grande do Sul, based on SAEB results in 2005, 2007, 2009, 2011, and 2013. Those authors reported

[...] investigate and understand oscillations and trends in relation to the performance averages of the analyzed spheres, with a special focus on the mathematical abilities equivalent to each performance level. The results show progressive oscillations, mainly in the 5<sup>th</sup> year; significant advances of the same group of students at different school moments, and a deficit between the expected and obtained mathematical abilities by students of all school years evaluated (SANTOS; TOLENTINO-NETO, 2015, p. 309).

In “Factors associated with school performance: an analysis of the mathematics proficiency of students in the 5<sup>th</sup> year of elementary school in the municipal education system in Rio de Janeiro”, Palermo, Silva and Novellino (2014) aimed to discuss aspects “[...] that influence the school performance of students in the 5<sup>th</sup> year of elementary school, in municipal public schools in the city of Rio de Janeiro”. To achieve that aim, those authors used the students' proficiency results, measured from a standardized math test, with an emphasis on problem solving, as a dependent variable to study the determinants of school performance. The students' scores in the Prova Brasil (2007) presented a proficiency scale ranging from 0 to 500.

The studies reported by Santos and Tolentino-Neto (2015) and by Palermo, Silva and Novellino (2014) show certain convergence with this study, as they considered the performance of students as an object of investigation, including their results in mathematics. However, they also present divergences.

For example, Santos and Tolentino-Neto (2015) sought to understand the fluctuations in the scope of different spheres, such as public and private schools, and considered the performance of the initial and final years of elementary and high school. In this research, however, we focus on understanding the performance in mathematics only in state schools, and only with students in the final years of elementary school, as it seeks, in a way, to draw a portrait of students that will enter high school, due to the restructuring of this teaching stage in Brazil.

The research by Palermo, Silva and Novellino (2014) is the one that most converges with this investigation, as they essentially considered the students' proficiency in mathematics. However, they used data related to students in the 5<sup>th</sup> year of elementary school, seeking to understand the factors that influenced those students' school performance, which is not the case of this investigation.

Therefore, this literature review reinforces the relevance of this research, since we could observe that the number of studies investigating elementary school students' level of proficiency in mathematics is low, and for the fact of providing an overview of the state education system in the state of Roraima. In this context, the next section seeks to present theoretical foundations in order to support the analysis of this research data analysis.

### 3 BRIEF NUANCES ABOUT SAEB

SAEB is an important large-scale assessment system carried out by INEP at the national level. Since 2019, it has covered the entire basic education, aiming to diagnose the students' level of learning in public and private schools in the country, and factors that may impact students' performance. With this evaluation system, INEP identifies the average performance of students that, associated with pass, fail and dropout rates, calculated through the School Census, result in the Basic Education Development Index (IDEB).

SAEB assessments are prepared considering reference matrices, which serve to “[...] indicate the abilities to be evaluated at each stage of schooling and guide the elaboration of test items and tests, as well as the construction of proficiency scales that define what and how much each student performs in the context of the assessment” (BRASIL, 2015, p. 1). Figure 1 shows an excerpt of the Mathematics Reference Matrix for the 9th Year of Elementary School.



I. ESPAÇO E FORMA	
D1	Identificar a localização/movimentação de objeto em mapas, croquis e outras representações gráficas.
D2	Identificar propriedades comuns e diferenças entre figuras bidimensionais e tridimensionais, relacionando-as com as suas planificações.
D3	Identificar propriedades de triângulos pela comparação de medidas de lados e ângulos.
D4	Identificar relação entre quadriláteros por meio de suas propriedades.
D5	Reconhecer a conservação ou modificação de medidas dos lados, do perímetro, da área em ampliação e/ou redução de figuras poligonais usando malhas quadriculadas.

**Figure 1** – SAEB Mathematics Reference Matrix: themes and their descriptors of the 9<sup>th</sup> year of elementary school  
Source: BRASIL (2020b)

The current Reference Matrix for Portuguese Language and Mathematics (Figure 1) is subdivided into topics or themes, called descriptors. These represent “[...] an association between curricular contents and mental operations developed by students” (BRASIL, 2020f). In other words, how students realize the contents they are exposed to in school and the mental processes they develop based on that, translating certain competences and abilities, specifying, therefore, what each ability implies. They are used as the basis for the construction of items from different school subjects.

As for the items, it is “[...] questions that make up the large-scale assessment, with a difference from the proposals in the classroom, as the item assesses only one ability, addressing a single dimension of knowledge” (CAED, 2020b, p. 1). Therefore, the SAEB questions are items prepared in line with the descriptors of the Reference Matrix of the curricular components evaluated, contemplating the content to be evaluated in each school period and curricular component.

The SAEB assessment seeks to verify students' proficiency, whose results can range from 0 to 900 and are “[...] presented on a performance scale capable of describing, at each level, the competencies and abilities that students demonstrate to have developed” (BRASIL, 2020a, p. 1). This scale is unique and cumulative for each of the curricular components in all years and grades evaluated, in such a way that, students in the 5<sup>th</sup> year of elementary school are expected to reach numerical averages lower than those in the 9<sup>th</sup> year, which, in turn, would reach lower averages than 3<sup>rd</sup> or 4<sup>th</sup> grade high school students (BRASIL, 2020a).

Thus, student performance is measured through the proficiency scale, which is considered

[...] a representation that distributes the results of the students' proficiencies in a straight line where the quality of learning is increasing. It is nothing more than a measuring ruler whose distribution of points and the consequent interpretation allows examiners to understand the results and compare them between results obtained by the same students in different years (BRASIL, 2018c, p. 1).

It also considers that

The process of building a proficiency scale concerns the methodological options underlying statistical, pedagogical and operational procedures and presents test results in a single metric, expressed in proficiency scores arranged on a unidimensional scale that can be interpreted educationally (OLIVEIRA, 2008, p. 23).

Thus, this methodology allows, after the application of tests, the students' responses to the items to be processed, constituting a database. Then, this database is processed using specific software and based on the Item Response Theory (IRT), by calculating the mathematical characteristics of the items or parameters and the students' proficiencies. Then, through equalization, the students' proficiencies and the item parameters are organized into a proficiency scale with nine levels, which is illustrated below (Figure 2).

<p><b>Nível 2</b> Desempenho maior ou igual a 225 e menor que 250</p>	<p>Além das habilidades anteriormente citadas, os estudantes provavelmente são capazes de:</p> <p>NÚMEROS E OPERAÇÕES; ÁLGEBRA E FUNÇÕES</p> <ul style="list-style-type: none"> <li>• Reconhecer a fração que corresponde à relação parte-todo entre uma figura e suas partes hachuradas.</li> <li>• Associar um número racional que representa uma quantia monetária, escrito por extenso, à sua representação decimal.</li> <li>• Determinar uma fração irredutível, equivalente a uma fração dada, a partir da simplificação por três.</li> </ul> <p>TRATAMENTO DE INFORMAÇÕES</p> <ul style="list-style-type: none"> <li>• Interpretar dados apresentados em um gráfico de linha simples.</li> <li>• Associar dados apresentados em gráfico de colunas a uma tabela.</li> </ul>
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**Figure 2** – Mathematics Proficiency Scale for the 9<sup>th</sup> year of elementary school  
Source: BRASIL (2020c)

With that, the results “[...] can be compared between different assessments in the same period of time or also in different periods of time, thus allowing the construction of performance indicators, such as the IDEB [...]” (CAED, 2020a, p. 1).

The process of interpreting the knowledge scale requires a certain translation of the results of the ability measured in terms of their cognitive and educational meaning. Therefore,

“[...] experts in the areas assessed, using student proficiencies and item parameters, interpret what it pedagogically means in certain performance categories” (CAED, 2020a, p. 1). Thus, it identifies, according to the proficiencies located at each level, what students are capable of doing.

Chart 1 shows the levels and their respective proficiencies, indicating 9<sup>th</sup> grade students’ performance in mathematics.

LEVEL	PERFORMANCE
0	Less than 200
1	Greater than or equal to 200 and less than 225
2	Greater than or equal to 225 and less than 250
3	Greater than or equal to 250 and less than 275
4	Greater than or equal to 275 and less than 300
5	Greater than or equal to 300 and less than 325
6	Greater than or equal to 325 and less than 350
7	Greater than or equal to 350 and less than 375
8	Greater than or equal to 375 and less than 400
9	Greater than or equal to 400

**Chart 1** – Performance Standard for the 9<sup>th</sup> year of elementary school in mathematics  
Source: (BRASIL, 2020c)

In this way, the levels presented in the proficiency scales serve to indicate the performance standard of students in large-scale assessments through IRT.

In this section, we sought to present, albeit briefly, basic aspects of the SAEB so that the reader can better understand the investigation process that was carried out in this research.

#### 4 THE METHODOLOGY OF THE RESEARCH PROCESS

This research was carried out fundamentally considering the need to diagnose and understand the proficiency and the oscillations of the average performance in mathematics of students in the final years of elementary school in the state education system, to direct the efforts to implement the New High School in the state of Roraima. Thus, the following guiding question was established: What is the students' mathematics proficiency profile in the final years of elementary school in the state education system in Roraima?

In this sense, to find answers to the research question, it was established that this research aims to analyze the performance in Mathematics - Average proficiency and

performance levels - of students in the final years of elementary school in the public education system in Roraima, according to SAEB results in 2015, 2017, and 2019.

Considering the need to consolidate an overview of proficiency in mathematics, with students in the final years of the state education network, the mathematics scores obtained by students in the 3 most recent years of the SAEB evaluation (2015, 2017, and 2019) were collected from the database provided by INEP, to obtain the data for this research.

On the INEP page, IDEB results can be downloaded in several ways: Technical summary; IDEB by school; IDEB – Results and goals; IDEB worksheets; Results of elementary and secondary education at the national level; state and regions; by municipalities; or even by schools. The spreadsheet was then downloaded, allowing the consultation of data by schools, for the final years of regular elementary school.

In the worksheet, information related to state schools in Roraima was filtered. Thus, 59 schools were located in Boa Vista, capital of the state, and 82 schools in the 14 municipalities in the interior. These 141 schools are located in urban areas, non-indigenous rural areas, and indigenous rural areas. We had initially decided to organize these schools into 4 groups: schools in the capital, urban schools in the interior of the state, non-indigenous rural schools in the interior of the state and indigenous rural schools in the interior of the state. However, this was not possible because, when schools that did not have all the grades related to the last 3 SAEB evaluations were eliminated, this number reduced significantly.

When considering only schools with grades from the last 3 evaluations, 11 urban schools from the capital remained, as well as 4 urban schools in the interior and 3 non-indigenous rural schools in the interior, leaving no indigenous school, even though the state has 263 indigenous schools, according to 2019 Census data.

As a result and considering that urban and non-indigenous rural schools represented a significantly small number in isolation, we decided to group them. Thus, this research was carried out considering two groups: “Schools in the capital”, with 11 schools in the urban area of the capital, and schools in the interior, with 7 urban and non-indigenous rural “Schools in the interior”.

## 5 DATA PRESENTATION, ANALYSIS AND DISCUSSION

The data set of this research comprises the average math scores and the distribution of students by level of performance in mathematics, in the 3 most recent SAEB evaluations (2015,

2017 and 2019) including students in the 9<sup>th</sup> year of elementary school in the public education system in Roraima. These data were organized into two groups: urban schools in the capital and urban and non-indigenous rural schools in the interior of the state of Roraima. In this context, the data was analyzed considering the scale of proficiency in mathematics of students in the 9<sup>th</sup> year of elementary school (Chart 1) to identify the average standard of performance and the level of students' proficiency in mathematics in the SAEB.

The proficiency scale, for grade 9 students, presents a performance rating in relation to math proficiency. This scale was used in the data analysis to identify the average proficiency and the standard of students' performance in mathematics in the final years of elementary school in the state education system in Roraima, within the scope of schools in the capital and in the interior of the state.

## 5.1 Schools in the capital

To identify and understand the profile of students in the final years of elementary school in the capital of the state of Roraima, we decided to map their average scores in mathematics in the SAEB in the last 3 evaluations (Table 1).

**Table 1** - Average mathematics scores in the SAEB obtained by students in the 9<sup>th</sup> year of elementary school in schools in the capital of the state of Roraima in the period from 2015 to 2019

SCHOOL	SAEB SCORE MATH		
	2015	2017	2019
C. E. M. <sup>†</sup> PEDRO ELIAS ALBUQUERQUE PEREIRA	224.49	234.66	247.61
C. E. M. PROFESSORA MARIA DE LOURDES NEVES	229.77	229.72	241.74
C. M. E. <sup>‡</sup> CEL PM DERLY LUIZ VIEIRA BORGES	314.42	328.96	335.74
E. E. <sup>§</sup> CARLOS DRUMMOND DE ANDRADE	236.94	237.80	253.72
E. E. EUCLIDES DA CUNHA	251.86	275.41	280.40
E. E. FERNANDO GRANGEIRO DE MENEZES	233.42	238.75	231.71
E. E. GENERAL PENHA BRASIL	242.37	233.37	248.30
E. E. MARIO DAVID ANDREAZZA	249.30	254.04	257.32
E. E. MONTEIRO LOBATO	255.10	258.25	273.21
E. E. PROFESSOR CAMILO DIAS	246.76	256.66	245.61
E. E. SÃO JOSE	252.76	265.85	249.22

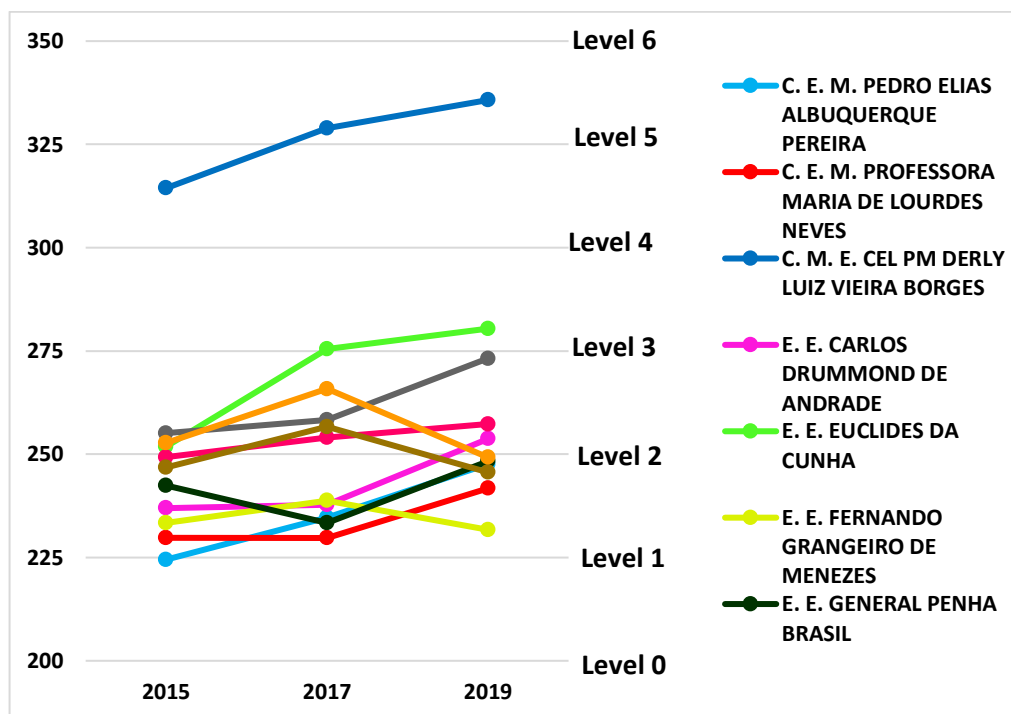
<sup>†</sup> C. E. M.: Militarized State school

<sup>‡</sup> C. M. E.: State military school

<sup>§</sup> E. E.: State School

Source: BRASIL (2020d)

For a better visualization and understanding of the average math scores in the SAEB obtained by students in the 9<sup>th</sup> year of elementary school in schools in the capital of the State of Roraima in the period from 2015 to 2019, these data were organized graphically (Graph 1).



**Graph 1** – Average math proficiency of students in the 9<sup>th</sup> year of elementary school in schools in the capital of the state of Roraima in the SAEB from 2015 to 2019  
Source: The authors (2021)

The data analysis revealed that one school differed from the set of 11 urban schools in the capital (Graph 1). This was the CME CEL PM Derly Luiz Vieira Borges, whose math proficiency averages were noticeably above those of other schools, even advancing from an approximate average of 314 in 2015 to 335 in 2019. The 9<sup>th</sup> year of CME CEL PM Derly Luiz Vieira Borges advanced from level 5 in 2015 to level 6 in 2019.

The significant distance between the averages of students’ mathematics proficiency in CME CEL PM Derly Luiz Vieira Borges and those of students in the other schools of the public education system in Roraima might be related to the fact that students must take a selection written test and be approved to enter this school. However, this is just a hypothesis, whose confirmation is out of the scope of this research objectives.

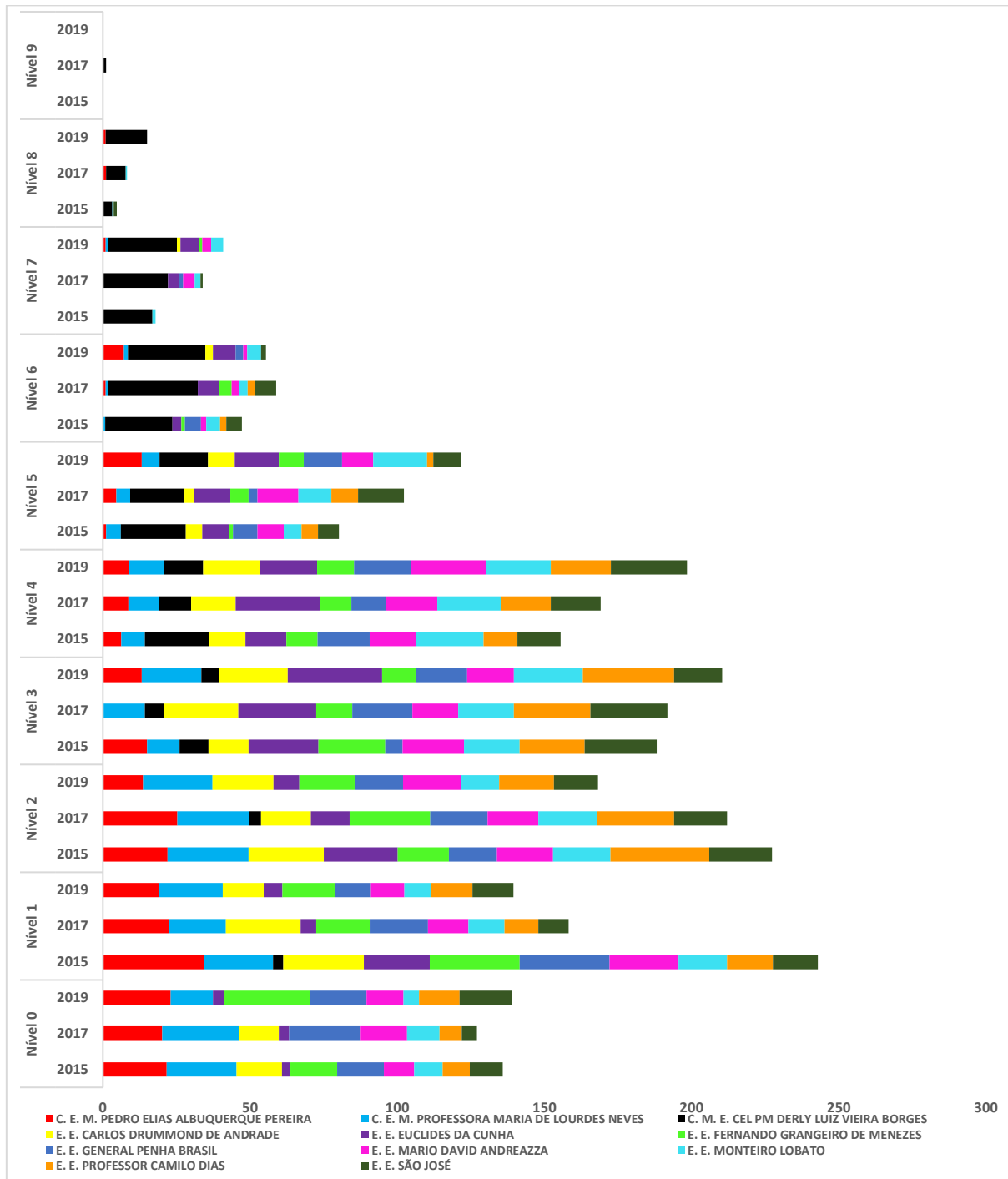
In contrast to the C. M. E. CEL PM Derly Luiz Vieira Borges, the other urban schools in the capital showed averages of mathematics proficiency ranging from level 1 to level 4 in the period from 2015 to 2019. In this set, a progressive advance in the averages of proficiency

in mathematics was observed in Euclides da Cunha, Monteiro Lobato, Mario David Andreazza, Carlos Drummond de Andrade State Schools, and Pedro Elias Albuquerque Pereira and Professor Maria de Lourdes Neves Militarized State Schools. General Penha Brasil State School also showed an increase from 2015 to 2019, but, unlike the others, it showed a decrease from 2015 to 2017 and an increase from 2017 to 2019, exceeding the average of 2015. The other schools, Fernando Grangeiro de Menezes, Professor Camilo Dias and São José showed progress from 2015 to 2017, but the averages dropped from 2017 to 2019, when lower averages were observed when compared to 2015.

The analysis of Graph 1 favors the observation of at least three general aspects, in addition to those already presented. One of them is that, comparing the results of 2015 and 2017, only 1 of the 11 schools showed a decrease in the averages of proficiency in mathematics, which indicates an improvement in the averages of approximately 91% of the schools. Comparing 2017 and 2019, 3 schools were seen to show a decrease in the averages of proficiency in mathematics, indicating an improvement of approximately 73% in the averages of the schools. As a result, a reduction in the advancement of averages was identified. This reduction in math proficiency averages was confirmed when the results of 2015 and 2019 were compared, and then it appears that only 8 schools show an increase in averages, which represents approximately 73%, unlike what had been observed between 2015 and 2017, when the increase was 91%.

We understand the importance of identifying the causes that made the advances evidenced possible so that they can be strengthened to guarantee that improvements are progressive. They might also be an example for schools that did not have the same performance. However, this is outside the scope of this research, and can be used in the development of further studies.

Considering that the data analyzed address proficiency averages and, seeking to better understand the mathematics proficiency behavior of 9<sup>th</sup> graders in urban schools in the capital of Roraima, in the period from 2015 to 2019, the data related to the distribution of students by level on the proficiency scale was also analyzed (Graph 2).



**Graph 2** – Distribution of students in the 9<sup>th</sup> year of elementary school in schools of the capital of the state of Roraima by mathematics proficiency level in the SAEB in the period from 2015 to 2019  
Source: The authors (2021)

Graph 2 makes it possible to understand, individually and in the last 3 SAEB evaluations, the students’ performance in the 11 non-indigenous schools in the capital regarding the distribution of students in each of the nine levels in the proficiency scale, which is used to assess performance in mathematics. It also enables the development of a comparative analysis



between the 11 schools investigated. Thus, we performed an individual analysis of the 11 schools and a relationship between them was established regarding their performance.

In the same way observed in the analysis of Graph 1, the C. M. E. CEL PM Derly Luiz Vieira Borges presented a different behavior in relation to the other schools, therefore, the scores obtained by the students of this school were distributed from level 1 to level 9, with greater concentration at level 6, in the 3 SAEB evaluations. In addition, at levels 7 and 8 a significant evolution was observed in the percentage of students at these levels, from 2015 to 2019. Also, in relation to the CME CEL PM Derly Luiz Vieira Borges, it is worth noting that, considering the result of the SAEB 2019, the students of this school with lower performance were found at level 3, while no students were found at level 0 in any of the three last SAEB evaluations. In fact, this is the only school where students reached level 9, in SAEB 2017. It seems relevant to emphasize that this school is the only military college in Roraima, being linked to the State Military Police.

Another school where a positive evolution in performance was observed is Euclides da Cunha. The increased rate of students at levels 3, 4, 5, 6, 7, and 8 from 2015 to 2019 is evident, resulting in a decrease in the rate of students at levels 1 and 2.

Another school that showed decreased rates at the lowest levels such as 0 and 1 was Carlos Drummond de Andrade. Consequently, an increase in the rate of students at levels 3, 4, 5, 6, and 7 was observed. Regarding levels 6 and 7, they were only reached by students in the SAEB 2019.

Professor Camilo Dias School showed a slight increase in the rates of students at levels 3 and 4; reduction in levels 2, 5, and 6; level 1 was practically stable, but there was also an increase in the rates at level 0. As a result, few positive changes were observed in the performance of students in Professor Camilo Dias State School, which, in general, showed the highest rates of students concentrated in levels 2 and 3.

C. E. M Pedro Elias Albuquerque Pereira showed a decrease in the indices related to levels 1, 2, and 3, and an increase in the indices related to levels 4, 5, 6, 7, and 8. However, it also presented an increase in the level 0 index, which, in general, did not affect severely the positive progress that that school has made over the last 3 exams analyzed.

The index of students at Monteiro Lobato School performing at level 6, from 2015 to 2019 was practically stagnant. It also showed growth in student rates at levels 3, 4, 5, and 7. As a result of the increased rates at higher levels, the school reduced rates at levels 0, 1, and 2.

General Penha Brasil School, over the 3 exams analyzed, showed growth in the number of students at levels 3, 4, and 5, keeping the rates practically stable at level 2 and a significant reduction at level 1. As for level 0, the school presented increased indices from 2015 to 2019.

The C. E. M Professora Maria de Lourdes Neves presented an increase in the indexes of levels 3, 4, 5, 6, and 7, and consequent decrease in the rates for levels 0, 1, and 2.

São José School showed an increase in the rates of levels 4 and 5. However, it also presented an increase at level 0 and a decrease at levels 1, 2, and 3. This has shown that São José School has barely managed to advance, even more if the decrease in the level 6 indices is considered.

Mario David Andreazza School presented an increase in the indexes related to levels 0, 2, 4, and 5 and a reduction in levels 1, 3, 6, and 7. These findings evidenced that the school did not present show changes.

As for Fernando Grangeiro de Menezes School, the only positive point observed was the increase in level 2 indices, albeit somewhat sharp. Indicating concern with the school's indexes, an increase was observed at level 0 and a decline in related indices at levels 1, 3, 4, 5, and 6.

Data related to the distribution students in the 9<sup>th</sup> year of elementary education, by level, in mathematics in the SAEB exam in non-indigenous schools in the capital of the state of Roraima, were shown in Graph 2. We carried out an individual analysis of each school. However, we also understood that it would be important to analyze these data together, as it would provide a better understanding of the performance of 9<sup>th</sup> graders in non-indigenous schools in the capital of the state of Roraima.

In this aspect, considering the accumulated percentages of students from non-indigenous schools in the capital of the state of Roraima, it became evident that, when considering the last 3 SAEB examinations, there was a positive progression in two moments. One refers to the highest accumulated percentages of students, in 2015, 2017 and 2019, at levels 1, 2 and 3, respectively. The other is in relation to the 2<sup>nd</sup> highest percentage of students, which, in 2015, 2017, and 2019 were at levels 2, 3, and 4, respectively.

Despite this positive progression, it is necessary to consider that the highest accumulated percentages of students from non-indigenous schools in the capital of the state of Roraima were at levels 1, 2, 3 and 4, indicating that there is a need for actions that can effectively enable advancement of these results. This is only possible with the performance of students in

mathematics reaching higher levels such as 5, 6, 7, 8 and 9.

## 5.2 Schools in the interior

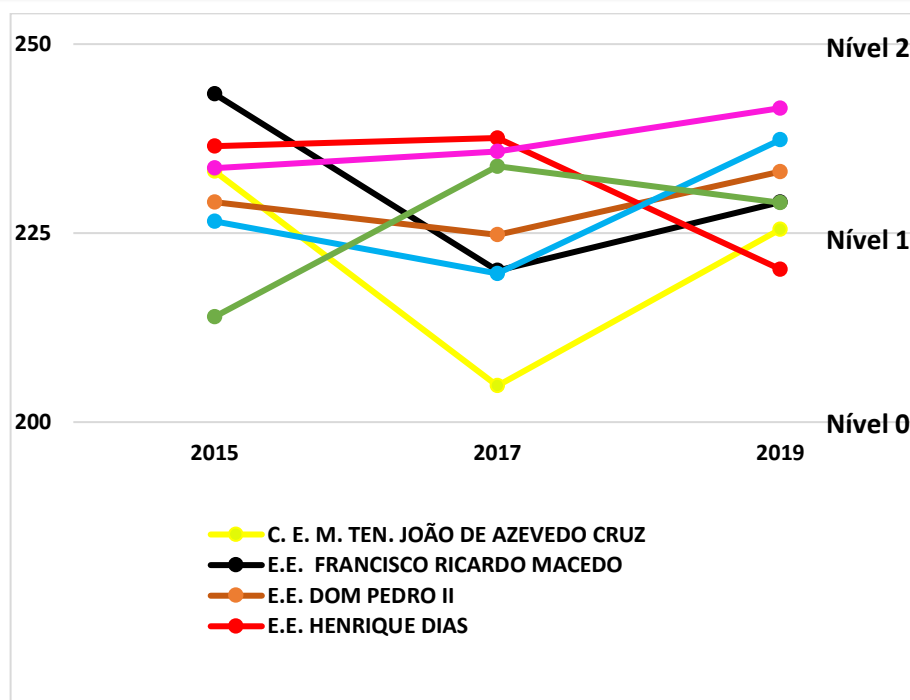
To identify and understand students' profile in the final years of elementary school in urban and non-indigenous rural schools in the interior of the state of Roraima, we mapped the average math grade in the 3 most recent SAEB examinations. These data are presented below (Table 2).

**Table 2** – Mathematics scores in the SAEB of students in the 9<sup>th</sup> year of elementary school in urban and non-indigenous rural schools in the interior of the state of Roraima

SCHOOL	SAEB SCORE MATH		
	2015	2017	2019
C. E. M. TEN. JOÃO DE AZEVEDO CRUZ	233,16	204,80	225,51
E. E. FRANCISCO RICARDO MACEDO	243,39	220,04	229,07
E. E. DOM PEDRO II	229,10	224,77	233,13
E. E. HENRIQUE DIAS	236,47	237,58	220,23
E. E. PROF. VENCESLAU CATOSI	226,57	219,66	237,33
E. E. SÃO FRANCISCO	213,94	233,85	229,02
E. E. VEREADOR FRANCISCO PEREIRA LIMA	233,59	235,83	241,53

Source: BRASIL (2020d)

For a better visualization and understanding of the average math scores in the SAEB obtained by students in the 9<sup>th</sup> year of elementary school in schools in urban and non-indigenous rural schools in the interior of the State of Roraima in the period from 2015 to 2019, these data were organized graphically (Graph 3).



**Graph 3** – Average proficiency in mathematics of students in the 9<sup>th</sup> year of elementary school in urban and non-indigenous rural schools in the interior of the state of Roraima in the SAEB from 2015 to 2019  
Source: The authors (2021)

When analyzing Graph 3, we could observe that two schools presented different behavior in relation to the other six, since they did not present average proficiency below level 1 in any of the 3 exams under analysis. These schools were Vereador Francisco Pereira Lima and Dom Pedro II schools. They managed to keep their averages at level 1 in the period analyzed, and Vereador Francisco Pereira Lima School showed a sharp growth in proficiency averages from 2015 to 2019. Dom Pedro II School showed a drop in average in 2017 when compared to 2015, but in 2019 it improved again overcoming the average achieved in 2015.

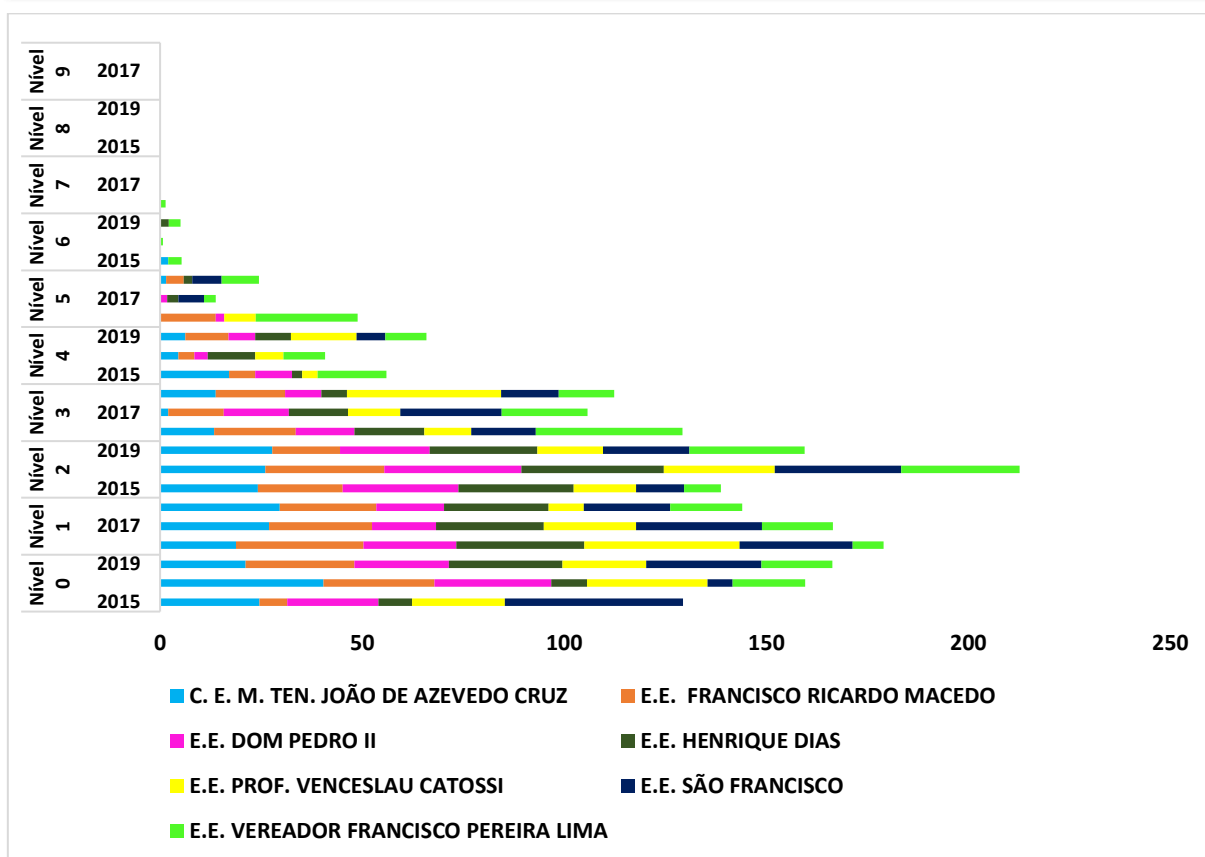
Among the schools analyzed, two presented similar behavior, with an increase in the average from 2015 to 2017, but a sharp drop from 2017 to 2019. One of them is São Francisco School, which in 2017 showed a significant increase in the average when compared to 2015, going from level 0 to level 1, but in 2019, decreased its average, remaining at level 1. The other school was Henrique Dias, which in 2017 practically kept the average achieved in 2015 stable, but in 2019 dropped its average considerably, going from level 1 to level 0.

With a different behavior to those presented above, the C. E. M Ten. João de Azevedo Cruz, Francisco Ricardo Macedo and Professor Venceslau Catossi schools. These 3 schools showed a sharp drop from 2015 to 2017, going from level 1 to level 0. However, in 2019 their averages grew in such a way that these schools returned to level 1.

Thus, at least three general aspects were identified. One of them is that when comparing the results of 2015 and 2017, 4 schools showed a decrease in the average performance, which indicates that only 43%, approximately, of this group of schools, managed to achieve positive progress. However, comparing the results of 2017 and 2019, we could see that there was some improvement, because, in this case, only two schools presented a decrease in the average performance, indicating that approximately 71% of schools achieved positive progress in mathematics proficiency averages. In addition, when comparing 2015 and 2019, we observed that out of the 07 non-indigenous urban and rural schools in the interior of the state of Roraima, 4 advanced in the averages of proficiency in mathematics, with an achievement of approximately 57%. Thus, the positive evolution initially signaled remained in the comparison between 2015 and 2017.

As mentioned in the section “Schools in the capital”, we understand the importance of identifying the causes that made advances possible, to strengthen them, so that, consequently, these improvements are progressive. At the same time, they might also be developed in schools that did not have the same performance. However, this is outside the scope of our current research, and can be used in the development of further research on this theme.

Considering this context and that the data analyzed addresses proficiency averages, we sought to better understand the behavior of 9<sup>th</sup> grade students’ proficiency in mathematics in non-indigenous urban and rural schools in the interior of the state in the period from 2015 to 2019 by analyzing data on the distribution of students by level in the proficiency scale (Graph 4).



**Graph 4** – Distribution of students in the 9<sup>th</sup> year of elementary school from urban and non-indigenous rural schools in the interior of the state of Roraima by standard of performance in mathematics in the SAEB in the period from 2015 to 2019  
Source: The authors (2021)

Graph 4 presents information, specifically related to the performance of 7 urban and non-indigenous rural schools in the interior of the state of Roraima, in the last 3 SAEB examinations, regarding the distribution of the percentage of students in each of the nine levels in the proficiency scale, which is used to measure performance in mathematics. But it also enabled the development of a comparative analysis between these 7 schools. Thus, initially an individual analysis of each school was carried out, and next we sought to establish a relationship between them regarding their performance.

The initial analysis of the data related to the standard of performance in mathematics in the SAEB of 9<sup>th</sup> grade students in elementary schools in urban and non-indigenous rural schools in the interior of the state allowed us to observe that, in the last 3 SAEB examinations, there were no students with performances at the levels 8 and 9 in any of the 7 schools investigated. As a result, a clear differentiation was observed between urban and non-indigenous rural schools in the interior of the state and non-indigenous schools in the capital. We can state that

based on data presented (Graph 2) showing that in the capital, students reached levels 8 and 9. In relation to level 9, only students from 1 school reached this level in 2017. However, level 8 was achieved by students from 5 schools over the years 2015, 2017, and 2019.

Although in this research the group of non-indigenous schools in the interior of the state comprises only 3 rural and 4 urban schools, it is hypothesized that the fact that the students from non-indigenous schools did not reach the highest levels such as 8 and 9 may have some relationship with those of the research by Schneider and Gouveia (2011, p. 59-60), in which “[...] there was a tendency for the highest proficiencies to be from students in schools with the greatest material and structural conditions”, because, in general, a significant difference was observed between schools located in urban areas and those located in rural areas. This could be the reason why in the capital, students reached the highest levels such as 8 and 9, while in schools in the interior of the state, the highest level reached was 7, in a single school and only in 2017. Obviously, for an effective verification of such hypothesis, an investigation is necessary to establish relationships between the material and structural conditions of these schools and students’ performance in the SAEB examination.

Still regarding the higher levels of the proficiency scale, level 7 was seen to be reached only by students from Vereador Francisco Pereira Lima School, but only in 2015. In fact, Vereador Francisco Pereira Lima School is the only school that has students at all levels below level 7, in all 3 SAEB examinations considered here, even if the highest percentage of students in that school are placed at levels 2 and 3. Furthermore, considering the last 3 SAEB examinations, an increase in the percentage of students at level 2 was observed.

Henrique Dias School is the only one in a close position to that of Vereador Francisco Pereira Lima School in terms of having students with proficiency level 6 in 2019. In addition, although the highest rates are concentrated at levels 1 and 2, Henrique Dias School also had students with proficiency at levels 3, 4 and 5.

The C.E.M Ten. João de Azevedo Cruz also presented students with proficiency at level 6, but only in the 2015 examination. It seems to be relevant to call attention to the clear improvement shown by this school from 2017 to 2019, when percentages at level zero decreased, and, consequently and positively increased at levels 1, 2, 3, 4, and 5.

As identified in the analysis of Graph 3, Dom Pedro II School along with Vereador Francisco Pereira Lima School did not present proficiency averages below 1 in the last 3 SAEB examinations. In addition, Dom Pedro II School showed an improvement in proficiencies when

comparing 2017 and 2019, since the percentages at level zero decreased, and, consequently, increased at levels 1 and 2. However, and still comparing 2017 and 2019, it is also necessary to consider that Dom Pedro II School showed a drop in the percentages of students that reached levels 3, 4, and 5, the latter being the highest level of proficiency reached by the students of this school in the 3 last SAEB examinations.

São Francisco School stood out, since from 2015 to 2017, it presented advances, but decreased its scores from 2017 to 2019. This can be evidenced when, from 2015 to 2017, there was a significant reduction in the percentages at level zero, but from 2017 to 2019, the percentage of students at this level increased again. Consequently, at levels 1, 2, and 3, there was an increase in percentages from 2015 to 2017, but a decrease from 2017 to 2019. The only positive aspect was the progress at levels 4 and 5. At level 4, it became evident that some students reached this level in 2019, while in 2015 and 2017 it had not occurred. We could also observe that some students reached level 5 in 2017 and 2019.

Professor Venceslau Catossi School presented a decrease in the percentage of students that remained at proficiency level 0 from 2017 to 2019, and the progressive advancement to proficiency levels 3 and 4 from 2015 to 2019. However, a reduction was observed in the percentage of students at level 1 from 2015 to 2019, as well as a reduction in the percentage of students at level 2 from 2017 to 2019.

Regarding Francisco Ricardo Macedo School, the increase in the percentage of students with proficiency at levels 3, 4 and 5 from 2017 to 2019 and the inclusion of students at level 5 in 2019 was positive, since in previous years the highest level reached by the students of this school was 4. However, the significant percentage of students at level 0 was worrying, indicating gradual reduction in the percentage of students in levels 1 and 2.

Data on the distribution of students in the 9<sup>th</sup> year of elementary school, by level, in mathematics in the SAEB examination in urban and non-indigenous rural schools in the interior, were evidenced through graph 4. From this information, each school was analyzed individually. However, we understand that it is also necessary to analyze these data together, seeking to understand how urban and non-indigenous rural schools in the interior of the state of Roraima can be characterized.

In the meantime, and considering the accumulated percentages of students from urban and non-indigenous rural schools in the state of Roraima, it became evident that in 2019, level 0 was the one with the highest percentage of students, followed gradually by levels 2, 1, 3, 4,



5, and 6. Regarding the 2017 exam, level 2 is the one with the highest percentage of students, followed gradually by levels 1, 0, 3, 4, 5, and 6. In the 2015 exam, level 1 presented the highest percentage of students, followed gradually by levels 2, 3, 0, 4, 5, 6, and 7.

In this regard and considering the significant percentages of students at level zero and at lower levels such as 1, 2, and 3, it is worth noting that students that only reached level 0 “[...] still do not demonstrate very elementary abilities that they should have at this school stage” (BRASIL, 2020c, p. 6). Therefore, there is an urgent need for actions that promote positive changes in students’ performance in mathematics.

## 6 FINAL CONSIDERATIONS

This research was carried out within the public schools of the state education system in the State of Roraima. It sought answers to the research question: What is the students’ mathematics proficiency profile in the final years of elementary school in the state education system in Roraima? Therefore, our objective was to analyze the performance in mathematics - average proficiency and performance levels - of students in the final years of elementary school in the state education system of Roraima, in the 2015, 2017 and 2019 SAEB examinations.

The data used in this research were extracted from the INEP’s public page, being produced through a large-scale evaluation called SAEB. In particular, the average of the 9<sup>th</sup> year students’ proficiency and the distribution of these proficiency in the 10 specific proficiency levels of the 9<sup>th</sup> year were used. These data are related to two groups of schools: schools in the capital, including all state schools in the urban area, whose data of the last 3 SAEB examinations was available, comprising a group with 11 schools and; and interior schools, including all non-indigenous schools in the state education system, in urban and rural areas of the 14 municipalities in the interior of the state, whose data of the last 3 SAEB examinations was available, totaling 7 schools.

In each of the groups of schools, an attempt was made to analyze the averages of proficiencies and the proficiency distribution in levels, according to a specific scale devised by the INEP, in relation to students in the 9<sup>th</sup> year of these schools. Thus, data analysis took place separately considering the two groups of schools, but this did not prevent the establishment of possible relationships between these data. From this analysis, a portrait of the profile of 9<sup>th</sup> graders in the public schools of Roraima was established. The results of the analysis allowed

us to infer what is presented below.

The analysis of the evolution of the averages of students' proficiency in mathematics in the 9<sup>th</sup> year of elementary school enabled the identification of some aspects related to schools in the capital and in the interior of the state. Among the schools in the capital, there was a significant positive increase in percentages when comparing 2015 and 2017. However, when comparing 2017 and 2019 and the entire survey period, from 2015 to 2019, we could see that the evolution initially observed did not continue. As for schools in the interior, it was found that the positive evolution was only 43%, between the 2015 and 2017 exams. However, this picture changed positively in the other comparisons. We could also observe a more accentuated evolution in the comparison of the SAEB results of 2017 and 2019, as well as of 2015 and 2019, although in this last period the percentage of schools that managed to advance was just a little over 50%. For this reason, we could infer that both groups of schools in the capital and those in the interior showed a certain positive evolution in their averages of proficiency in mathematics among 9<sup>th</sup> grade students, although this evolution was clearly not expressive.

In addition to the timid evolution in the averages of students' proficiency in mathematics in the state education system of Roraima, it is worth noting that in schools in the interior these averages are concentrated at levels 0 and 1, while in the capital, the averages are concentrated at levels 1, 2, 3, and 4, with the exception of only one school, whose averages concentrated at levels 4 and 5. But this is a single isolated case, whose reasons explaining such behavior should be the subject of future investigation.

In addition, this research considered the distribution of students' proficiency in mathematics in the 9<sup>th</sup> year of elementary school by performance pattern. In this regard, we believe it is important to understand that in the results of a large-scale assessment such as the SAEB,

[...] most of the students evaluated have their proficiency situated at medium levels. This translates to greater height of the curve in and around the center. However, as one moves towards the greater proficiencies located on the right of the graph and also towards the smaller proficiencies located on the left, the number of cases found decreases (OLIVEIRA, 2008, p. 35 – our emphasis).

However, the results obtained from both schools in the capital and schools in the interior go against this statement, especially those in the interior. This is because, in relation to the 9<sup>th</sup> graders' proficiencies in schools in the interior, the distribution of proficiencies is especially concentrated at the lowest levels such as 0, 1, 2, and 3. As for students from schools in the

capital, even though the general results were better than those from schools in the interior, they were still at a certain distance from what Oliveira (2008) pointed out. We draw attention to this, because most of the students evaluated in 2015, 2017, and 2019 SAEB examinations, had their proficiency situated between levels 1, 2, 3, and 4.

Taking that into consideration, we identified the need for further research that can investigate possible relationships between the material and structural conditions of schools in the state education system in Roraima and the performance of students in these schools in the SAEB, which might explain the reasons why in the capital there are students who reached the highest levels, such as 8 and 9, and in schools in the interior of the state, the highest level reached was 7, by a single school and only in 2017.

More comprehensively, this research strongly points to the need for further investigations that can identify the factors that contribute to the fact, or even, that are the cause of the average proficiency, or even the distribution of proficiency in mathematics, of students in public schools in the the state education system of Roraima not presenting a significant positive evolution. We believe that the identification of these factors will make it possible to direct actions in order to reverse the results of the context observed in this research.

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