

## Territory Mapping as a Citizen Education Tool: A Community Extension Approach from SENAI CIMATEC University

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**In 2018, the Ministry of Education implemented Resolution No. 7, which establishes guidelines for extension in Higher Education and makes it a part of the curriculum. This new model seeks to strengthen the social commitment of Higher Education Institutions by promoting social participation. At SENAI CIMATEC University, university extension was restructured with the creation of the Community Extension Center (NEC) in 2024. The NEC works to develop extension programs that incorporate the principles of Popular Education and Citizen Education, promoting social development and integrating teaching and research. To identify community needs, the NEC adopted the Territory Mapping tool, in which students conduct a sociocultural assessment of the location, understanding its physical, political, and cultural dimensions. The territory mapping was conducted by Mechanical Engineering and Data Science and Artificial Intelligence students between March and July 2025. This work aimed to report on the experience of the NEC team and the students, addressing the main stages of the mapping, student feedback, and the identification of potential projects. The first part of the mapping investigated basic infrastructure and environmental and cultural aspects. The second part addressed community participation, economic issues, security, and cultural manifestations. The most frequently identified cultural manifestations were music, dance, sports, graffiti, and crafts. Through their experience reports, the students demonstrated their involvement and knowledge of local realities. Territory mapping proved to be an effective tool for civic education, allowing students to connect with the realities of their communities and awakening the desire to develop relevant extension projects. The mapping results, including the identification of infrastructure, environmental risks, and cultural manifestations, will serve as a basis for future extension projects, strengthening the relationship between teaching, research, and extension, in line with the objectives of SENAI CIMATEC University.**

**Keywords: Territorial Mapping. Citizen Education. Extension. Engineering. Data Science.**

In 2018, the Ministry of Education implemented Resolution No. 7, which establishes guidelines for extension in Higher Education and makes extension curricular [1]. This new model reinforces the social commitment of Higher Education Institutions through actions that foster Social Participation. Thus, university extension at SENAI CIMATEC University was restructured in 2024 with the implementation of a community- focused extension program through the creation of the Community Extension

Center (NEC), located within the Office of the Provost for Extension and Community Affairs. To gain a broader understanding of the problem, provide more effective responses, and strengthen citizenship and sustainability initiatives, the NEC established a multidisciplinary structure composed of professionals from the fields of engineering, pedagogy, anthropology, psychology, and social work. Biweekly meetings are held to discuss key cases and tools for analysis, feedback, and integration of different perspectives based on the PBL methodology. The new community outreach culture was implemented systematically, articulating with teaching and research and involving the University's and the SENAI CIMATEC ecosystem's key areas: education, science, technology, innovation, and business for industry and society, such as the Institutional

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Relations and Technology areas. This proposal is based on the development of an outreach program guided by the principles of Popular Education and Citizen Education, focused on promoting social development, overcoming merely welfare-based practices. Community outreach is structured and curricular based on the premises of the document "Extension in Social Participation – Reference Document" [2]. With this premise, extension practices are articulated at NEC through two extension programs: the Girls 4.0 Program: Connection to Change the World, which began as a teaching initiative, was added to the core due to the experience and alignment of its mission with that of NEC. It is composed of extension workers, members of the Women in Engineering (WIE) student branch, and partner schools. The objective is to guide, connect, and inspire girls from elementary and high school onwards to greater participation in the STEM (Science, Technology, Engineering, and Mathematics) field through workshops and guided tours at various companies in the industrial sector; and the Public Office of Engineering and Architecture (EPAE), whose main objective is to provide architecture and engineering services to the communities and partner institutions served, focused on the development of supervised projects that enable students to develop and improve technical skills in their respective areas of training, in addition to strengthening transversal skills related to extension practices.

To identify the demands and needs of the communities, the Territory Mapping tool was adopted. This tool allows students to conduct a sociocultural assessment of the territory chosen for extension work. This allows them to understand its physical, political, and cultural dimensions, enabling them to identify actions and projects to be developed. The tool brings students closer to the communities.

Territory mapping involves conducting research on the community's socioeconomic data on official websites such as the Brazilian Institute of Geography and Statistics (IBGE), researching

the map of streets and public spaces in the area in digital and georeferenced format using aerial photogrammetry and satellite imagery, available on Google Earth, for example. In addition, technical field visits and dialogue with community members are conducted.

Within this context, this work aimed to report the experience of the NEC team and first-semester extension students in the Mechanical Engineering and Data Science and Artificial Intelligence programs during the territory mapping activity. The main stages of this activity, including student insights and feedback, and the identification of potential projects and actions based on the mapping results, were discussed here. In other words, it's important to emphasize that this was the first step in the ongoing initiative, which will continue in subsequent semesters, as the extension program runs from the first to the fourth semester.

### **Territory from the Perspective of Extension Practice**

It is necessary, first, to conceptualize territory and then to understand its dimension for extension practice. The term territory comes from the Latin "territorium," an expression referring to a delimited space. However, the "physical" dimension alone does not encompass all the issues involved in extension work. Other dimensions, such as political, cultural, economic, and regional, must be considered [3]. Thus, the NEC operates based on Corrêa's understanding, which considers that territory is, in reality, a concept subordinate to a more comprehensive one: space—that is, spatial organization. Territory is space endowed with political, affective, or both dimensions [4]. In addition, it is based on Santos' understanding that it is within the territory, as it currently exists, that citizenship is learned and must be claimed, as it occurs within the political, social, and legal context through institutional mechanisms that guarantee the exercise of agreed-upon rights and, in the event of denial, ensure the right to file a complaint and be duly heard. This is one of

the areas in which extension practices operate: contributing to the awareness of citizenship through Social Participation [5]. Since the beginning of globalization, the concept of territory has expanded, no longer tied to a single physical space, changing the way individuals relate spatially, breaking down borders, and building a new order—an open, global space.

In extension, territory presents itself as a space for the development of citizenship education, the consolidation of teaching and research, and the dissemination of knowledge. This interrelationship between territory and education is addressed in various fields of knowledge and represents important milestones in the history of Brazilian education. Table 1 shows the evolution of the concept of territory over the decades, its origins, and its foundations, as they relate to education.

It can be seen that the set of values that guided figures in the history of Brazilian education, such as Paulo Freire and Anísio Teixeira, or important movements such as Educating Cities, remain relevant and fundamental in building a more just and equal society. After almost a century, Brazilian education is experiencing a moment of

profound transformation with the emergence of curricular extension. The territory is, so to speak, a space for the dissemination of knowledge based on the relationships between extension workers and communities. It is worth emphasizing that the use of territory mapping is precisely an affirmation of this bias, as this tool invites extension workers to step outside their supposedly knowledgeable position and listen to those in the territory, thus enabling a joint diagnosis and paving the way for joint planning and action. In this way, the civic experience is encouraged in all involved in the process.

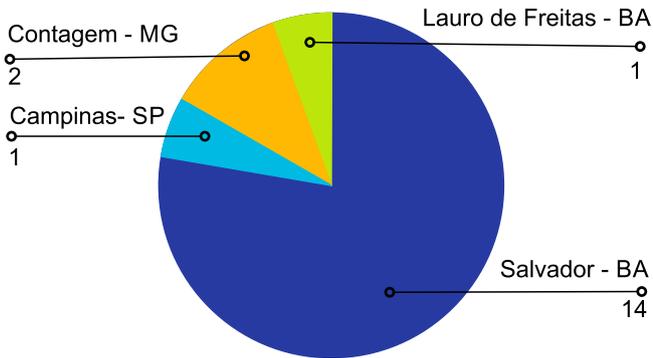
### Results of the Territory Mapping

The territory mapping was conducted by first-semester students of the Mechanical Engineering and Data Science and Artificial Intelligence (CDIA) programs, offered through distance learning (EAD) by SENAI CIMATEC University, with different campuses. The activity was conducted between March and July 2025. Figure 1 shows the number of students involved in this activity, distributed by city/hub.

**Table 1.** Important milestones in the history of Brazilian education. Adapted from [6].

Author	Educational Territory	Principles
Mário de Andrade, 1935 (Architect)	Playgrounds	Learning environment through experience and play.
Anísio Teixeira, 1950, (Jurist and professor)	Public School (Park School)	Comprehensive education, democratic and inclusive principles, openness to the community, socially engaged education.
Paulo Freire, 1960 (Pedagogue)	Schools and Universities	Citizen Education.
Charter of Educating Cities, Bologna, 1994	of Educating Cities (Cities that are part of the International Association of Educating Cities)	Participation in urban planning.
Ladislau Dawbor, 2000, (Economist)	Neighborhood/Community	Student protagonism, knowledge of reality, connection, empowerment and citizenship.
Multi-authored, 2025	Academic Territory (Symbolic Space)	Education takes place inside and outside the University walls.

**Figure 1.** Number of students by city.



To prepare students for the practical work, they had the opportunity to experience synchronous meetings with their faculty advisors and participate in thematic workshops (Community Outreach and Anti-Racist Practices), which are part of the set of outreach strategies for developing social technology.

The goal of territory mapping was to identify the initial information important for developing outreach projects, such as needs, resources, and social factors.

This tool allowed students to delimit the area of attention (the area where outreach projects will be developed) and define the micro-areas based on the identified indicators, social risks, and territorial barriers [7,8].

In the synchronous monitoring, guidance, and project dedication classes, the tasks to be submitted by students were presented: the territory mapping, divided into two parts, and the experience report, which is the student's perception of what they learned using the tool. At this stage, students were able to define which territory to map based on their teaching center. Table 2 shows the number of students and the territories/communities chosen for mapping.

The first part of the mapping investigated aspects of basic infrastructure, such as access to water and sewage services, housing typology, public facilities, as well as environmental and cultural aspects.

After defining the territory/community, the students identified areas with potential for

**Table 2.** Number of students per team and territories chosen.

City/State	District / Community	Students per Team
Salvador-BA	Bairro da Paz	7
Lauro de Freitas-BA	Vila Praiana Community	1
Salvador-BA	Community of Trobogy	1
Salvador-BA	Aristides Maltez Hospital	3
Contagem-MG	Vila Barraginha	2
Salvador-BA	Calabetão	2
Campinas-SP	Centro Dia	1
Salvador-BA	CASE Foundation	1

developing outreach projects, described as follows: Buraquinho, Bairro da Paz, Trobogy, and Calabetão (Bahia); Vila Barraginha (MG) were defined as peripheral areas; Aristides Maltez Hospital (HAM) as a philanthropic (public) hospital; Day Center as a foundation specializing in elderly care; and the Case Foundation, identified as a center for the detention and education of young people deprived of liberty.

After the geographic characterization of the territories, other aspects related to infrastructure were analyzed, such as the quality and availability of public transportation and housing types.

Most students identified public transportation as efficient, and regarding the type of occupancy, only 27.8% considered it regularized. This data highlights the need to examine the status of these properties and consider possible actions in this regard. On the other hand, this percentage reveals the difficulty of EPAE's actions, since property documentation is a prerequisite for project development.

Regarding public facilities, 90% of students identified the presence of public facilities in the areas investigated, with schools being the most

cited type, reaffirming that this is the most strategic space for the development of extension activities. Since 2024, NEC has been carrying out activities at Colégio Mestre Paulo dos Anjos (CEMPA), located in the Bairro da Paz Community, where several extension projects have already been developed and others are underway or in the implementation, deployment, and monitoring phases.

The most frequently cited environmental risks were floods, landslides, erosion, and pollution. This data also reveals a significant field of action. The second part of the instrument addressed aspects of community participation and development, economic and security issues, and local cultural manifestations. The results revealed limited or no community participation in collective decision-making processes, highlighting the need to develop strategies to increase community political engagement, especially when striving for equity, social justice, and sustainable development. When the community participates in decision-making, these decisions better reflect the real needs and desires of the area, ensuring that public policies and government actions are more effective and legitimate. Furthermore, historically marginalized groups can have an active voice in decision-making, strengthening the fight against inequalities, and securing rights.

Regarding safety, almost half considered the area safe. It is important to emphasize that this is an external perception, a perspective from someone "outside" the community. Identifying cultural manifestations opens a space for recognizing and strengthening local culture. The most frequently identified manifestations were music, dance, sports, graffiti, and crafts. The presence of leisure and cultural spaces points to potential development initiatives.

After completing the second part of the mapping, experience reports were compiled, in which the teams evaluated what was learned in the previous phases. The experiences were recorded through videos and podcasts.

Two notable reports were presented in podcast format. A team from Minas Gerais reported on a

landslide that occurred in 1993 in Vila Barraginha, killing 36 people, leaving nearly 70 injured and hundreds homeless [9]. When the students described the Vila Barraginha area, they realized the scale of the tragedy for that community, the state of Minas Gerais, and Brazil. They reported, in their orientation, that in 1993, a year after the landslide, the National Conference of Bishops (CNBB) presented decent housing as the theme of its fraternity campaign, given the scale of the tragedy. The theme was "Fraternity and Housing" and the motto "Where Do You Live?" [10].

According to the students, more than twenty years after the tragedy, the local community still faces difficulties resulting from the tragedy, sparking a desire to develop something relevant, through outreach, to improve that community. It is noteworthy that the perspective of the students and the Center itself refers to a contribution, with an awareness of the limits and responsibilities that fall to the Academy in its relationship with the social context.

A second account came from a group that described the Brotas neighborhood, where the Aristides Maltez Hospital is located. The team's goal is to develop an application to reduce the waiting time for treatment in patients with BI-RADS 4 results (indicative of cancer) [11]. The Aristides Maltez Hospital is a reference in cancer treatment, classified as the largest 100% cancer center within the Unified Health System (SUS) in Brazil [12]. In both reports, it was concluded that the teams were engaged with the spaces delimited in their respective mappings. The instrument proved effective in enabling connection between them and the communities, as a first step toward understanding and building bonds. By the end of the semester, they demonstrated engagement and a greater understanding of local realities.

## Conclusion

Territorial mapping proved to be an effective tool for civic education, allowing students to connect with the realities of their communities.

Initially, students had more general information about the realities they studied, but by the end of the semester, they demonstrated engagement and a greater level of knowledge about local contexts. This connection sparked a desire to develop relevant outreach projects, such as the Minas Gerais team, which, after studying the history of Vila Barraginha, expressed interest in working to improve the community. Another example is the group that mapped Aristides Maltez Hospital and proposed creating an app to reduce waiting times for patients diagnosed with cancer.

The results of the territorial mapping, which included the identification of infrastructure, environmental risks, and cultural manifestations, will serve as a basis for the development of outreach projects in subsequent semesters. Schools, for example, were the most frequently identified public facilities, indicating potential for outreach activities. The presence of environmental risks such as floods and landslides also revealed significant scope for action. Thus, mapping strengthens the inseparability of teaching, research, and outreach by enabling the structuring of diagnostic research, discussions mediated by the teaching field, and projects for community feedback. Furthermore, the foundation of secondary education is the construction of a critical analysis regarding the value and relevance of local knowledge contributed by social actors, forming a cycle of knowledge based on experience and social relationships: students are protagonists of outreach activities, which, in turn, foster the appreciation and protagonism of the community, in accordance with the objectives of SENAI CIMATEC University.

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