

Climate change integration in technical environmental training: a case study in Brazilian professional education

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Abstract

This research sought to understand the positioning of approaches to climate change in technical courses on the environment integrated into high school in Brazil, based on a case study of the Federal Institutes (IFs) distributed in the state of Rio Grande do Sul (RS). As a methodological tool we use the search for descriptors in Pedagogical Projects of Courses (PPC's), namely "climate change", "climate crisis" and "climate emergency", the search for similar terms and phrases to the focus of the investigation were used, and the search for specific thematic projects, adding to the review bibliography for the elaboration of the discussion of the data obtained. It is concluded that the subject is not central in the courses studied and that there is no effective pedagogical construction of mitigation and adaptation in the curricula, which complicates the idea of Climate Change Education (CCE) in Brazilian professional training.

Keywords: Climate Change Education. Climate crisis. Vocational training and climate emergency.

1. Introduction

Given the current climate emergency, there is a growing need to critically examine how countries are integrating climate change issues into different educational frameworks (UNESCO, 2023). Stevenson, Nicholls and Whitehouse (2017) showed that the integration between formal education and the scope of climate is essential to promote potentialities in the different social arrangements of the planet, observing the organization and implementation of actions that contribute to present solutions to the witnessed crisis.

For this bias, studies that seek to identify practices and, at the same time, promote discussions on the climate change education (CCE) stand out, given the relevance of this approach to the various referrals that involve contemporary global problems (Anderson, 2012; Oversby, 2015; Boakye, 2015; Stevenson; Nicholls; Whitehouse, 2017; Cantell et al., 2019). In this context, it is necessary to understand school curricula and how they specifically address the topic under focus here, since they contain the political and pedagogical syntheses of the different and contradictory conflicts expressed in an educational community (Apple, 1993; Mnguni, 2013), showing how different countries have organized the issue.

In this regard, this research sought to discern the approaches positioning on climate change in technical courses on the environment integrated in high school in Brazil, based on a case study of the Federal Institutes of Education, Science and Technology (IFs) distributed in the state of Rio Grande do Sul (RS), in light of the terms "climate change", "climate crisis" and "climate emergency", the analogous terms or phrases on the subject and looking for specific thematic projects in the curricula.

Brazil is an emerging economy and a signatory to the Kyoto Protocol (1997), which established international climate commitments. It created its National Climate Change Policy (PNMC) in 2009 and recently aligned itself with the Paris Agreement in 2015 (BRAZIL, 2016). On the other hand, the State of RS, is a Brazilian federal unit with a large IFs distribution and relevant participation in the national GDP, especially with economic activities linked to the primary and secondary sectors, with a wide sensitivity to environmental oscillations (Socioeconomic Atlas of Rio Grande do Sul, 2019; Marengo, 2014).

The IFs are representative because they symbolize the main opportunity for technical education in the public sphere in the country, being completely free of tuition or annual fees, allowing democratic access to their proposals for teaching and scientific integration. Meanwhile, the technical course in the environment, by hypothesis, would necessarily dialogue with recurrent and dynamic themes regarding the impact of societies in the climate sphere, exercising a representative parameter for the analytical approach adopted. Together, the creation of IFs training units is linked, through federal law, to regional economic arrangements. Thus, the assimilation of how their curricular provisions articulate the approaches to climate change helps the dialectical interpretation of the evaluation given to the scope by the regional economic actors who are in contact with the campuses that offer the verified courses. This corroborates the notes of Nogueira and Molon (2017), who shed light on vocational training as it promotes work paths for the capitalist market in its affirmations and contradictions.

Therefore, this interpretive movement brings to light a facet of the challenges and priorities given to the formation of a professional who approaches the environmental treatment in the daily productive of a country that is central in the debates on global climate change, promoting discussions and insights for the necessary transformations. Likewise, the study raises a question about the challenges of building a CCE in a critical way in an emerging country.

Therefore, an attempt has been made to show the methodology for collecting and organizing information in order to produce a broad understanding of the topic addressed. A delineation of the professional training of IFs in Brazil is described; a characterization of the environmental perspective in RS and the importance of the environmental technician is promoted; the data obtained with the proposed methodological application are evidenced and, from this, a discussion is established on the challenges in the affirmation of the CCE.

The research questions

This work was positioned by the following questions:

- a) What is the relevance of the use of the terms "climate change", "climate crisis" and "climate emergency" in the pedagogical plans of the technical courses in environment in the IFs in RS?
- b) In what way are the searched terms ("climate change", "climate crisis" and "climate emergency") used in the pedagogical plans of the technical courses in environment in the IFs in RS?
- c) What terms or analogous phrases might be associated with the climate change debates in the courses covered?
- d) Are there specific climate change projects in the courses analyzed?

Contribution to the field

This study was carried out to contribute to the knowledge on the establishment of CCE in an emerging country, with reference to the United Nations Sustainable Development Goals (SDGs - UN), especially 13^o - "Climate Action", in which the following dimension is verified: "Enhance education, awareness and human and institutional capacity for climate change mitigation, adaptation, impact reduction and early warning" (UN-BRASIL, 2015). Considering technical education as one of the driving forces of economic development, this analysis allows us to verify the final effects and

meanings produced by elements that create tensions in the curricula of a country with important environmental commitments.

2. Materials and methods

In order to verify the priority framework given to climate change in technical training courses in the environment integrated in high school, an attempt was made to delimit the State of Rio Grande do Sul (RS) as a case study and analytical reference, addressing the three IFs existing within this federative unit, namely: Federal Institute of Rio Grande do Sul (IFRS), Federal Institute Sul-Rio-Grandense (IFSUL) and Federal Institute Farroupilha (IFFAR). The methodological basis used was the selection of a case study based on Flyvbjerg (2006), seeking information through a guided selection, focusing on an object from a perspective of maximum variation, where the importance of multiple information can be obtained.

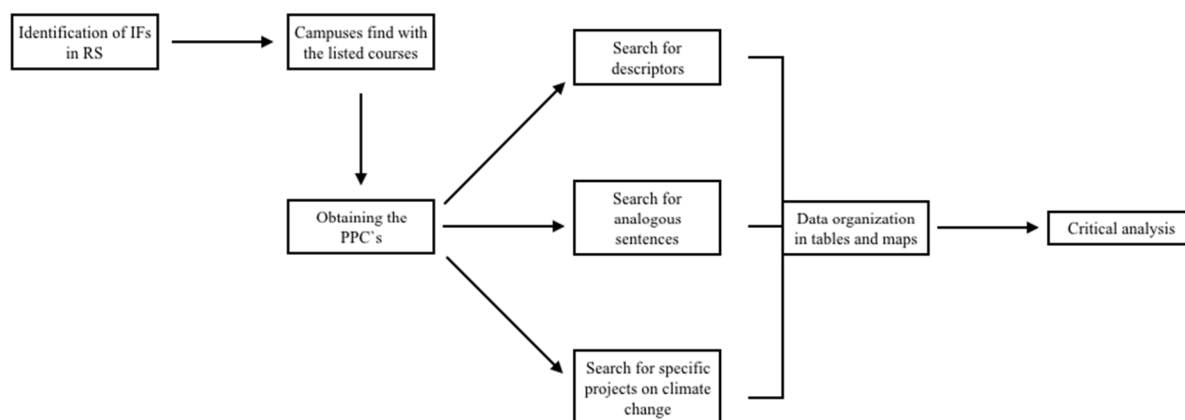
This is due to the importance of these institutions in the state and national educational scenario, considering the evaluation indicators of the Nilo Peçanha Platform (PNP), in addition to the fact that RS is a state with a representative number of IFs units. Together, this Federation component has a great insertion in the national economic context, with a share of about 6.5% of the internal GDP, according to the Socio-Economic Atlas of Rio Grande do Sul (2019). The atlas also shows that the predominant activities in the state are those related to agriculture and transformation industries, which may be affected in a climate change scenario.

Data collection was carried out from the Pedagogical Projects of Courses (PPCs), documents that take with them the justifications of the formative implantation offers up to curricular and evaluative definitions for the students who will be future professionals of the field in analysis.

The following points were obtained: a) identification of IFs in RS; b) the units that had courses in the listed area; c) the descriptors “climate change”, “climate crisis” and “climate emergency” to verify how the terms are used in PPC’s; d) analogous terms or phrases within the PPC’s that fall within the scope of climate change; e) specific projects to work on climate change in curricula; f) systematization in tables and maps, with the aim of explaining the information.

The methodological flowchart for collecting and organizing data is shown below:

Figure 1. Data collection and organization flow.



Source: Author's organization.

The search for the descriptors "climate change", "climate crisis" and "climate emergency" is pertinent due to the representativeness of the terms and also due to the expressive meanings they have in the nominations of the crisis faced, since they represent aspects of conceptual syntheses of the impacts generated by societies and economies to the climate on a global scale, visa the reports of the Intergovernmental Panel on Climate Change (IPCC) and other national documents, such as the National Policy on Climate Change in Brazil (PNMC).

This research has a qualitative and an exploratory character, seeking to fill a gap on the manifestation of a CCE within professional training in Brazil. The results have been problematized in the light of theoretical references that dialogue with the verified focus, seeking to discern the role of the issue in the PPC's addressed.

3. Technical training through the Federal Institutes of Education, Science and Technology (IFs) in Brazil and the State of RS

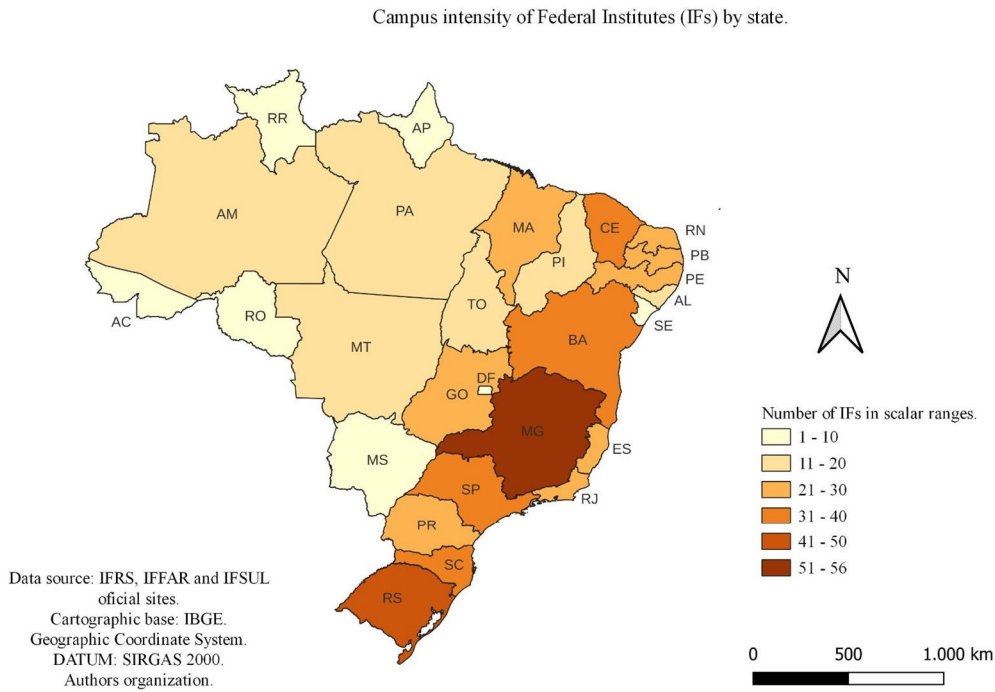
Since 2008, the Federal Institutes of Education, Science and Technology (IFs) have been created in Brazil by Law No. 11.892. These institutions have the primary purpose of training middle-level technicians, and 50% of their positions must be dedicated exclusively to this purpose (Verges et al., 2022). According to Silva and Eltz (2019), IFs are responsible for the internalization of training offerings in different modalities, with a large expression for technical courses.

One of the aspects that justify the existence of IFs is their link with regional economic needs, thus allowing the training of professionals to meet the development installed in the territories. Pacheco (2022, p.1) characterizes IFs on the basis of the following dimensions:

[...] territoriality, verticality, transversality, integral human formation (polytechnics), inseparability between research, teaching and extension, work as an educational principle, etc. However, the main foundation of this identity is the polytechnics that is expressed, mainly, through Integrated Secondary Education [...].

As Mariz Fernandes (2009) describes, IFs are structured, each one with a rectory and several campuses, dimensioned in a concept of teaching network, development of science and application of technologies. The expressiveness and spatiality of the IFs in Brazil can be seen in Map 1.

Map 1. Campus intensity of Federal Institutes (IFs) by States in Brazil.



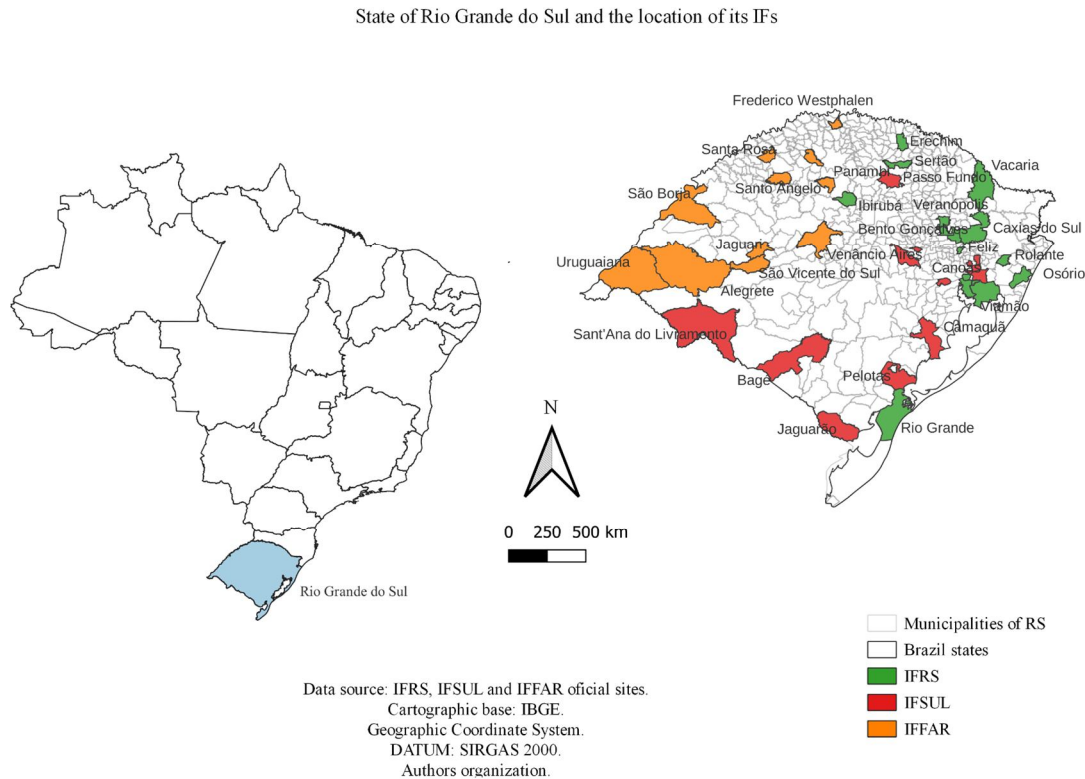
Source: Author's organization.

In the state of Rio Grande do Sul (RS), there are three IFs that offer different training opportunities for mid-level technicians, namely Federal Institute of Rio Grande do Sul (IFRS), Sul-Rio-Grandense Federal Institute (IFSUL) and Farroupilha Federal Institute (IFFAR).

Each of them presents itself as an autonomous institution, called autarchy, with its own rectory. For the IFRS, the administrative headquarters are located in the municipality of Bento Gonçalves, in addition to 17 other campuses. IFSUL has its rectory in the municipality of Pelotas and has 14 campuses. IFFAR locates its Rectory in the municipality of Santa Maria, with 11 campuses distributed across the state.

The locations of the State of Rio Grande do Sul (RS) and, in particular, of the campuses of the different IFs in this area can be seen on Map 2 below.

Map 2. Location of the State of Rio Grande do Sul (RS) and distribution of IFs in its territorial extensions.



Source: Author's organization.

It can be seen that there is a significant campus distribution of IFs in the state of RS, covering different internal regions of the federation unit. This makes it possible to expand the scope of possibilities in supporting professionals with technical qualifications to support economic and environmental development in the country, especially with regard to issues related to changes in climate regulations.

4. General environmental aspects of the state of Rio Grande do Sul (RS) and the importance of training Environmental Technicians

The State of RS has an estimated population of 11,466,630 inhabitants, according to the Brazilian Institute of Geography and Statistics (IBGE, 2022). It has a territorial area of 281,707.51 km², of which 3,601.63 km² are urbanized (IBGE, 2022). It is characterized by the development of activities related to the primary and secondary sectors of the national economy (Socioeconomic Atlas of Rio Grande do Sul, 2019).

From the perspective of the characterization of the natural contexts, based on the studies carried out by Cordeiro and Hasenack (2009), the prairie phyto-ecological regions are the majority in RS, corresponding to 62.2% of the total area of the State. The forest phytoecological regions occupy 33.1% of the territory, in addition to the transitional areas with 4.7% (Cordeiro & Hasenack, 2009).

However, considering the historical context of the occupation in RS, the current scenario is as follows:

The anthropic occupation in the state produced a landscape dominated by anthropic physiognomies. Remaining 31.38% of its coverage with natural or semi-natural characteristics (...). Nevertheless, this occupation took place differently in each Phyto-ecological Region, producing different landscapes. The Pioneer Formation Areas had the most natural vegetation cover removed, leaving 15.35%. Followed by those of transition between phyto-ecological regions (...) with 15.94% (...) of remnants of its original coverage. The forest regions (...) had their natural vegetation cover removed by 83.02% (16.98% of the original area remaining) [...] (Cordeiro & Hasenack, 2009, p.289).

For example, Echer et al. (2015) have shown that in a large part of the Pampa-the prairie phyto-ecological region-primary economic activities such as grazing, agriculture, and forestry are firmly established and have a strong impact on regional environmental dynamics, requiring a greater presence of regulatory agencies, research, ecological zoning, and linkages between economic actors and communities to ensure sustainable use of the area.

Another important sector for the RS, according to the Socioeconomic Atlas of Rio Grande do Sul (2019), is the secondary. Its industrial activity is diversified, undergoing significant transformations in the food, metal-mechanical and transport sectors, among others. Martins and Oliveira (2009) demonstrated a growth in the state of industrial activities with high pollution potential. Such an impact dynamic was significant for important areas with population agglomerations, such as the case of the metropolitan region of Porto Alegre, its capital (Martins & Oliveira, 2009).

Climate data for the RS corroborate the changes observed on a global scale (Berlato & Cordeiro, 2018), requiring the construction of strategies to implement mitigation and adaptation to climate change (Berlato & Cordeiro, 2018).

For these aspects, the objective importance of technical professionals in the environment in the state of RS is dimensioned, allowing a practical equation in what corresponds to the requirements and climatic scenarios.

The technician in this line of work is valued for what is evident in the constitution of the National Catalogue of Technical Courses of the Ministry of Education (MEC), which presents one of its purposes: "[...] monitoring, correction and prevention of human activities, conservation of natural resources through preventive analysis" (MEC, 2023). Likewise, environmental technicians have as a professional needs the arrangement of environmental proposals that guarantee access to a balanced life system, going through the manifestations of basic sanitation, the dimensions of air quality, the socio-environmental, economic and cultural frameworks, to the perspectives linked to the health of the population (MEC, 2023).

In this sense, in a state like RS, with a high economic insertion in the national scenario and with the environmental and sectoral characteristics it has, it is essential to present the professional training in the listed area with insertions together with issues related to climate change. For this reason, the study of how the topic of climate change is treated in technical courses on the environment at IFs in RS places a considerable sample of the scope of the topic in the universe of curricular affirmation of this issue.

5. Technical Courses in the Environment Integrated in High School in the IFs of Rio Grande do Sul (RS)

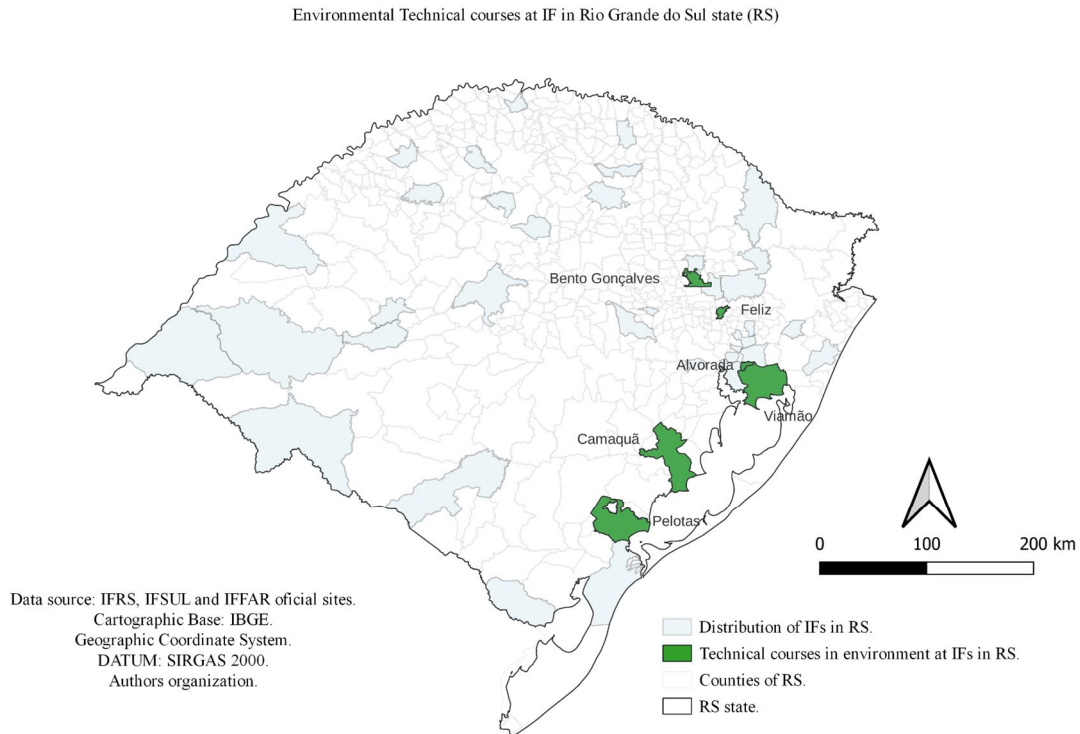
Considering the descriptions given in the previous topics, it is important to note how climate change is positioned within the training scenario in the IFs, given that these institutions are the official vehicles in Brazil responsible for preparing technicians at medium level for professional work in regional economies. In this sense, the discernment of the question helps to propose projects and actions on the political constructions of the courses, in addition to the need for continuing education within the framework of the theme focused on in this work.

Thus, Table 1 is presented below, with the identification of technical courses in the environment integrated in high school in the IFs of RS in Brazil, together with Map 3, demonstrating their spatial characterizations by state.

Table 1. Distribution of technical courses in the environment integrated in high school in IFs in Rio Grande do Sul (RS).

IF	County	Course creation year	Nomenclature variation
IFSUL	Camaquã	2010	Environmental Control Technician
IFSUL	Pelotas - Visconde da Graça	2011	Environmental technician
IFRS	Alvorada	2016	Environmental technician
IFRS	Viamão	2017	Environmental technician
IFRS	Bento Gonçalves	2019	Environmental technician
IFRS	Feliz	2019	Environmental technician
IFFAR	Does not have	Does not have	Does not have

Source: Institutions' websites.
Author's organization.

Map 2. Spatialization of technical courses on the environment in the IFs of Rio Grande do Sul (RS).

Source: Organization of authors.

Check that there are 6 formative perspectives in two different teaching institutions distributed in this state, being the IFRS and IFSUL, and that, in a greater number, the courses are recent. One of them is located in Serra Gaúcha, one in Vale do Rio Caí, two in the metropolitan region of Porto Alegre and two others in the center-south part of the state. The nominal name of the courses varies only in one campus, specifically the Camaquã of IFSUL, but the objectives of the professional training proposal are in line with the other courses entitled "Environmental Technician".

6. Priorities given to Climate Change in Technical Courses in the Environment Integrated in High School in the IFs of Rio Grande do Sul

As an exploratory study, the descriptors indicated in the methodology were searched in the PPCs, as well as the existence of analogous terms that dealt with the subject in general in the documents, complementing the search for projects that specifically dealt with climate change. In this context, the organization of the results obtained is presented in Table 2.

Table 2. Searched descriptors, analogous terms/phrases and specific projects on climate change in the PPC's.

IF	County	Number of uses for "Climate Change"	Number of uses for "Climate Crisis"	Number of uses for "Climate Emergency"	Observed analogous terms / phrases	Specific projects on Climate Change
IFSUL	Camaquã	0	0	0	Global warming; effects on the climate;	0
IFSUL	Pelotas - Visconde da Graça	2	0	0	Crisis and Alternatives for a Sustainable Country;	0
IFRS	Alvorada	0	0	0	Production processes that cause environmental problems; reduction of harmful emissions; environmental modifications;	0
IFRS	Viamão	0	0	0	Analysis of climatic phenomena and human interference; damage to the environment and the evolution of environmental issues; pollutant emissions;	0

IFRS	Bento Gonçalves	1	0	0	Environmental changes due to human activity; Global environmental changes; Planetary changes; Temperature increases; Melting glaciers; Rising sea levels;	0
IFRS	Feliz	0	0	0	Adaptive strategies of organisms in the face of environmental change.	0
IFFAR	Does not have.	Does not have.	Does not have.	Does not have.	Does not have.	0

Source: Pedagogical Projects of Courses (PPC's).
Author's organization.

It seems that even in a global and national political context where discussions about climate change are evident, the topic is not directly prioritized in the curricula. This is particularly the case if we look at the low use of the descriptors studied. There is some evidence that work on the topic is fragmented into different curricular components, known in other educational perspectives as disciplines, which highlights a number of challenges related to the training of professionals with the capacity to deal effectively with mitigation and adaptation issues.

Two examples of this finding are the courses offered by Campus Pelotas - Visconde da Graça (IFSUL), where the descriptor "climate change" appears in a bibliographic reference next to the curricular component entitled "Regional Geographical Aspects", and the offering by Campus Bento Gonçalves (IFRS), where the curricular component entitled "Climate and Water Resources" includes a reference to an atlas on climate change. This prism is close to the one found by Ho and Seow (2017), indicating that often a few disciplines, such as geography, end up being the main and only means of discussing the issue.

Regarding the "climate crisis" and the "climate emergency", no indication or effective work was observed within the course proposals, which characterizes a marginalization of the focus on the training perspectives for an environmental technician, even considering that most of the courses start after 2015 and the Conference of the Parties (COP) in Paris. Brazil was aligned with the discussions within the aforementioned COP and presented its official communication with specific

commitments the following year, its participation being ratified by the speech of the then President Dilma Rousseff in New York City on April 22, 2016 (BRAZIL, 2016).

Due to the lack of disclosure of the searched descriptors, no specific projects and/or plans were found that dealt with climate change frameworks in the analyzed courses. This indicates the value placed on the content of specific curricular components, suggesting the complexity of transversal and effectively interdisciplinary work, which is one of the recurring references in authors seeking to analyze conceptualizations of education for climate change.

With regard to analogous terms and phrases, it is pertinent to review the approach to environmental issues in an equally general format, without evidence of a specificity for climate change. A certain exposition of the impacts generated by anthropic activities follows without the historical allocation of debates focused on climate regulations and their interactions with the environmental and political constraints of recent years. In this case, observing the prism of a climate change education, the movement of information, organization and generation of active capacities revolves around the student's ability, per se, to gather the elements addressed and link them to the focus analyzed in this work.

6.1. Toward a critical analysis

Seeking to promote a critical analysis of the data obtained and to show them in a perspective of movement of the affirmation reality of CCE in Brazil, from the professional formation of technical courses in environment of medium level in IFs, it can be demarcated three guiding parameters, namely: 1) the lack of legal mechanisms that induce CCE manifestations in the curricula; 2) tangential approximation of the curricula to the conceptual CCE perspectives 3) indicative of unevenness between the commitment to environmental education and the focus on climate change;

In this way, each of these analytical parameters will be specified below, in an attempt to promote the clarification of the guiding questions of this work.

6.2. The lack of legal mechanisms to include the manifestations of climate change in curricula

As Zezzo and Coltri (2022) point out, there is no specific legislation in Brazil for the inclusion of climate change in school curricula. The combination of actions in the country related to education is foreseen in its alignment with the United Nations Convention on Climate Change, together with its PNMC. As noted: "Art. 5. The guidelines of the National Policy on Climate Change are: (...) XII - To promote the dissemination of information, education, training and public awareness on climate change" (PNMC-Brasil, 2009).

This demonstrates the nascent nature of the issue in the country's educational contexts, considering that the national environmental education policy dates back to 1999 and the climate change policy only appeared in 2009.

Adams (2013) showed that in the country, there was a relative latency in the implementation of debates and actions in the curricula that properly correspond to environmental education. This required the implementation of concrete legislation on the subject, namely Law 9795 of April 27, 1999. In its confirmation process, this law was included in the National Curriculum Parameters (PCN's) and reinforced in new guidelines in 2012, creating an explicit scenario for its inclusion in school education proposals (ADAMS, 2013).

This is not the case for climate change, which expresses the effective contradiction between the country's insertion in international discussions on the subject and the capillarity within its training systems, having as a reference, here, professional training at the technical level. Jacobi et al.

(2011) showed the existence of a global concern regarding the pragmatic distance of what fits within the policies of the countries on the climate issue and its extensions within the educational systems. For the technical courses in the environment at the IFs in RS, it is pertinent to point out that a concrete parameter is missing that signals work with climate change, both in its forms and in its contents.

For this reason, it is ultimately up to teachers or professional training institutions to generally recognize the subject of climate change, its conceptual processes and forms of links with education and, together, its practical dynamics with the work effectively linked to teaching and learning. This movement, without legal instruments or incentives that guarantee its inclusion in the curricula and, as has largely been the case with environmental education, generate funding and training effects for teaching colleges, ends up distancing or marginalizing the proposal.

6.3. Tangential alignment of curricula with the conceptual perspectives of CCE

Regarding the conceptual dimension of CCE, we can list some characteristics raised by authors such as Oversby (2015), Vaughter (2016), Kolleck, Jörgens, and Well (2017), Foss and Ko (2019), Reid (2019), Gaudiano and Cartea (2020) as a guide to its understanding to allow the analysis of junctions or distances through the data collected in this research.

Meanwhile, the following aspects have been identified as defining the existence of a curriculum effectively linked to debates on climate change: a) concrete recognition of the issue, focusing on social commitments and new teaching methods; b) competent action, promoting systemic engagement; c) awareness of causes and impacts; d) local scale; e) interdisciplinary approach; f) teaching and learning focused on the actions of individuals; g) teaching and learning aimed at understanding uncertainties (Oversby, 2015; Vaughter, 2016; Kolleck, Jörgens & Well, 2017; Foss & Ko, 2019; Reid, 2019; Gaudiano & Cartea, 2020).

The data from the surveyed environmental studies courses at the IFs show that the inclusion of key concepts in this process has been reduced. At the same time, work on climate change is spread over only a few curricular components that focus primarily on the physical demonstration of the phenomena involved. Similar terms or phrases qualify this finding because they are presented as vague indications of the problem and do not necessarily translate the manifestations of an CCE as delineated by the reference used. At the same time, there are no specific projects aimed at teaching the subject. Without the treatment directed to the scope, it is not possible to verify an educational effectiveness that encourages professionals who are sensitive and dedicated to climate challenges, especially with skills for working treatment and organizing society in this focus.

This issue allows us to understand the detachment of the construction process of these curricula from the main global debates on the subject studied, especially considering that 4 of the 6 courses offered were implemented after the COP 2015 in Paris, in which Brazil is a signatory of the new international agreement (BRASIL, 2016). This underlines the importance of concrete legal instruments to include and mobilize the issue in the curricula, as has been demonstrated in the case of environmental education. At the same time, it reveals the relationship between the training of a technical professional and the links between pedagogical projects and the satisfaction of regional economic demands, indicating that there are spaces to be filled through socio-environmental achievements/struggles.

Curriculum formation, as historically demonstrated by Apple (1993) and Mnguni (2013), is a dialectical result between interests and tensions, especially when building professional courses in public institutions, fostering the labor market that will meet the interests of different sectors. determined economics. That is, taking into account the results of the research, the scalar limitation of the

political processes is characterized, and decision-making on a macro scale ends up not reaching, at this analytical moment, the medium or micro dimensions identified in the curricula. Since the IFs in Brazil have signed a commitment in their guiding legislation to train professionals to serve the regional economies, it is possible to verify that the technical courses in the environment in the IFs of RS end up presenting a picture of lack of consolidation of the capillarity of the theme of climate change in the offer of technical workers in the country, as well as curriculum synthesis via the interests of regional markets and educational agents, pointing to a complexification of debates in the scalar dimension.

This confirms what was found by Verges (2017) in studies on the Brazilian climate policy and its territorial scope, verifying that the directives of international agreements and their national policies were not fixed in the local context. As far as the CCE is concerned, based on the case analyzed, it is appropriate to point out the same direction of the facts, reflecting a misalignment between global actions and agreements with regional or local applications.

Thus, professional training institutions end up playing a distant role in the development of political actions related to the climate. In other words, they do not present themselves as a force in the sense of promoting a CCE, currently representing spaces of spraying the issue.

Because of these aspects, it necessarily falls back on a dialogue about the possible gap between environmental education and the treatment of climate change.

6.4. Indication of imbalance between environmental education commitment and climate change focus

Jacobi et al. (2011) pointed out that in the scenario of countries that had effectively discussed the issue of climate change from an educational perspective, there were three groupings: 1) working with the CCE independent of environmental education; 2) CCE inserted in the environmental education; and 3) the independent CCE, but still working with the references of environmental education.

From the point of view of the data obtained through the survey produced with this work, it verified the occurrence of peripheral development of the motto about climate change from scores in generalist curricular components, without specified projects, and a focus for work with environmental education by force of Brazilian legal indications.

In technical courses in the environment, environmental education is also configured as a practical instrument of professional performance, with normative tasks from the supervisory bodies of the labor market. A curricular dimension has not been achieved that constitutes the particularization of climate change in the same sense, that is, neither as a way of acquiring specific skills and competences, nor as a path to the daily work of an environmental technician.

In this sense, for the case observed in the country, it is not possible to affirm that there is a particularization of the CCE nor its necessary link to environmental education, but the spectrum of the subject ends up pulverizing the physical mechanism on the climate and some points on the impact of societies in an in-depth discussion. In this way, there is a notorious unevenness between the two subjects, representing a normative and pedagogical absence for what is understood by CCE.

It is observed that environmental education is included in the analyzed curricula as a normative aspect, through the law, and at the same time as an instrument of professional performance. In conceptual determinants, clearly defined climate change is not allocated in its organizational and pedagogical contexts, punctuating it shallowly in other moments (curricular components) of the training of technicians in the environment. As a result, institutions do not offer a professional who

can effectively determine the specificity of the problem, and similarly, economic actors do not impose themselves as thematic beacons.

This review brings with it a widening of the difficulties that can be expressed in new questions about the process of asserting CCE in professional education in the country. That is, who are the professors who discuss climate change in their pedagogical practices? What are their objectives? When do they work on this topic? In which spaces and with which didactic strategies can it be studied?

Zeppo and Coltri (2022) point out the lack of teacher training to deal with climate change in Brazilian education and the scarcity of academic materials with this focus on the Portuguese language, which confirms part of what was identified by Jacobi et al. (2011). At the same time, there is a lack of determination in the legislation that provides the basis for working with the subject, which adds to the gaps produced in the curricula, reinforcing the gap between environmental education and CCE.

7. Analytical perspective synthesis

Considering the guiding questions of the research, it is possible to verify that: 1) the terms "climate change", "climate crisis" and "climate emergency" are not very relevant in the studied courses, not necessarily producing a pedagogical work organized around the focused theme; 2) the analyzed terms are inserted in some curricular components, without specificities and alignments to the indicatives of a CCE; 3) terms or phrases analogous to climate change indicate the spraying and generalist perspective for the scope, without deepening; 4) there are no projects in the curricula for working on climate change in the verified courses.

For these aspects, it is noted that the debates and insertions carried out by Brazil at the international level on climate change end up not being carried out, from the perspective of a CCE, in the curricula of professional training at a technical level in the field of the environment, considering the adopted selection. This expresses a scalar discontinuity on the analyzed topic, which may require the formalization of normative instruments that guarantee work on climate change in school curricula.

8. Conclusion

Through the results obtained with the survey carried out and the elucidate references, it is pertinent to indicate the need to expand the discussions on climate change in Brazil from the concrete manifestation of components and projects in the curricula. What is observed is an approach to the theme, with a character centered on some isolated identifications of the general functioning of the climate and the impacts that societies can generate, but there is no debate centered on the dimensions of the recognition of roles in society on the problem post, the perspectives of mitigation and, also, of adaptation to changes in the climate.

The general dimension of environmental education has been centered in the educational spheres of the country through legislative formalization, inserting it in the contexts of the national guidelines for education. In the case of climate change, there are only suggestions in the public policies raised by the international commitments assumed by the country, which in the end does not burden the effective work and organization of a CCE in the specific formations that we analyze as case studies in this work.

In this way, it is proposed the expansion of qualitative studies with the collegiate that organize the professional curricula to measure the indicators of the absence of a CCE in the constructed pedagogical processes.

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