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Technical education integrated into high school in federal institutes: compliance with Law 11.892/2008 (2017-2022)

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ABSTRACT. Technical Education Integrated into High School (EMI) at Federal Institutes (IFs) is crucial for complying with Law n° 11.892/2008, which requires that at least 50% of enrollments (MEq) be allocated to technical courses. This quantitative study investigated the role of EMI in achieving this goal, analyzing its distribution regionally and nationally across the country. The research revealed that the Northeast leads in offering enrollments, accounting for 37% of the national total, followed by the Southeast (23%), the South (17%), and the Central-West and North regions (approximately 10% each). EMI, responsible for 55% of MEq, stands out as an essential tool for meeting the legal requirement, promoting a comprehensive education that combines technical skills and critical development.

Keywords: professional education; legislation; vocational education integrated.

O ensino médio integrado nos institutos federais: atendimento à Lei 11.892/2008 (2017-2022)

RESUMO. O Ensino Médio Integrado (EMI) nos Institutos Federais (IFs) é crucial para cumprir a Lei n° 11.892/2008, que determina que ao menos 50% das matrículas-equivalentes (MEq) sejam destinadas a cursos técnicos. Este estudo quantitativo investigou o papel EMI para alcance desta meta, considerando a distribuição regional e nacional no país. A pesquisa revelou que o Nordeste lidera a oferta de matrículas com 37% do total nacional, seguido pelo Sudeste (23%), Sul (17%), Centro-Oeste e Norte (cerca de 10% cada). O EMI, responsável por 55% das MEq, destaca-se como uma ferramenta essencial para o alcance da meta, além de promover uma formação omnilateral que combina competências técnicas e desenvolvimento crítico.

Palavras-chave: educação profissional; legislação; ensino médio integrado.

La educación profesional integrada a la educación media en los institutos federales: cumplimiento de la Ley 11.892/2008 (2017-2022)

RESUMEN. La Educación Media Integrada (EMI) en los Institutos Federales de Educación Profesional (IF) es fundamental para el cumplimiento de la Ley n° 11.892 (2008), que exige que al menos el 50% de las matrículas (MEq) se destinen a cursos técnicos. Este estudio cuantitativo investigó el papel de la EMI en el logro de este objetivo, analizando su distribución a nivel regional y nacional en todo el país. La investigación reveló que la región Nordeste lidera en la oferta de matrículas, representando el 37% del total nacional, seguida por el Sudeste (23%), el Sur (17%) y las regiones Centro-Oeste y Norte (aproximadamente el 10% cada una). La EMI, responsable del 55% de las MEq, se destaca como una herramienta esencial para el cumplimiento del requisito legal, promoviendo una educación integral que combine habilidades técnicas y desarrollo crítico.

Palabras clave: educación profesional; legislación; educación media integrada.

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Introduction

The Technical Education Integrated into High School (Ensino Médio Integrado – EMI) envisions the aspirations of a unitary and omnilateral school, providing lower levels of inequality in opportunities so that any student, regardless of social class, gender, or racial/ethnic background, may, through publicly funded education, pursue the educational path they desire.

Law n°. 11,892 (2008) establishes that, within the scope of the Federal Institutes, at least 50% of equivalent enrollments (MEq) must be allocated to technical education courses, prioritizing their provision in the integrated format. In this context, understanding the role played by EMI is essential for assessing compliance with the legislation and analyzing the impact of this modality on the configuration of institutional offerings. Article 7, item I, of the aforementioned law states that the Federal Institutes must "[...] provide professional technical education at the secondary level, primarily through integrated courses [...]", reinforcing the centrality of this modality within the institutional mission (Lei n°. 11,892, 2008).

Historically, it is important to highlight the differences between the EMI and Technical Secondary Education (Ensino Médio Técnico – EMT). EMT was the model adopted prior to the creation of the IFs in 2008, mainly by the Federal Technical Schools, Federal Agricultural Schools, and Federal Centers for Technological Education (CEFETs), whereas EMI became consolidated with the establishment of the Federal Institutes of Education, Science and Technology (IFs) [1].

In EMT programs, general secondary education and technical education contents were taught in parallel manner, allowing students to obtain certification independently in both secondary education and technical training. Although these schools were recognized for the quality of education they provided, this conception did not include the perspective of an omnilateral education or the requirement for interconnection among disciplines, as occurs in EMI.

Frigotto (2018) portrayed the sociopolitical context surrounding the development of technical schools and pointed to the reinforcement of technicism during the civil-military dictatorship period under the pedagogical perspective of polyvalence. During the post–civil-military dictatorship period, under the administration of President José Sarney (1985–1990), the perception of the need to strengthen technical education gained momentum through the Technical Education Expansion and Improvement Program (PROTEC) in 1986. The program aimed to build 200 new schools. Although this number was not fully achieved, the period witnessed significant growth in the educational network, characterized by the restructuring of existing technical schools and the creation of CEFET-MA and CEFET-BA.

The expansion of technical education faced financial difficulties following the approval of Law n°. 8,948 on December 8, 1994, at the end of the government of President Itamar Franco. This law did not provide federal funding for new schools, indicating instead that financial support should be secured through agreements involving municipalities, states, productive sectors, or non-governmental organizations (Lei n°. 8,948, 1994).

The relevance of resuming the debate on a new model for the Law of Guidelines and Bases of National Education (LDB) coincided with the process of redemocratization. After a long period of discussion, initiated by Draft legislation (Projeto de Lei – PL) N°. 1,258/1988, Law n°. 9,394 was enacted on December 20, 1996, by the National Congress. The government of Fernando Henrique Cardoso was criticized by the academic community, which perceived a predominant orientation toward fiscal adjustment, State reform, and productive restructuring, to the detriment of massive investment in Public Education (Frigotto, 2018).

The change in the educational profile of EMT was consolidated through the creation and expansion of the EMI proposal during the government of Luiz Inácio Lula da Silva, through Decree n°. 5,154 (Decreto n° 5,154, Art. 4, § 1):

> § 1 The articulation between upper secondary technical professional education and secondary education shall occur in the following manner:
>
> I – integrated, offered only to students who have already completed elementary education, with the course designed to lead the student to a technical professional qualification at the secondary level within the same educational institution, with a single enrollment for each student;

The Marxian conception of polytechnic education provides a theoretical foundation for thinking about EMI, as discussed by Dermeval Saviani (1989, p. 18, emphasis added):

> If we think in this way, it seems possible to understand more clearly the meaning of polytechnic education. If the aim is to organize secondary education on the basis of polytechnic education, it would not mean multiplying qualifications infinitely in order to cover every possible form of activity that may be identified in society. Rather, it means organizing workshops, that is, real work processes, because polytechnic education presupposes the articulation between manual and intellectual labor. This should be organized in such a way as to enable the assimilation not only theoretical, but also practical, of the scientific principles that underlie modern organization. Those scientific principles that the student has already encountered

[1] The remaining Federal Centers for Technological Education (CEFETs) after 2008 (CEFET-RJ and CEFET-MG) offer only EMI with no possibility of pursuing either technical education or general secondary education separately.

during elementary education, those notions from the Natural Sciences and Social Sciences that were assimilated in their theoretical sense, as an expression of how nature is constituted and behaves, and how society is constituted and behaves, must now be understood not only theoretically.

Karl Marx and Friedrich Engels' educational conception was found by Afonso and Gonzalez (2020) to share similarities with EMI through the articulation between theory and practice, conceptual education not solely devoted to industrial or business interests, and the association of intellectual labor with technical manual labor.

In Brazil, the implementation of EMI gained national scale with the creation of 38 Federal Institutes of Education, Science and Technology, as established by Law n°. 11,892, enacted on December 29, 2008 (Lei n° 11.892, 2008). This measure incorporated former Federal Agricultural Schools, most of the Federal Centers for Technological Education (CEFETs), and isolated technical schools.

From a legal perspective, the IFs have as their fundamental goals the provision of high-quality professional and technological education, the development of extension and research activities across the different regions of the country, the strengthening of local productive arrangements, and the fulfillment of workforce training demands at both regional and national levels (Lei n° 11.892, 2008). These objectives reflect the commitment of the Federal Institutes to promoting education aligned with the needs of productive sectors and with the country's socioeconomic development.

One question raised in this process concerns the difference between the IFs established from 2008 onward, and the federal schools, whose history dates back several decades. Regarding the debate presented thus far, it is evident that the IFs were conceived with the mission of reformulating the polyvalent structure inherited from these institutions since their origins, such as the Schools of Apprentices and Craftsmen created in 1909, which evolved over time into the current federal professional schools. Another perspective to be considered is that the IFs are subject to specific legal criteria, guaranteeing, for example, a minimum offer of 50% of Equivalent Enrollments (MEq[2]) in technical education courses and 20% in teacher education programs (Lei n° 11.892/ 2008).

A point of pedagogical debate between EMT and Integrated EMI may arise from the difficulty of providing adequate teacher training and pedagogical support for this type of educational modality. Would the mere transformation of federal school units into Federal Institutes be sufficient to alter the teaching-learning approach, especially in schools historically associated with technicist characteristics?

In the context of cultural issues, it is relevant to consider that many of the institutions converted into IFs possess a long historical trajectory, with pedagogical characteristics established over decades. In the case of teachers, it is believed that educational environments were formed around the use of traditional pedagogical methods. Given this scenario, certain difficulties emerge in the integration process, since professionals are accustomed to conventional approaches[3].

During the period between the creation of the IFs in 2008 and 2023, several studies were conducted with the aim of improving the understanding of EMI, which will be discussed in the following paragraphs.

Aspects related to the Marxian conception of EMI were discussed by Moura (2013), who, in his text, reflects on the difficulties inherent in political disputes over budget allocation (especially regarding the role of the Sistema S), the subordination of school education to an immediate market-oriented attitude, and the criticisms directed at EMI — both from conservative academics inspired by Enlightenment and liberal humanist perspectives, and from progressive scholars who interpret it as a concession to the interests of capital. The author's proposed solution lies in the pursuit of omnilateral education as the guiding conception for student formation, regardless of income, gender, or racial/ethnic background.

Concerned with the approach to specific pedagogical practices for EMI, Santos et al. (2018), in their research conducted on articles published between 2007 and 2017, concluded that most integration occurs through interdisciplinary projects as isolated integration initiatives, while greater difficulties were identified in practices related to human formation.

Arantes et al. (2023) conducted a study with 1,077 teachers from the 38 Federal Institutes (IFs) regarding teachers' perceptions of EMI. As a result, they identified difficulties related to the concept of unitary

[2] The concept of Equivalent Enrollments is referred to as *Mateq* (Ordinance No. 146, 2021); however, in this study, due to graphs and legends, the shorter abbreviation *MEq* was adopted. The concept of Equivalent Enrollment is derived from the notion of equivalent student.

[3] It should be considered that teachers of technical disciplines do not always possess pedagogical training, despite the provisions established by the Law of Guidelines and Bases of National Education/1996 (LDB/1996). Even when such training is present, it is questionable whether a full understanding of EMI is effectively developed among professionals such as engineers, administrators, veterinarians, agronomists and even licensed teachers. Nevertheless, in 2017, the National Congress approved Law N°. 13.415/2017, which revised the LDB/1996 and established the National Common Curricular Base (BNCC) model. In the field of teacher education, the legislation amended Article 6 of the LDB, allowing professionals with recognized expertise (*notório saber*) to teach subjects related to their area of training. To some extent, this mechanism discouraged professionals holding bachelor's degrees from pursuing teacher education programs or pedagogical certification, which may hinder the full implementation of EMI.

education and observed that teachers tend to fragment the integrated proposal, idealizing their own approach as though it constituted the whole. According to the authors, the university and social background of teachers, who do not belong to the dominant class, was considered a factor contributing to the difficulties in implementing integration.

In 2022, the IFs accounted for 95% of enrollments in the Federal Network of Professional, Scientific, and Technological Education (RFEPCT), encompassing 602 campuses, 11,096 courses, 1,437,395 enrollments, 1,045,649 vacancies, 486,924 graduates, and 737,722 new entrants (Ministry of Education, 2023). In the same year, technical education courses were offered in 596 campuses, totaling 5,017 courses, 492,609 enrollments, 163,584 available seats, 79,147 graduates, and 143,660 new entrants, representing offerings in 99% of IF campuses. Regarding EMI, its presence was recorded in 530 campuses, comprising 2,290 courses, 271,664 enrollments, 73,021 available seats, 53,932 graduates, and 70,542 new entrants (Ministério da Educação, 2023).

Based on these considerations, the purpose of this study was to determine, using the RFEPCT database available on the Plataforma Nilo Peçanha (PNP), the contribution of EMI to compliance with the legislation establishing a minimum of 50% of Equivalent Enrollments (MEq) in the Federal Institutes, both at the national level and across the different regions of the country. Failure to comply with the legislation may result in administrative measures, such as the denial of authorization for the opening of new courses, in addition to possible sanctions regarding the funding of institutions or campuses that do not conform to the established regulations.

The quantitative distribution of EMI vacancies across the regions of the country was also compared with data from the 2022 Census, with the objective of identifying differences in the structure of educational provision throughout the country

Methodology

This study consists of a bibliographic-documentary investigation employing a quantitative approach, grounded in the consultation and systematization of data available on the Plataforma Nilo Peçanha (PNP), using data corresponding to the 2017–2022 reference years. Based on the compilation of enrollment and Equivalent Enrollment (MEq) data, the necessary filters were applied for the identification and characterization of the study.

The Equivalent Enrollment (MEq), established by the Secretariat for Professional and Technological Education (SETEC) through Ordinance n°. 25 of August 13, 2015[4], constitutes a management instrument that adopts different weighting factors according to the type of course offered and the number of laboratories required, referred to as the 'course effort factor' (CEF). In addition, there is a workload criterion applied exclusively to Initial and Continuing Education (FIC) courses, in which the unitary proportion corresponds to a baseline parameter of 800 hours. For all other courses, including technical education programs, no workload reduction factor is applied in the calculation of MEq.

Technical Education comprises courses linked to technical training and may be offered in integrated, concomitant, Youth and Adult Education (EJA), or subsequent formats. Each type of course is assigned a weighted equivalent enrollment value.

For the execution of the data selection process, the following parameters were considered: Academic Organization (Federal Institutes – IFs); Enrollment Years (2017, 2018, 2019, 2020, 2021, and 2022); Course Modality (in-person and distance learning); Location (national level, Northeast Region, North Region, South Region, Southeast Region, and Midwest Region); Types of Courses (all); and Technological Axis (all).

The analysis comprised three main stages: (1) identification of the annual evolution of Total Technical Equivalent Enrollments (MEqTec Total) and Total Equivalent Enrollments (MEq Total); (2) determination of the relative participation of EMI within the total MEq allocated to professional technical education; and (3) comparison between the regional distribution of EMI enrollments and the population data from the 2022 Demographic Census.

For the analysis, tables and graphs were developed to represent trends and percentage variations, enabling the identification of temporal and regional patterns. The combined analysis of unit enrollment data, MEq data, and census data made it possible to simultaneously assess compliance with the legislation and the territorial distribution of educational provision.

[4] The Equivalent Student indices were modified by Ordinance n°. 146 (2021).

National and Regional Distribution of Equivalent Enrollments (MEq) in Technical Education Integrated into High School (EMI) at the IFs

To guide this study, the recorded MEq values related to the IFs were compiled, considering each region of the federation. For comparative purposes, MEq values corresponding to the total number of courses offered by each IF (Total MEq) were also obtained, encompassing programs ranging from short-term professional training courses to technical, undergraduate, and graduate programs.

The records of Total Technical Equivalent Enrollments (MEqTec Total) and Total Equivalent Enrollments (MEq Total) for the 2017–2022 period are presented in Table 1.

National data demonstrated compliance with the minimum requirement of 50% of MEq allocated to technical education programs throughout the entire 2017–2022 period, with values ranging from 65.54% (2017) to 56.50% (2022), resulting in a 13.80% decrease in the relative participation of technical education programs. Based on these findings, a gradual reduction in the number of vacancies offered in technical education programs was observed within the broader educational context. The persistence of this trend may pose a threat to compliance with the legislation in the coming years.

Table 1. Distribution of MEqTec Total and MEq Total by region.

Region	Type of enrollment	2017	2018	2019	2020	2021	2022	Δ [%] 2017-2022
National	MEqTec Total	516,194.52	522,539.10	539,095.90	519,845.43	502,652.91	528,.596.22	2.40
	MEq Total	787,617.11	812,922.70	860,893.00	853,663.40	881,485.75	935,639.68	18.79
	MEqTec Total. / MEq Total ratio	65.54	64.28	62.62	60.90	57.02	56.50	-13.80
Northeast Region	MEqTec Total	197,881.78	200,633.50	206,942.30	197,603.29	187.855.36	197,290.17	-0.30
	MEq Total	287,495.94	293,499.00	312,037.70	305,595.59	313.674.71	328,002.99	14.09
	MEqTec Total. / MEq Total ratio	68.83	68.36	66.32	64.66	59.89	60.15	-12.61
Southeast Region	MEqTec Total	110,976.91	114,920.10	120,873.70	115,861.89	122.283.73	130,133.37	17.26
	MEq Total	184,664.32	197,010.60	209,813.70	206,963.59	227.694.74	242,974.90	31.58
	MEqTec Total. / MEq Total ratio	60.10	58.33	57.61	55.98	53.71	53.56	-10.88
South Region	MEqTec Total	85,313.24	88,364.20	90,397.90	84,234.08	80.799.66	85,835.35	0.61
	MEq Total	132,397.18	140,720.10	148,549.00	143,081.71	143.006.75	154,627.48	16.79
	MEqTec Total. / MEq Total ratio	64.44	62.79	60.85	58.87	56.50	55.51	-13.85
North Region	MEqTec Total	73,074.31	68,213.40	70,113.40	70,225.85	62.090.39	62,904.55	-13.92
	MEq Total	100,210.28	94,261.90	99,743.20	104,719.19	100.474.55	105,997.00	5.77
	MEqTec Total. / MEq Total ratio	72.92	72.37	70.29	67.06	61.80	59.35	-18.62
Midwest Region	MEqTec Total	48,948.28	50,407.90	50,768.60	51,920.32	49.623.77	52,432.78	7.12
	MEq Total	82,849.39	87,431.10	90,749.40	93,303.32	96.635.00	104,037.31	25.57
	MEqTec Total. / MEq Total ratio	59.08	57.65	55.94	55.65	51.35	50.40	-14.70

Source: Data adapted from Ministério da Educação (2023); table prepared by the authors.

All regions presented values above 50% throughout the entire period, evidencing a decrease in the proportion of MEqTec/MEqTotal over the analyzed interval. In the Northeast Region, there was a reduction from 68.83% (in 2017) to 60.15% (in 2022), representing a decrease of 12.61%. In the Southeast Region, the proportion declined from 60.10% (in 2017) to 53.56% (in 2022), indicating a decrease of 10.88%. In the North Region, the variation ranged from 72.92% (in 2017) to 59.35% (in 2022), corresponding to a decrease of 18.62%. In the Midwest Region, a reduction of 14.70% was observed, decreasing from 59.08% to 50.40%, reaching the minimum threshold established by the legislation.

Figure 1 visually presents the behavior of the MEqTec Total/MEq Total ratio, making it possible to observe the declining trend of this proportion and identify the pattern of progressive reduction in this participation.

Figure 2 illustrates the proportional distribution of Total Technical Equivalent Enrollments (MEqTec Total) by region, indicating the Northeast Region as having the highest participation, accounting for between 37% and 38% (197,000–206,000 MEq); the Southeast Region, 21%–24% (110,000–130,000 MEq); the South Region, 16%–17% (80,000–85,000 MEq); the North Region, 11%–14% (62,000–73,000 MEq); and the Midwest Region, 9% (48,000–52,000 MEq). Figure 2 (line graph) enables the visualization of the modest 2.41% growth in MEq over the analyzed period, with a recorded value of 516 thousand in 2017, increasing to 528 thousand in 2022.

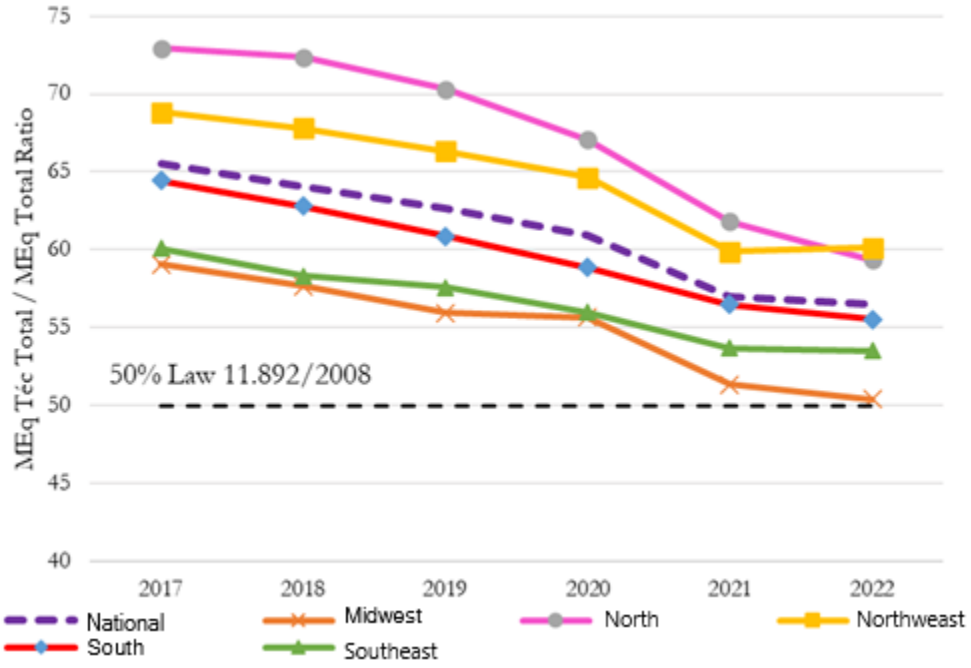

Figure 1. MEqTec Total/MEq Total Ratio Across the Regions of Brazil.
Source: Source: Data adapted from Ministério da Educação (2023); graph prepared by the authors.

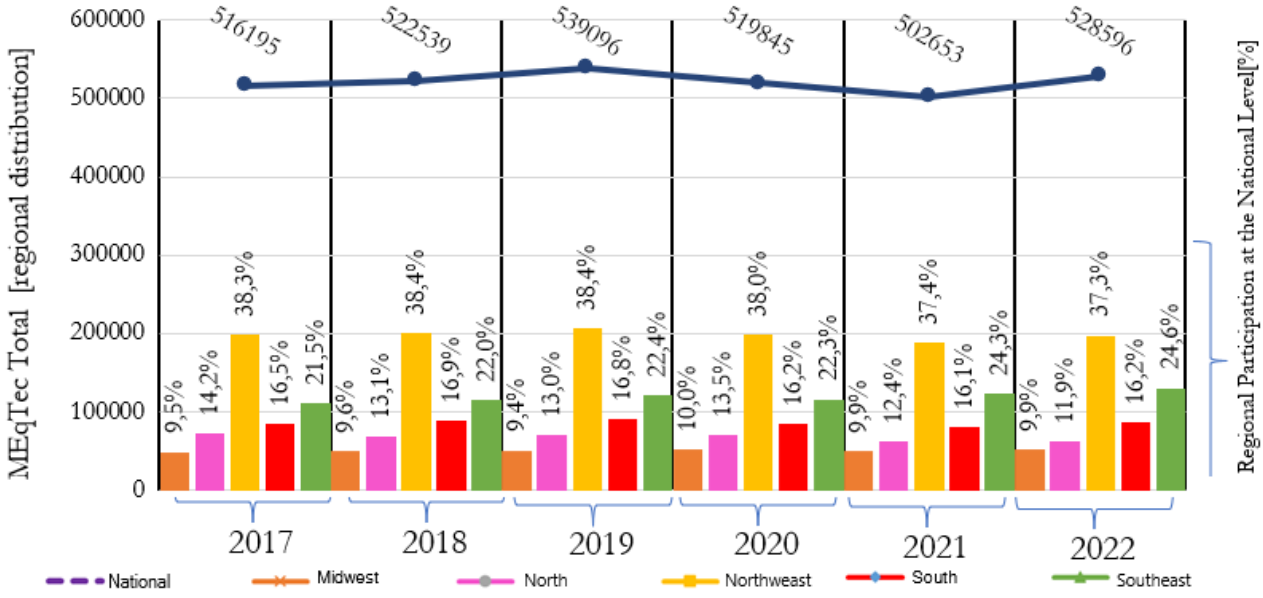

Figure 2. Regional Distribution of Total MEqTec.
Source: Source: Data adapted from Ministério da Educação (2023); graph prepared by the authors[5].

The data demonstrate a continuous decline in the participation of technical education programs between 2017 and 2022 across all regions, approaching the legal minimum threshold of 50% and indicating a future risk of noncompliance with the legislation.

National and Regional Distribution of MEq and Its Importance in the Provision of Total MEqTec

The identification of the proportion of EMI within the distribution structure of technical education programs was carried out through the recording of enrollments, the conversion of these enrollments into MEq values, and the registration of the total MEq corresponding to all courses, in order to emphasize the importance of integrated technical programs in complying with Law No. 11.892 (Lei, 2008). The data are presented in Table 2 and Figure 3.

[5] Graph contextualization: for the year 2017, the distribution of Total Technical Equivalent Enrollments (MEqTec Total) was as follows: Midwest, 9.5%; North, 14.2%; Northeast, 38.3%; South, 16.5%; and Southeast, 21.5%.

Table 2. Regional Data on EMI Enrollments, MEq EMI, and Total MEqTec.

Region	Type of enrollment	2017	2018	2019	2020	2021	2022	Δ [%] 2017-2022
National	Enrollments EMI	211,144	223,716	233,818	243,270	270,575	271,664	28.65
	MEq EMI	257,063.32	271,378.90	283,464.30	295,644.75	289,607.90	290,449.97	12.99
	MEqTec Total	516,194.52	520.939.10	539,095.90	519,845.43	502,653.28	528,616.75	2.41
	MEq EMI/ MEqTec Total ratio	49.80	52.09	52.58	56.87	57.62	54.95	10.34
Northeast Region	Enrollments EMI.	82,371	85,574	88,813	91,476	98,603	101,261	22.93
	MEq EMI	100,449.82	104,150.30	107,985.80	111,416.44	105,187.13	107,933.19	7.45
	MEqTec Total	197,881.78	199,033.50	206,942.30	197,603.29	187,855.52	197,290.28	-0.30
	MEq EMI/ MEqTec Total ratio	50.76	52.33	52.18	56.38	55.99	54.71	7.78
Southeast Region	Enrollments EMI	46,209	49,149	52,664	54,233	63,954	62,257	34.73
	MEq EMI	56,277.89	59,811.80	64,056.70	65,895.75	69,267.29	67,282.29	19.55
	MEqTec Total	110,976.91	114,920.10	120,873.70	115,861.89	122,283.80	130,101.20	17.23
	MEq EMI/ MEqTec Total ratio	50.71	52.05	52.99	56.87	56.64	51.72	1.99
South Region	Enrollments EMI	33,206	37,026	39,238	41,311	46,062	46,027	38.61
	MEq EMI	40,669.73	45,127.70	47,765.30	50,456.66	49,430.67	49,371.25	21.39
	MEqTec Total	85,313.24	88,364.20	90,397.90	84,234.08	80,799.70	85,.867.86	0.65
	MEq EMI/ MEqTec Total ratio	47.67	51.07	52.84	59.90	61.18	57.50	20.62
North Region	Enrollments EMI	26,572	27,177	27,941	29,337	31,473	32,133	20.93
	MEq EMI	32,196.68	32,592.60	33,485.70	35,395.26	33,037.44	33,700.16	4.67
	MEqTec Total	73,074.31	68,213.40	70,113.40	70,225.85	62,090.39	62,904.55	-13.92
	MEq EMI/ MEqTec Total ratio	44.06	47.78	47.76	50.40	53.21	53.57	21.58
Midwest Region	Enrollments EMI	22,786	24,790	25,162	26,913	30,483	29,953	31.45
	MEq EMI	27,469.20	29,696.50	30,170.80	32,480.64	32,685.37	32,163.08	17.09
	MEqTec Total	48,948.28	50,407.90	50,768.60	51,920.32	49,623.77	52,452.78	7.16
	MEq EMI/ MEqTec Total ratio	56.12	58.91	59.43	62.56	65.87	61.32	9.27

Source: Data adapted from Ministério da Educação data (2023); table prepared by the authors.

At the national level (Table 2), a 28.65% increase was observed in the number of EMI enrollments, rising from 211.1 thousand (in 2017) to 271.6 thousand (in 2022). However, this increase was not proportionally reflected in the calculation of EMI Equivalent Enrollments (MEq EMI), which recorded an increase of 12.99% over the same period, rising from 257.0 thousand MEq (2017) to 290.4 thousand MEq (2022). When analyzing the components of Total Technical Equivalent Enrollments (MEqTec Total), the overall growth was 2.41%, while the ratio between MEq EMI and MEqTec Total showed a positive variation of 10.34%, increasing from 49.80% (2017) to 54.95% (2022).

In the Northeast Region (Figure 3b), a 22.93% increase in the number of EMI enrollments and a 7.45% growth in MEq EMI were identified during the 2017–2022 period. When analyzing the components of MEqTec Total, a total decrease of 0.30% was observed, whereas the MEq EMI/MEqTec Total ratio presented a positive variation of 7.78%, increasing its participation from 50.76% (2017) to 54.71% (2022) [6].

In the Southeast Region (Figure 3c), during the 2017–2022 period, EMI enrollments increased by 34.73%, corresponding to a 19.55% increase in MEq EMI. Considering all MEqTec Total values, an increase of 17.23% was recorded, lower than the contribution of MEq EMI. The MEq EMI/MEqTec Total ratio increased by 1.99%, rising from 50.71% (2017) to 51.72% (2022) [7].

EMI enrollments in the South Region (Figure 3d) exhibited a growth of 38.61%, corresponding to a 21.39% increase in MEq EMI. When considering the variation in all MEqTec Total values, the indicator remained practically stable, at +0.65%. The MEq EMI/MEqTec Total ratio increased by 20.62%, rising from 47.67% (2017) to 57.50% (2022) [8].

The North Region (Figure 3e), during the 2017–2022 period, recorded a 20.93% increase in EMI enrollments, corresponding to a 4.67% increase in MEq EMI. A variation of -13.92% was observed in MEqTec Total, indicating a significant reduction in this indicator for the region. The MEq EMI/MEqTec Total ratio increased by 21.58%, rising from 44.06% (2017) to 53.57% (2022) [9].

The Midwest Region (Figure 3f), during the 2017–2022 period, increased EMI enrollments by 31.45%, registering a 17.09% increase in MEq EMI and evidencing a 7.16% growth in MEqTec Total. The MEq EMI/MEqTec Total ratio increased by 9.27%, rising from 56.12% (2017) to 61.32% (2022) [10].

[6] Calculated values: 22.93% = 82,371 (2017) ➔ 101,261 (2022); 7.45% = 100,450.82 (2017) ➔ 107,933.19 (2022); -0.30% = 197,882.78 (2017) ➔ 197,290.28 (2022) (Table 2, rows 6–9).

[7] Calculated values: 34.73% = 46,209 (2017) ➔ 62,257 (2022); 19.55% = 56,277.89 (2017) ➔ 67,282.29 (2022); 17.23% = 110,976.91 (2017) ➔ 130,101.20 (2022) (Table 2, rows 10–13).

[8] Calculated values: 38.61% = 33,206 (2017) ➔ 46,027 (2022); 21.39% = 40,669.73 (2017) ➔ 49,371.25 (2022); 0.65% = 85,313.24 (2017) ➔ 85,867.86 (2022) (Table 2, rows 14–17).

[9] Calculated values: 20.93% = 26,572 (2017) ➔ 32,133 (2022); 4.67% = 32,196.68 (2017) ➔ 33,700.16 (2022); -13.92% = 73,074.31 (2017) ➔ 62,904.61 (2022) (Table 2, rows 18–21).

[10] Calculated values: 31.45% = 22,786 (2017) ➔ 29,953 (2022); 17.09% = 27,469.20 (2017) ➔ 32,163.08 (2022); 7.16% = 48,948.28 (2017) ➔ 52,452.80 (2022) (Table 2, rows 22–25).

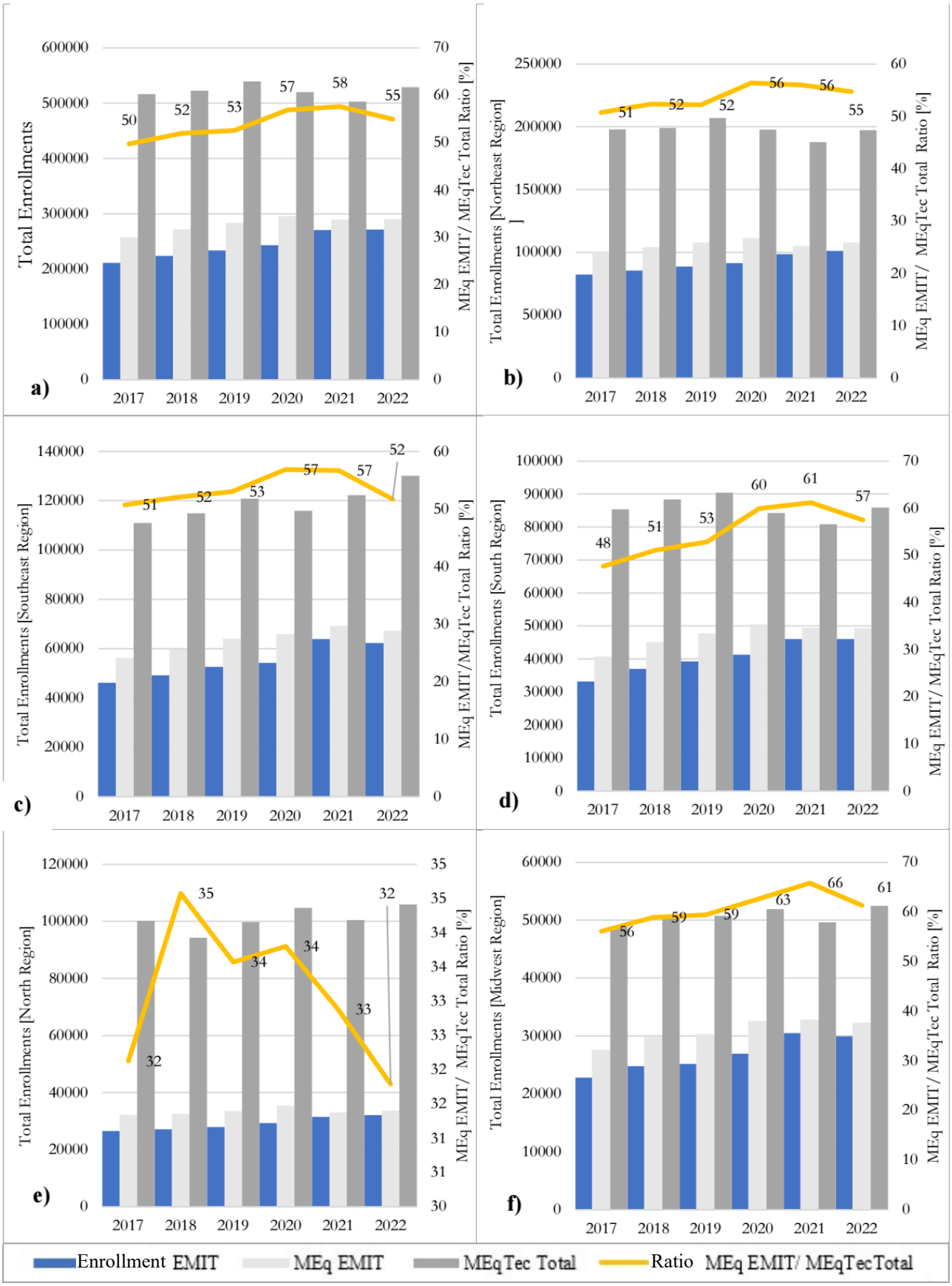

Figure 3. National and Regional Distribution of MEqTec and Total MEq.
Source: Data adapted from Ministério da Educação (2023); graph prepared by the authors.

Regarding the behavior presented in Figures 3a–f, no significant changes were observed among the regions: EMI enrollments remained lower than MEq EMI values, indicating a factor greater than 1. The fact

that enrollments exhibited higher growth values in comparison with MEq values may be justified by student retention issues, since students who discontinue their studies are no longer included in the MEq calculation, as well as by the revision of the Course Effort Factor (CEF), which was reduced by Ministry of Education Ordinance N°. 146, of March 25, 2021[11].

The importance of MEq EMI within the composition of Total MEqTec is illustrated in Figures 3a–f (yellow lines displayed on the secondary scale), highlighting the Midwest Region with the highest indicator, 65.87%, in 2021. The lowest participation was recorded in the North Region, with 44.06% in 2017. The South and North Regions exhibited the greatest increases in the MEq EMI/MEqTec Total ratio during the 2017–2022 period, with values of 20.62% and 21.58%, respectively, demonstrating the importance of these programs in relation to the total technical education provision.

Programs related to Integrated EMI recorded growth across all regions of the country, contributing to the maintenance of the legal indicator requiring 50% of equivalent enrollments in technical education.

Even in the North Region, which presented a negative indicator of -13.92% in MEqTec Total (2017–2022), the contribution of MEq EMI remained positive at 4.67%. Other types of technical education offerings likely experienced reductions, thereby contributing to the regional result observed.

Figure 4 presents the distribution of EMI technical education enrollments across the regions of the country. The blue line indicates continuous growth in enrollments over the analyzed period, reporting enrollment stability in 2021 (270,575) and 2022 (271,631).

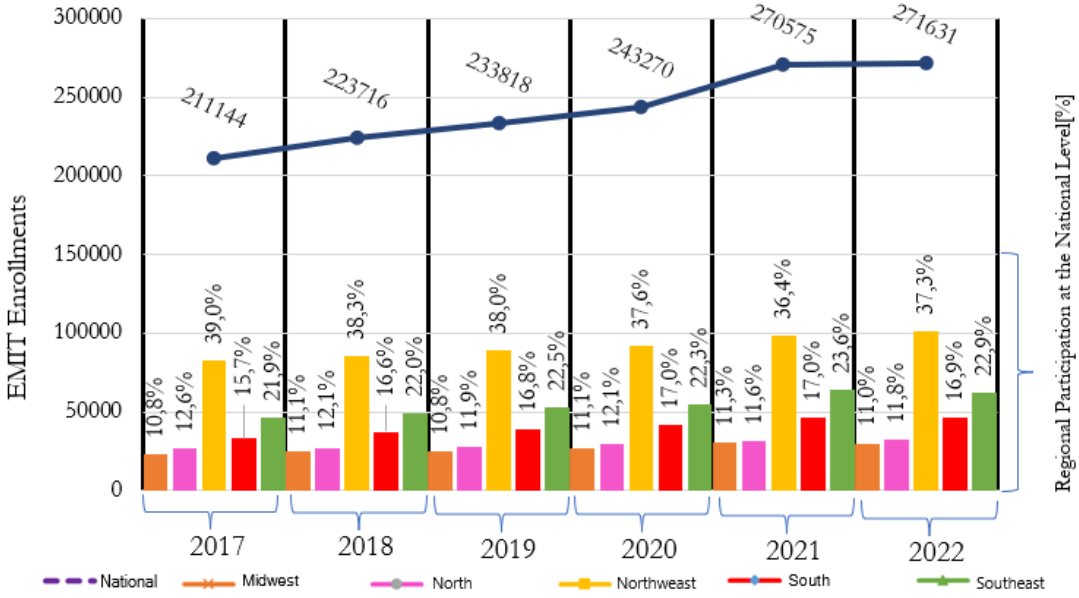

Figure 4. Distribution of EMI Enrollments and the Proportional Participation of the Regions.
Source: Data adapted from Ministério da Educação (2023); graph prepared by the authors.

The importance of the Northeast Region in EMI provision was verified through the proportion of enrollments achieved, contributing approximately 37% of the available positions, equivalent to nearly 100,000 positions. Overall, in ascending order, the highest national regional percentage indicators were: Midwest (10–11%), North (10–11%), South (15–17%), Southeast (21–22%), and Northeast (37–39%).

In order to compare EMI enrollments and their expression in MEq EMI, the distribution of MEq EMI and its proportional distribution across each region of Brazil were analyzed (Figure 5).

The distribution of enrollments (Figure 4) and MEq EMI values (Figure 5) revealed similar percentages and indicators, once again indicating that the Northeast Region remained the most significant. It was also observed that the other regions presented similar patterns.

EMI exhibited consistent growth in both enrollments and MEq values across all regions between 2017 and 2022, increasing its participation within the total MEqTec and contributing to the maintenance of compliance with the legal minimum requirement of 50%. Despite regional variations, the Northeast Region led in overall

[11] The effects of the change in the Course Effort Factor (CEF) introduced by Ministry of Education Ordinance N°. 146 (2021) can be observed in the 2020–2021 transition (Table 2, rows 2 and 3, national analysis), in which the growth proportions between EMI enrollments and MEq values during the 2017–2020 period were practically identical: Δ2017–2018 – EMI Enrollments +5.95%, Δ2017–2018 – MEq EMI +5.56%; Δ2018–2019 – EMI Enrollments +4.51%, Δ2018–2019 – MEq EMI +4.45%. This proportionality was lost during the 2020–2021 transition, with Δ2020–2021 EMI Enrollments +11.22% and Δ2020–2021 MEq EMI -2.04%, directly impacting the indicators of the IFs.

volume, and all regions demonstrated a relative increase in the MEq EMI/MEqTec Total ratio. Factors related to the expansion of undergraduate programs, state-level technical education initiatives, and, in the more industrialized regions, competition from Serviço Nacional de Aprendizagem Industrial (SENAI) may negatively affect enrollments at the IFs.

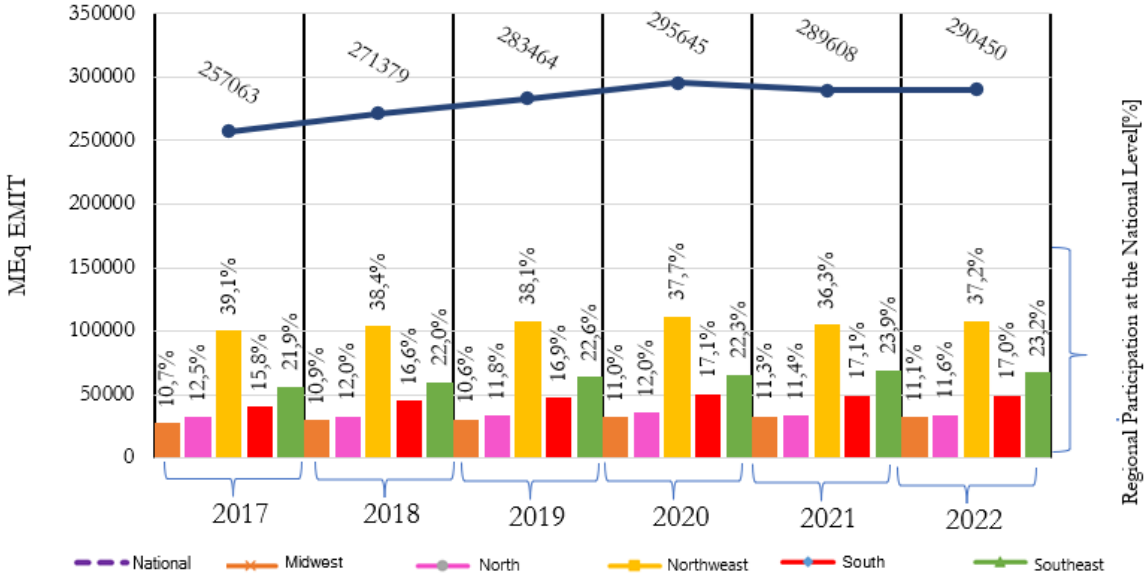

Figure 5. Distribution of MEq EMI and the Proportional Participation of the Regions.
Source: Data adapted from Ministério da Educação (2023); graph prepared by the authors.

Regional Comparison Between the Distribution of EMI Enrollments and 2022 Census Data

The comparison between the proportion of EMI enrollments and the 2022 Census data (Figure 6) highlights the superior performance of the Northeast Region within the national scenario, accounting for 37.3% of enrollments while representing 26.9% of the national population. The North (11.8%), Midwest (11.0%), and South (16.9%) Regions also exhibited enrollment proportions approximately 3% higher than their respective shares of the national population.

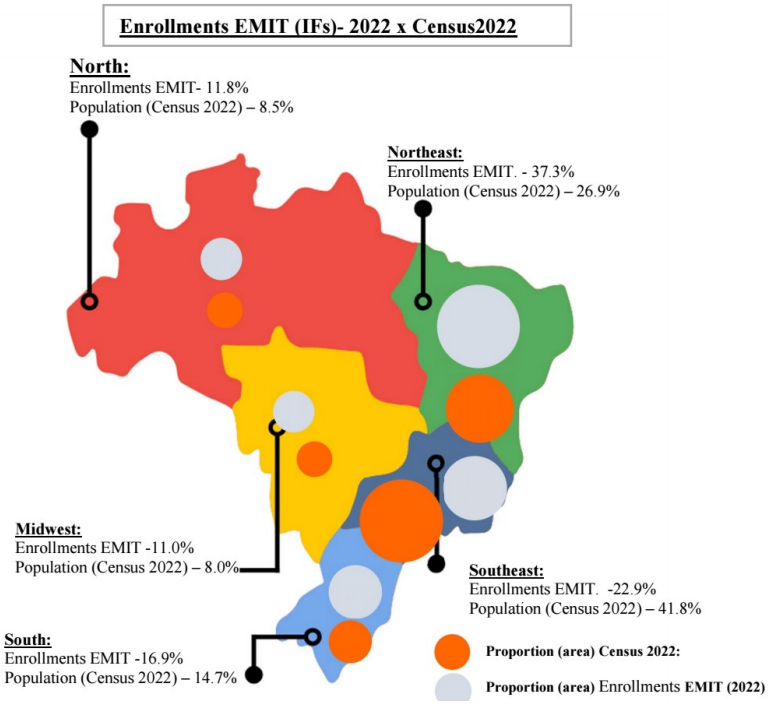

Figure 6. EMI Enrollment Data in the Federal Institutes Related to the 2022 Census.
Source: Figure adapted from Ferrari (2023), based on data from the Ministério da Educação (2023) and the Instituto Brasileiro de Geografia e Estatística (2022).

The Southeast Region was the only region that presented a percentage of EMI enrollments lower than its proportion of the national population, accounting for 22.9% of EMI enrollments while comprising 41.8% of the country's population.

Final considerations

Regarding the national context, the IFs fulfilled their role in providing more than 50% of enrollments in technical education programs across all regions of the federation.

Overall, for the MEqTec Total/MEq Total ratio, a continuous decline was observed during the 2017–2022 period: North (-18.62%); Midwest (-14.70%); South (-13.85%); National (-13.80%); Northeast (-12.61%); and Southeast (-10.88%).

This occurrence may be understood in light of the introduction of other types of programs, which impact the overall panorama of educational provision within the IFs. The rapid shift from technical education programs toward undergraduate programs may be associated with the aspiration to resemble universities, as well as with the rapid incorporation of a large number of young master's and doctoral degree holders who, due to external pressures, perceive the need to teach in undergraduate and graduate programs[12] (Frigotto, 2018).

This change may also be linked to the cultural maturation and improvement in the postgraduate training of faculty members within these institutions, a phenomenon that, if sustained, may indicate challenges for IFs in complying with Law n°. 11.892/2008.

The Northeast Region stood out in the national scenario, revealing the highest percentage of MEqTec Total, with values ranging from 197,000 to 206,000, corresponding to approximately 36–39% of the national context. This was followed by: Southeast, 21–23% (110,000–130,000 MEq); South, 15–17% (80,000–85,000 MEq); North, 11–12% (62,000–73,000 MEq); and Midwest, 10–11% (48,000–52,000 MEq).

EMI represented, in general terms, 55% of enrollments related to all types of technical education programs, contributing to compliance with the goals established by Law n°. 11.892/2008.

Once again, the Northeast Region presented the highest MEq EMI indicators, corresponding to approximately 100,000 MEq, or nearly 37% of the national total. The distributions of MEq EMI were similar to the results previously discussed.

A convergence trend of the MEq EMI/MEqTec Total ratio toward 55% was observed during the 2017–2022 period. In Table 2 (North Region), particular emphasis is given to the evolution of the North Region, which exhibited a progressive increase from 44.06% (2017) to 53.27% (2022).

No significant differences were identified between EMI enrollment data and MEq EMI values, indicating that the conversion factor applied to MEq does not hinder the general analysis of the data, given that this factor is consistently greater than one.

An intriguing factor was the increase in EMI enrollments that was not proportionally reflected in MEq EMI values. For example, in the national analysis, a 28.65% increase in enrollments resulted in only a 12.99% increase in MEq EMI. One possible explanation may be related to the revision of the Course Effort Factor (CEF) parameters established by Ministry of Education Ordinance No. 146 (2021), which reduced the CEF for several programs by values close to 20%[13].

The reduction in the Course Effort Factor percentage directly affects the Federal Institutes and may lead to noncompliance with current legislation, thereby requiring attention from institutional administrators.

The comparative analysis between EMI enrollments and population distribution based on the 2022 Census indicated a proportional disadvantage for the Southeast Region relative to the other regions, while the Northeast Region proved to be the region most aligned with the IF policy regarding the provision of EMI programs.

Future studies addressing the profile of EMI students, with stratification by fields of knowledge, sex, racial/ethnic background, and income, may contribute to further deepening research on this topic, particularly when combined with investigations concerning dropout rates and graduates.

Data availability

The data used in this article are publicly available on the Nilo Peçanha Platform website.

[12] As an example, Gaudêncio Frigotto (2018) cites the Sertão Campus of the Instituto Federal do Rio Grande do Sul (IFRS), which transitioned from offering no undergraduate programs to allocating nearly 50% of its vacancies to such programs within five years.

[13] As another example, the Course Effort Factor (CEF) for the Technical Program in Information Technology, which had previously been 1.25, was reduced to 1.053 starting in 2021, representing a 15.75% reduction in the enrollment "value."

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