OTHER THEMES

What Explains the Infrastructure Inequality of the EMEIs in Belo Horizonte?

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ABSTRACT – What Explains the Infrastructure Inequality of the EMEIs in Belo Horizonte? The article analyzes whether there is an association between inequality in the infrastructure of municipal schools (EMEIs) in Belo Horizonte regarding i) location, ii) the type of management and iii) the correction to information provided to the School Census 2019. We also compared the data from the School Census with economic indicators and *on-site visits*. We found that the territorial distribution of EMEIs and the type of administration affect the degree of school infrastructure adequacy. However, these variables showed few explanatory powers to the inequalities seen in the School Census. On the other hand, we identified discrepancies between the data filled out by the educational units and the information verified in local visits.
Keywords: **Early Childhood Education. Conditions of Educational Offer. School Infrastructure. Inequalities of Educational Opportunities. Public Policy Instruments.**

RESUMO – O que Explica a Desigualdade de Infraestrutura das EMEIs em Belo Horizonte? O artigo analisa se há associação da desigualdade na infraestrutura das escolas municipais de educação infantil (EMEIs) de Belo Horizonte quanto i) à localização, ii) ao tipo de gestão e iii) à correção de informação censitária prestada, em relação ao ano de 2019. Os dados do Censo Escolar foram cotejados com indicadores econômicos e visitas *in loco*. Verificou-se que a distribuição territorial das EMEIs e o tipo de administração têm repercussões no grau de adequação de infraestrutura das escolas. Porém, essas variáveis apresentaram pouco poder explicativo para as desigualdades encontradas no Censo Escolar daquele ano. Em contrapartida, identificou-se discrepâncias entre os dados preenchidos pelas unidades educacionais e as informações verificadas em visitas locais.
Palavras-chave: **Educação Infantil. Condições de Oferta Educacional. Infraestrutura de Escolas. Desigualdades de Oportunidades Educacionais. Instrumentos de Políticas Públicas.**

Introduction

School infrastructure has been a theme of studies in the education field, which gained prominence in the discussions about school effectiveness in the 1970s and 1980s (Rutter; Maughan; Mortimore; Ouston, 1979; Madaus; Airasian; Kellaghan, 1980; Mortimore; Sammons; Stoll; Lewis, 1988). The aim was to evaluate to what extent the characteristics of the school environment, its spaces, and equipment, among other factors, influenced the educational results (Brooke; Soares, 2008). More recently, several studies in Brazil with different forms to collect data and analytical methodologies (Alves; Xavier; Paula, 2019) have ensured a space for this discussion in the country's education research agenda. Some examples are the studies on the relationship between school infrastructure and learning results (Alves; Franco, 2008); school architecture throughout education history (Faria Filho, 2000; Dórea, 2013); sector public policies (Duarte; Gomes; Gotelipe, 2019); and effects of education funding on infrastructure (Duarte; Braga, 2019; Schneider; Frantz; Alves, 2020).

Added to this education research agenda are international and national discussions about educational public policies regarding the importance of good offer conditions for developing quality and equitable education work. For instance, Goal 4 of the 2030 Agenda for Sustainable Development[1] (NU, 2015), to which Brazil is a signatory, refers to education and expresses the countries' commitment to building and improving schools' physical facilities. Brazilian *Plano Nacional da Educação* – PNE [National Education Plan] (Brasil, 2014) encompasses the issue of improving infrastructure among its strategies to ensure teaching and learning conditions for all teachers and students. Strategy 3 of Target 6, for example, envisions the establishment of a collaboration regime to broaden and restructure public policies by building educational spaces, such as sports courts, laboratories, and libraries, among others (Brasil, 2014).

As the central educational public policies in the 1990s and early 2000s were focused on elementary and middle school (Cury, 2002), there is a significant number of studies about school infrastructure regarding the intermediate phase of K-12 education (Sá; Werle, 2017). More recently, with obligatory enrollment in preschool and high school (Brasil, 2009, art. 1°), other works analyzed the schools' infrastructure from the specificities of these phases (Azevedo, 2012; Rodopoulos, 2017; Carnaval, 2020).

This research refers to the infrastructure of childhood education schools, specifically the inequalities in construction conditions, spaces, and equipment in nurseries and preschools. We point out that the use of the term inequalities is based on the sociological concept of education inequality, which seeks to highlight that, more than differences, the conditions signalize a hierarchy that can directly reverberate in the teaching and learning processes (Dubet, 2008; Nogueira, Catani; 1998).

Starting in the 1950s, in a post-war context, the debate on educa-

tional inequalities gained steam, considering that, as stated by Nogueira (1995), the governments of various countries, especially European ones, committed themselves to promoting school access to broader population groups, thus believing that they would build more equalitarian and fair societies. Therefore, the investment in education to increase economic competitiveness, a concept corroborated by Eric Hanushek and Ludger Wößmann (2020), Stanford University researchers, when highlighting that, in a way, the differences between the countries' economic growth rates can be explained by differences in the quality of education offered to their people. Thus, knowledge and learning opportunities count for economic growth, not only school time. Hence, when creating public policies, paying attention to school quality is essential, which encompasses the observation and analysis of structures.

Nowadays, we clearly perceive the progress in the massification of K-12 education and the broadening of childhood education. However, some challenges related to the structural and pedagogical challenges remain. Hence, the need to question the legal instances goes beyond reproducing and legitimizing school inequalities (Bourdieu, 2011a; 2011b), in order to foment fairer and more democratic schools and educational processes.

Infrastructure is one of these elements. It is defined as a set of facilities, equipment, furniture, materials, etc., and the base to create and organize learning environments seeking to attend children's care, education, and development in nurseries and preschools (Garcia, Garrido, Marconi; 2017; Silva, 2023).

The spatial context of this text is the city of Belo Horizonte. The data refer to 2019, collected in the *Censo Escolar* [School Census] of the *Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira* – INEP (INEP, 2020). Among other aspects, we opted for the 2019 census considering the challenges and data inconsistencies of the 2020 and 2021 censuses, which were caused and imposed by the pandemic. Besides the census data, we conducted 117 visits to municipal schools of childhood education (EMEIs) out of the 143 schools. This work unfolds from a recently published study (Silva; Braga; Vieira, 2021), which investigated the infrastructure of public and private childhood education institutions from Belo Horizonte.

On that occasion, the researchers identified in the *Censo Escolar* 2018 that, generally, the educational institutions for childhood education in the city presented inequalities in the adequacy levels of spaces and facilities (Silva; Braga; Vieira, 2021). Regarding the public services of water and electric supply, sewage, and basic sanitation, the childhood education schools reached satisfactory levels of adequacy. A considerable part of public and private preschool institutions and an even more significant number of nurseries continue to work in religious spaces, teachers' houses, warehouses, and other places that were not school buildings. Besides this, many had no playgrounds, green areas, and restrooms adapted to children.

The hypothesis in that work was that, despite the general inadequacies of the institutions, the EMEIs, considered a bold and model project in Minas Gerais and the country to attend the first phase of K-12 education (Brasil, 2006), would tend to present a better infrastructure to attend children from 0 to 5 years old. When trying to encompass, in its design, children's development needs in early childhood, EMEIs would be, as a whole, more equipped than private ones. However, the *Censo Escolar* data of that year showed that the EMEIs also presented meaningful inadequacies in spaces and facilities. Besides this, within the universe of municipal public schools, the study perceived a high variation degree among institutions, showing the inequalities in the infrastructure conditions of these schools (Silva; Braga; Vieira, 2021).

Therefore, this work seeks to answer if it is possible to associate the infrastructure inequalities among the EMEIs in Belo Horizonte (dependent variable) and explanatory factors (independent variables). Considering the literature on education inequalities, two explanatory factors were considered: the territory (Érnica; Rodrigues, 2020) and public-private partnership (Adrião, 2018; Fernandez; Rosa; Carraro; Shikida; Carvalho, 2019). A third explanatory hypothesis referred to the limitations of the *Censo Escolar* [School Census] characteristics (Alves; Xavier; Paula, 2019). We considered the filling of this census tool as a possible explanatory factor for inequalities.

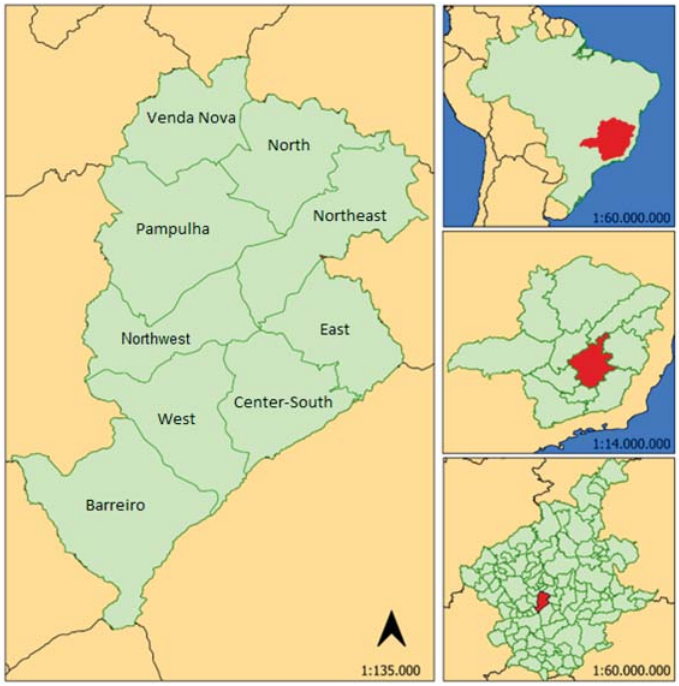
Therefore, the general objective of this work is to analyze which aspects matter for the inequality of educational opportunities for children between 0 to 5 years old, considering the infrastructure in the same public education system presented in the census data. As specific objectives, the work intends to 1) evaluate EMEIs infrastructure adequacy regarding public services, spaces, facilities, and equipment in the 2019 *Censo Escolar*; 2) spatially map the infrastructure adequacy levels in the territory of Belo Horizonte; 3) analyze the infrastructure aspects of schools build by public-private partnerships; and 4) compare the information of *Censo Escolar* with *in loco* visits in the EMEIs.

The EMEIs experience in Belo Horizonte

The *Rede Municipal de Educação de Belo Horizonte* (RME-BH- Belo Horizonte Municipal Education System) is established by public educational institutions that attend childhood education (children from 0 to 5 years old), elementary and middle education (children and teenagers from 6 to 14 years old), and Young and Adult Education (encompassing those that do not participate on it or those who did not finish any schooling phase in the predicted age). In 2021, the RME-BH had 321 of their own schools, out of them 143 EMEIs, 176 elementary/middle municipal schools (EMEFs). Among the latter, 84 also attended some segments of childhood education. Besides this, 216 private institutions were affiliated with the *Prefeitura de Belo Horizonte* (PBH- Belo Horizonte City Hall). When added, the offer of childhood education in the public sector amounted to 445 institutions, besides the 506 non-affiliated private

institutions. These institutions are spatially well-distributed in Belo Horizonte, the capital of Minas Gerais state. Each of the nine regions, presented in Figure 1, Barreiro, Northeast, West, Pampulha, Northwest, North, Center-South, East, and Venda Nova, has an education management office located in the territory aiming to better articulate the regional demands with the Municipal Education Secretary.

Figure 1 – Map of Belo Horizonte and its regions (2019)



Source: Created by authors.

Bibliographic studies indicate that the first school to attend the public from 4 to 6 years old in Belo Horizonte was Escola Estadual Delfim Moreira (Terra, 2008; Rocha, 2009), which, as one of the unfoldings of LDB, Lei nº 9.394/96, was municipalized, becoming one of the first municipal schools of childhood education but the municipal offer started in 1957 with the opening of *Jardim Municipal da Renascença* (Melo, 2016). Between 1957 and 2003 – when PBH started to implement the *Unidades Municipais de Educação Infantil* (UMEI- Municipal Units of Childhood Education), Law nº 8.679, from November 11 –, children's education in the RME-BH encompassed the ages from 4 to 6 years old, mostly in partial hours in the municipal school of childhood education and municipal elementary/middle schools with some childhood education classes (Silva, 2017).

Besides the public offer, other initiatives took place in the late 1970s, with the emergence of community nurseries in the industrial

area of Belo Horizonte (Terra, 2008), motivated by working mothers and the creation of the *Movimento de Luta Pró-Creche* (MLPC- Movement for Nurseries), which, at first, aimed to raise financial resources to maintain the nurseries (Silva, 2017). In 1983, Belo Horizonte City Hall signed the first agreement with the nurseries, intermediated by the Health Secretary (Veiga, 2005). After that, the agreement policy was consolidated in the city. The agreement management was transferred from the Municipal Secretary of Social Assistance to the Municipal Secretary of Education of Belo Horizonte (SMED/BH) in 2002 (Terra, 2008).

Since 2003, childhood education in Belo Horizonte started to be offered in different types of institutions: public ones, such as UMEIs; municipal preschools, former municipal nurseries; elementary schools with childhood education classes; and private ones, with and without public agreements. Throughout the following two decades, the city increased the number of childhood education institutions, which started to have pedagogical and financial autonomy when emancipating and being recognized as schools – Law n° 11.132 (Belo Horizonte, 2018). At first glance, the change of names from *Unidades de Educação Infantil* [Unities of Childhood Education] to *Escolas de Educação Infantil* [Childhood Education Schools] can seem simply bureaucratic, but, in fact, the law implied a significant change in the organizational structure and school management. Before, they were managed by the principal of the headquarters school, who often ignored the specificities and needs of childhood education, among which the structural needs and issues, as in the Resolution CME/BH Nº 001/2015 (Belo Horizonte, 2015).

Materials and Methods

The analysis of EMEIs infrastructure in Belo Horizonte was conducted from the data of Censo Escolar 2019, specifically, the information in schools' forms. In his form, the schools' principals or secretaries fill the presence of lack of items, such as the supply of public services of water and light, basic sanitation and food; building architecture and its facilities; and equipment to develop didactic-pedagogical practices (INEP, 2019). The data were directly imported from the INEP site and processed through *Statistical Package for Social Sciences* (SPSS) software.

Initially, we selected 45 primary variables. In this selection, we sought to encompass elements present in the *Parâmetros Básicos de Infraestrutura para Instituições de Educação Infantil* [Basic Infrastructure Parameters for Childhood Education Instittutions] (Brasil, 2006) and in Article 50 of the Resolution CME/BH nº 001/2015 (Belo Horizonte, 2015). We highlight that, as the *Censo Escolar* data (INEP, 2019) does not inform the dimensions of the school spaces nor the quality of the items, some standards of the aforementioned documents could not be evaluated.

The primary variables were organized into thirteen items of interest (Table 1) that, by complementarity, express a situation of lower, average, and higher adequacy. This complementarity considers the amal-

gamation of school elements for a specific purpose. For example, the Resolution CME/BH (Belo Horizonte, 2015) establishes that the institutions of public childhood education in the capital should have a complete restroom for adults, children's restrooms, restrooms for children with disabilities, and showers. The existence of four primary variables in a school in the item of interest (5) *Restrooms* are the most adequate situation for childhood education. In a situation in which there are no restrooms adapted for people with disabilities or showers, even if it can lead to difficulties in caring for and educating all children, but there are specific restrooms for children separated from adults, the item can be considered as 'basic' in this school. However, the lack of bathrooms for adults or children, leading to the sharing of these spaces by different publics and the specificities of their physiological needs, makes the situation 'inadequate' for this item in that institution.

Following this complementary logic, the table below presents the interest items and the primary variables used for their discrimination. It also presents the values attributed to the combinations, 2 para item "adequate"; 1 for "basic"; and 0 for "bellow basic".

Table 1 – Interest items for the infrastructure analysis of EMEIs in Belo Horizonte

Interest Items	Combination of primary variables	Attributed Value
(1) Water supply	Drinkable water from the public system supply	2
	Drinkable water from outside the public system supply (well, pit)	1
	Non-drinkable water	0
(2) Electric energy	Through public energy system	2
	Other sources to obtain energy (generator)	1
	No electric energy	0
(3) Basic sanitation	Through public system and periodic collection or recycling	2
	Other sources of garbage and sewage disposal	1
	No public system and periodic collection or recycling	0
(4) Food	Meals, kitchen, and cafeteria	2
	Meals together with kitchen or cafeteria	1
	Food with no kitchen and cafeteria	0
(5) Restrooms	Specific restrooms for adults, children, people with disabilities, and shower	2
	At least specific restrooms for adults and children	1
	No specific restroom for adults or for children	0
(6) Administrative facilities	Principal office, secretary, and teachers' room	2
	At least two administrative facilities	1
	At least one or no administrative facility	0

(7) Complementary facilities	Warehouse and pantry	2
	Only one complementary facility	1
	No complementary facility	0
(8) Recreation areas	Covered and open-air schoolyard, green area, and multi-use room	2
	At least two recreation areas	1
	One recreation area and/or yard	0
(9) Library and Reading room	Library	2
	Reading room or reading corner in the classrooms	1
	No reading space	0
(10) Playground and equipment	Playground and toys	2
	Or playground or toys	1
	No playground and no toys	0
(11) TVs and DVDs	Has television and DVDs devices	2
	Has only television	1
	Has no television and DVD	0
(12) Copier and printer	Has a copier and a printer	2
	Has one of the two pieces of equipment	1
	Has neither of the pieces of equipment	0
(13) Sound system and multimedia	Has a sound system and multimedia	2
	Has at least one piece of equipment	1
	Has neither a sound system nor a multimedia equipment	0

Source: Created by the authors based on the schools' forms from *Censo Escolar* (INEP, 2019).

The attributed values for each interest item were calculated as scores aiming to build a synthetic index of infrastructure adequacy for comparison. The scores were transformed into a scale from 0 to 1 to make the index values more easily interpretable. The closer to 0 the school's score, the less adequate the infrastructure was considered when compared to the national parameters and the Resolution CME/BH nº 001/2015 (Belo Horizonte, 2015). In contrast, the closer to 1, the more adequate the infrastructure.

The formula used to build the index was:

$$\frac{1}{n}\sum_{i=1}^{n} x_i$$

in which n is the maximum possible score (26 points), and x_i is the grade reached in the interest item.

The territorial arrangement in the map shape (created using the *software* Qgis), the synthetic infrastructure adequacy index was organized into three categories: bellow adequate, average adequacy, and higher adequacy. To do so, the schools' scores were placed on a *continuum* from lower to higher. Considering this *continuum*, we have opted to use the interquartile range as a *proxy* of schools' classification regarding infrastructure. This range composes, with the standard deviation, the variance of the statistical measures that evaluate the degree of data spreading around a center (median). While the standard deviation and the variance calculate the dispersion measure disregarding the order of the data, the interquartile range evaluates the data spreading after its ascending order (Pinheiro; Carvejal; Cunha, 2012).

The interquartile range is calculated using the quartiles (25% of data). The first quartile (inferior), the intermediary quartile (median), and the third quartile (superior) are connected to the concept of quartile, that is, the points established in the regular intervals from the cumulative distribution function (CDF). The quartiles divide the data ordered in q subsets of data of essentially equal dimensions. Therefore, they originate the q-Quantis established from the cutoff points determining the limits between the consecutive subsets (Pinheiro; Carvejal; Cunha, 2012). Thus, we established the criteria of lower, average, and higher infrastructure adequacy of EMEIs in Belo Horizonte, respectively, the scores with values under the first quartile; between the first and the third quartile; and above the third quartile.

Results and Discussion

According to the information of *Censo Escolar* (INEP, 2019), Belo Horizonte had 145 EMEIs in 2019, 99 of them managed by PBH, the other 46, by Inova-BH/Transpes, through a public-private partnership (PPP). The first part of this section describes the adequacy levels of childhood schools considering the interest items of the research. It also discusses the inequality implications in the infrastructure of EMEIs for the education reality of children from 0 to 5 years old in the nurseries and preschools in the capital. In the second part, we test the three hypotheses of explanatory factors for inequalities.

Infrastructure conditions and Inequalities between EMEIs: evidence from the Censo Escolar

The infrastructure of school institutions is a fundamental aspect of improving the care of babies and children. In the literature, the school space is a meaningful element of the curriculum, a source of experience and learning, a living entity, concrete, considered as a pedagogical partner of the teacher, portraying the concepts of childhood, education, and teaching (Frago; Escolano, 1998; Horn, 2017; Silva, 2023).

Regarding the public services (water supply, electric energy, basic sanitation, and food), all EMEIs have an adequate situation. That is,

all the elements determined in the legislation are present. In the other nine interest items, the schools have differences in the varied levels of inequality.

On the item restroom (Table 1), the *Censo Escolar 2019* (INEP, 2019) points out that half of the schools had restrooms for adults, children, adapted for people with disabilities (45.5%) and showers (55.2%). PPP built nine out of the twelve schools that had no specific restrooms.

Table 1 – EMEIs adequacy level regarding restrooms

	N	%
Bellow adequate	12	8.3
Basic	60	41.4
Adequate	73	50.3
Total	**145**	**100.0**

Source: *Censo Escolar* (INEP, 2019).

Regarding the administrative facilities (Table 2), the principal's office was the space that had the highest percentage of absence in the EMEIs. They were lacking in 27.6% of schools in the *Censo Escolar* 2019 (INEP, 2019). This can be related to the fact that there were school unities until 2018. In these cases, many issues related to the principals were dealt with in the headquarter-school. The teachers' room was present in 96.6% of the schools. Only one school, EMEI Sarandi, in the Pampulha region (built through a PPP), did not register any administrative facility in the census, informing a lack of a principal's office, secretary, or teachers' room.

Table 2 – EMEIs adequacy level regarding the administrative facilities

	N	%
Bellow adequate	7	4.8
Basic	39	26.9
Adequate	99	68.3
Total	**145**	**100.0**

Source: Censo Escolar (INEP, 2019).

The other focused facilities were adequate for more than half the schools (Table 3). However, a significant number of EMEIs registered in the *Censo Escolar* (INEP, 2019), only one of the facilities: the warehouse or the pantry. The latter was more common than the first, being present in 94.5% of the records of *Censo Escolar* 2019 (INEP, 2019) against 53,1%, respectively.

Table 3 – EMEIs adequacy level regarding the complementary facilities

	N	%
Bellow adequate	5	3.4
Basic	66	45.5
Adequate	74	51.0
Total	**145**	**100.0**

Source: Censo Escolar (INEP, 2019).

Regarding the playgrounds (Table 4), according to the *Censo Escolar* 2019 (INEP, 2019), no EMEI had all the specific spaces listed in the regulation documents of PBH (covered yard, open space with sunlight, green area, and multiuse room). Only one in three had a green area. The same happened with covered yards and open areas. Over half of the EMEIs (53.1%) had no multiuse room.

Table 4 – EMEIs adequacy level regarding playgrounds

	N	%
Bellow adequate	134	92.4
Basic	11	7.6
Total	**145**	**100.0**

Source: Censo Escolar (INEP, 2019).

Regarding reading spaces, more than half of the EMEIs recorded not having one in the *Censo Escolar 2019* (INEP, 2019). Proportionally, there were fewer schools managed by PBH with adequate libraries than those managed by PPP. While 26.2% of PBH EMEIs were adequate, 82.6% of the Inova-BH/Transpes EMEIs had the same level, as informed in the census form by the schools' principals or secretaries.

Table 5 – EMEIs adequacy level regarding libraries and reading rooms

	N	%
Bellow adequate	79	54.5
Basic	11	7.6
Adequate	64	44.1
Total	**145**	**100.0**

Source: Censo Escolar (INEP, 2019).

The playing components, in 2019, were adequate for most EMEIs of Belo Horizonte. The schools were equipped with spaces for playing and pedagogical materials, such as games and toys. Despite this, an impressive number of schools registered in the *Censo Escolar* that year (INEP, 2019) did not have a playground (37.2%). Of these, 31 were managed by PBH and 23 by Inova-BH/Transpes.

Table 6 – EMEIs adequacy level regarding toys and plays

	N	%
Basic	55	37.9
Adequate	90	62.1
Total	**145**	**100.0**

Source: Censo Escolar (INEP, 2019).

Considering the complementary facilities, most EMEIs were adequate. More than 84% of them recorded, in the *Censo Escolar* (INEP, 2019), that they were equipped with sound systems and multimedia and, for more than 91%, TVs and DVDs. Regarding copiers and printers used for administrative services and activities for the children, half of the schools had none of them.

Table 7 – EMEIs adequacy level regarding copiers and printers

	N	%
Bellow adequate	73	50.3
Basic	34	23.4
Adequate	38	26.6
Total	**145**	**100.0**

Source: Censo Escolar (INEP, 2019).

The infrastructure investment is essential to combat the inequalities, the differentiated access to hygiene spaces (restrooms), administrative and complementary facilities, recreation areas, libraries, reading rooms, and equipment, such as copiers and printers. They tell us about the hierarchies and the opportunities for children and teachers to develop in the school environment. Different structures, sometimes unequal, create different learning opportunities. The government and civil society need to foment mechanisms to equalize environments that allow for more positive and successful educational experiences, aiming for education with social quality.

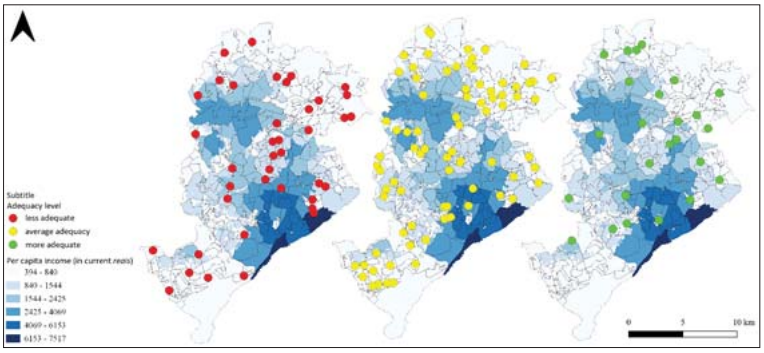
Do location and public-private partnership explain the inequalities?

Considering the object of infrastructure inequalities in childhood education schools in Belo Horizonte, we tested the hypothesis of the distribution of these inequalities in the territory as a possible explanatory factor. We expected that the schools with less adequate conditions (and more precarious ones) would be located in the peripheral regions and/or with a high poverty concentration, according to the pattern identified in other schooling levels in Brazilian metropolises (Érnica; Batista, 2012; Érnica, 2013; Koslinski; Alves; Lange, 2013).

When analyzing the EMEI's spatial distribution by adequacy level regarding families' *per capita* income, the data indicates that the correlation between these two variables can be considered weak ($\rho_s = 0{,}28$). This low correlation is also evident in schools' spatial distribution in

the maps (Figure 2). Thus, it is not possible to distinguish a clear correspondence between schools with less or more adequate levels and the regions with the worst economic indicators in the city (lighter areas in the maps).

Figure 2 – EMEIs distribution maps per adequacy level and per capita income in Belo Horizonte, 2019



Source: Created by the authors.

Even if a smaller percentage of EMEIs was located in areas with more income (Silva; Braga; Vieira, 2021) – the darker blue areas in the maps– the proportion of schools with more adequate infrastructure (green points) is not substantially higher than less adequate ones (red points) to be perceptible in the graphic representation. In the same measure, the proportion of red points is not clearly distinguishable in the areas with less income *per capita* in the capital of Minas Gerais.

On the other hand, when evaluating the proportion of schools in each adequacy level, it is possible to make some remarks in another sense (Table 8). The data reveal that, proportionally, 29.7% of the schools from low-income neighborhoods have low adequacy of infrastructure, while 18.2% of the schools with higher *per capita* income were in this situation. 17.1% of the schools with higher adequacy indexes are located in the poorest neighborhoods, while the same occurred in 20,0% of the schools with more income per family.

Table 8 – Proportion of EMEIs per adequacy level and neighborhood category

	Low-income	Middle class	High class	**Total**
Less adequate	29.7%	53.2%	17.1%	**100,0**
Average adequacy	21.1%	63.2%	15.8%	**100,0**
More adequate	13.3%	66.7%	20.0%	**100,0**

Source: Censo Escolar (INEP, 2019).

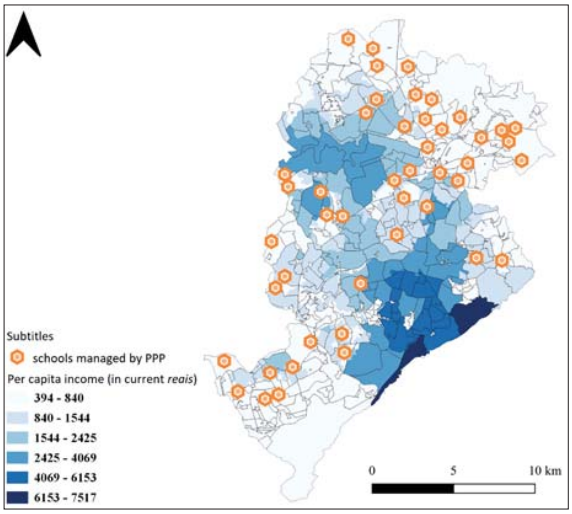
Therefore, the analyzed data suggest some evidence that the middle and high-class neighborhoods concentrated the higher proportion

of EMEIs with adequate levels of infrastructure. However, the dispersion of this type of school in the city and the dispersion of less adequate schools in the capital make the effect-territory a factor with less explanatory effect on the infrastructure inequality of the EMEIs.

We also tested the hypothesis of inequalities based on schools' management regimes. We compared the infrastructure adequacy in the EMEIs directly run by PBH with those built and non-pedagogically managed by a public-private partnership agreement.

The 46 schools kept by PPP were relatively well-distributed in the territory (Figure 3). Only eight were located in low-income neighborhoods (five in middle-class ones and three in neighborhoods with a higher *per capita* income in the city).

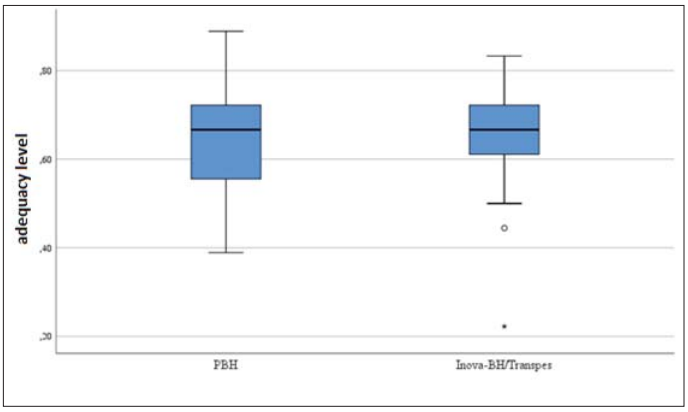
Figure 3 – EMEIs distribution map managed by Inova-BH/ Transpes per income and *per capita* in Belo Horizonte, 2019



Source: Created by the authors.

The index average of schools with direct administration was slightly lower than those in Inova-BH/Transpes schools (0.64 and 0.65), according to Figure 3. However, the Mann-Whitney test showed that the administration model did not affect EMEIs' infrastructure adequacy (U=2057,500; p>0,05). That is, there was no significant statistical difference between the medians. The variation coefficient of the adequacy levels of PBH schools was also lower than those of Inova-BH/Transpes schools, 16.7% against 18,2%. Hence, there is a higher inequality between the schools run by PPP.

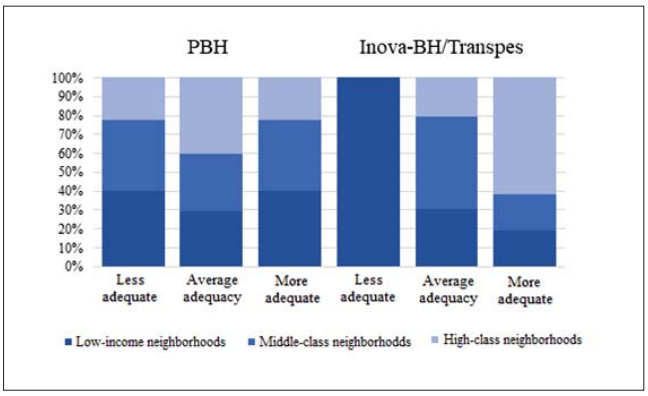
Figure 4 – *Boxplot* with the distribution of EMEIs infrastructure adequacy level per administration in Belo Horizonte, 2019



Source: Created by the authors.

Despite not having a significant statistical difference between the indexes of schools managed by PBH and by Inova-BH/Transpes, the distribution of these EMEIs by level and neighborhood class (Figure 5) allows for some reflections. While, for PBH schools, the distribution of childhood schools' infrastructure less and more adequate is relatively equivalent in low-income and high-income neighborhoods, the same is not true for Inova-BH/Transpes schools. In these, all schools with the worst infrastructure levels are in the neighborhoods with low *per capita* income. On the other hand, two in every three schools with more adequate levels are in high-income neighborhoods.

Figure 5 – Percentage of EMEIs infrastructure adequacy level per administration and neighborhood type in Belo Horizonte, 2019



Source: Created by the authors.

Therefore, data suggest that the location choices to build the EMEIs by a public-private partnership follows a logic to attend to the

most vulnerable population in the city. However, projects of more adequate infrastructure for childhood education seem to be prioritized for more economically- favored areas in Belo Horizonte.

Regardless, the coexistence of various adequacy levels within the same model of construction and management of EMEIs via PPP, with those of PBH, weakens the explanatory power of this variable for the infrastructure inequalities of childhood education schools. In the face of an insufficient causal explanation, a direct observation of the schools' spaces and structure was needed.

Comparison between the data from *Censo Escolar* and in loco *visits*

Finally, we compared the *Censo Escolar 2019* (INEP, 2019) data with technical visits to the EMEIs in 2021. The visits took place during the field research of the Belo Horizonte phase of the *Estudo Nacional sobre Qualidade da Educação Infantil*[2] [National Study on Childhood Education Quality] and, as presented at the beginning of the text, 117 of the 143 EMEIs in the city (82% of the total). The observation list and interviews of the *Estudo Nacional* involved different aspects related to the quality of learning environments, such as children's educational opportunities, their interactions and everyday plays/games; professionals' profiles, motivations, and needs that are part of the system; and the physical structure and organization of the unit visited.

For this study, we selected all six items in the observation list corresponding to the *Censo Escolar* 2019 (INEP, 2019): covered and open-air schoolyard, adapted restrooms for childhood education; playground; green area; and toys. We considered only the 117 EMEIs visited. The data of Table 9 show a discrepancy between the information filled in the *Censo Escolar* and those checked in person:

Table 9 – Comparison of the percentage of items in EMEIs in the *Censo Escolar* 2019 and the *in loco* visit

Checked item	Presence in the EMEIs (%)	
	Censo Escolar 2019	*In loco* visit
Covered schoolyard	35.9%	66.5%
Open-air schoolyard	0%	99.1%
Adapted restroom	84.6%	99.6%
Playground	64.1%	98.7%
Green area	36.8%	94.0%
Toys	91.5%	93.1

Source: Created by the authors.

Except for adapted restrooms and the presence of toys that, though different, had similar percentages, the distortion between the school reality informed in the Censo Escolar (INEP, 2019) and that observed by the researchers was very significant. For example, though 11

EMEIs informed in the INEP form that they had no adapted restrooms for children from 0 to 5 years old, with adequate sizes, models, and materials, this situation was seen in only one EMEI. In the other ten, we saw the restroom with the needed adaptations. Likewise, none of the 117 EMEIs informed having open-air external spaces for recreational activities. However, this type of area was identified in 116 EMEIs. Forty-one EMEIs said they were not equipped with a place for childhood education with installations/equipment designed for safe recreational activities, games, and toys. However, the visits revealed that his lack could only be confirmed in two EMEIs. If we consider only the six elements previously listed, the reality of the schools could be considered more adequate than that informed in the census. Thus, it is reasonable to suppose that the other items may also present inconsistencies in their filling. The *in loco* visits indicate that the EMEIs of Belo Horizonte have better offer conditions and present a more adequate situation than the information indicated in the *Censo Escolar*.

By extension, some inadequacies of infrastructure identified in the *Censo Escolar* (INEP, 2019) and reported by the literature that uses this instrument to evaluate the offer conditions can partly be explained by mistaken interpretation in the filling of forms. Considering the data collection of INEP (2019) aims to monitor and evaluate different aspects of Brazilian educational reality and foment public policies, the lack of accuracy in its filling can create inaccurate diagnoses and, consequently, imprecise, unnecessary, and less effective interventions, regarding the improvement of public school quality. In this sense, the secretaries and INEP should pay more attention to the adequate formation of the workers responsible for filling this data/information in the platform.

Final Remarks

To effectively fulfil the right to education presented in the 1988 Constitution, education, in all its phases, should be offered in equal conditions for access and permanence, and the guarantee of quality standards (Brasil, 1988, sec. I and VI of art. 206). Childhood education, as an integral part of the structure of Brazilian K-12 education since 1996 – and compulsory since 2009 – should also have adequate buildings, spaces, and facilities for the public. The increasing number of studies about the infrastructure of institutions for children between 0 to 5 years old in the Brazilian education research agenda shows this theme's importance. After all, the school infrastructure of childhood education is one of the aspects to promote quality education; the space educates children, like a teacher; can favor learning or not; and affects users' lives and the work satisfaction of education workers.

Despite being considered a successful experience in consolidating education for young children in nurseries and preschools and being a model and reference for other systems in Brazil, Belo Horizonte still presents inequalities in the infrastructure adequacy of its childhood education system. Though all municipal schools of childhood educa-

tion in the city have their specific own buildings and are supplied by public services of water, energy, basic sanitation, and food, the *Censo Escolar* and the *in loco* research show that there are still units with no restrooms adapted for the children, green areas, children's playgrounds and toys, libraries/reading rooms, and administrative and complementary facilities.

This work investigated if it was possible to associate the infrastructure inequalities between the EMEIs in Belo Horizonte (dependent variable) and explanatory factors (independent variables), seeking the reasons for these lingering inequalities within the same system. To do so, we tested three hypotheses: the effect territory; the presence of schools built and managed through public-private partnerships; and the filling of *Censo Escolar*.

The research perceived a higher proportion of less adequate schools in low-income neighborhoods in the city; and a higher proportion of schools with higher adequacy levels in neighborhoods with high *per capita* income. We also identified that the distribution of less and more adequate schools between the types of neighborhoods per income was more balanced between schools managed by a PBH than those of PPP. The schools with less adequate infrastructure built by agreement were all located in low-income neighborhoods, and more than half of the schools with better adequacy were concentrated in neighborhoods with higher incomes in the capital.

Even with these findings, the results do not allow us to affirm that there is a territorial distribution pattern on the infrastructure inequalities of EMEIs. The spatial distribution of more or less adequate schools encompasses areas with higher income and peripheral ones. Similarly, even if the PPP schools have infrastructure indexes with a higher average than those of PBH, this difference is not statistically significant. Besides this, the affiliated schools, even with a slightly higher average, also present a standard deviation higher than the index, indicating a higher internal inequality in the schools' infrastructure.

Thus, the hypothesis of the location effect and the public-private partnership help to understand childhood education offered by EMEIs in Belo Horizonte but presented themselves as insufficient explanatory factors for the inequality phenomenon in the infrastructure of the institutions identified in the census tool.

We also highlight that the inequalities evidenced by the studies seem to be, to a certain measure, the direct result of the nature of the data used, as the *Censo Escolar* is a self-declaration filled by the schools' principals or secretaries. It may not reliably indicate reality, which might be a limit of this public policy tool. The support for this statement can be seen through the observations held in the schools of the municipal system of Belo Horizonte.

A limitation of this research is that only some elements of the *Censo Escolar* were examined *in loco*. Therefore, we suggest other studies that locally check more items. Besides this, we need to problematize

the items themselves, as well as their descriptions, in the *Censo Escolar*. When seeking to encompass such different phases of K-12 education, some items lose their role in the analysis and evaluation of childhood education. Furthermore, in certain aspects, the lack of elements related to structure depends on the interpretation of the professional in charge of filling in the data. Hence, we need to reflect if such metrics distort the results. We also suggest studies that consider other explanatory factors for inequalities, such as those that analyze the date of construction, transfer of management, profile of the public and type of service, eventual changes in the structural project during time, and the financial resources for EMEIs' constructions and maintenance.

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Notes

1 Approved in 2015 during the World Education Forum, which took place in Incheon, South Korea.

2 The study was nationally coordinated by the *Laboratório de Estudos e Pesquisas em Economia* Social in *Universidade de São Paulo campus Ribeirão Preto* (LEPES/USP), together with *Fundação Maria Cecilia Souto Vidigal* (FMCSV), *Itaú Social*, and the *Movimento Bem Maior*. Between November and December 2021, 400 childhood education classes were visited to analyze, based on international indicators, the quality of the level in the city. More information can be found in the site http://lepes.fearp.usp.br/estudo-nacional-de-avaliacao-da-qualidade-da-educacao-infantil/.

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