Interaction Design and Architecture(s) Journal - IxD&A, N.65, 2025, pp. 207 - 235
DOI: 10.55612/s-5002-065-007

A Participatory Model for Urban Design on University Campuses: A Map-Based Approach

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Abstract. The built environment significantly shapes perceptions and behaviors in public spaces, including university campuses. However, institutional fragmentation and limited participatory planning often create gaps between research and practical application. This article introduces a Participatory Model for Urban Design on University Campuses, which employs a Map-Based Approach emphasizing collaborative interactions with physical maps during in-person workshops. Tested at the Federal University of Rio de Janeiro (UFRJ), the model inspired a participatory approach that engaged participants, leveraged collective intelligence and generated new perspectives for campus planning. By integrating maps with design thinking, this study connects theoretical concepts and practical challenges, synthesizing expertise from a multidisciplinary team to address spatial complexities dynamically. Beyond presenting the model, the article provides a replicable framework for participatory processes and advances research in collective intelligence and mapping activities. These findings offer valuable guidance for planners, architects, administrators, and researchers seeking to implement inclusive and impactful urban design practices.

Keywords: collective intelligence; participatory design; design thinking; urban planning, urban design; urban care

1 Introduction

The critique of modernist formalism that gained momentum in the 1960s sought to address the growing complexity of urban life and the multiplicity of social and cultural modes of existence. This period marked a shift in focus toward exploring

concepts such as identity, neighborhood, and everyday spatial practices. At the same time, the debate intensified around the gap between the values upheld by architects and the actual needs of citizens. In response, new movements emerged to bridge this disconnect, with participation becoming a key strategy to foster a more relational and inclusive form of architecture. Participation was a political gesture and a methodological reorientation that positioned users as co-creators of space. As Löw [1] observes, this period corresponds to what has been described as the spatial turn, a critical moment in which scholars recognized that social change could no longer be adequately explained without reconceptualizing spatial categories and acknowledging the spatial dimension of social life.

Numerous studies have examined how the built environment influences individuals' use, perceptions, and behaviors within public spaces, particularly on university campuses [2,3,4]. However, the practical application of research findings often faces challenges, especially when they do not align with specific political agendas. This misalignment exacerbates the research-practice gap, as university campus development projects frequently encounter institutional fragmentation. Decision-making processes in these contexts typically involve multiple governance levels across various university and government departments, leading to coordination difficulties. Moreover, while concepts such as the socio-spatial aspects of creativity are acknowledged in the planning and designing of university campuses' public spaces, their practical implementation remains limited. This issue highlights a significant gap between theoretical understanding and participatory design practices in campus development [5].

Although university campuses share similarities with other urban territories, they possess distinct characteristics compared to cities. Beyond their primary functions of teaching, research, and community outreach, the university is also significant as an cultural space in its own right. It generates internal particularities, such as areas with specific modes of operation and public policies, which are essential for proper functioning. As a unique urban territory, the university can serve as a space conducive to exploring and investigating urban forms that differ from the hegemonic ones, alternative ways of carrying out urban projects and structuring governance. These forms may emerge through theoretical reflections, research and outreach projects, and practical experiments within the university territory.

The Federal University of Rio de Janeiro (UFRJ), particularly the University City Campus, has an urban dimension. Its social body comprises approximately 80,000 people, and its structure resembles that of a medium-sized brazilian city, consistent with its strategic relevance for the country's development. Also, the characterization of UFRJ as an urban space is not sustained solely by the number of people who frequent it. The University City alone occupies around 4,800,000 square meters [6,7]. Like the others belonging to the institution, this campus consists of streets, blocks, open areas, and a wide array of buildings. It has its own internal dynamics and features a university administration responsible for managing security in common areas, the road system, and the maintenance of streets and public infrastructure, among other functions. As in Brazilian cities, the university's urban environment is marked by fragmentation, episodes of violence, deteriorating buildings, vulnerabilities, and deficiencies. Nevertheless, its territory and heritage are of great importance not only to the history of Rio de Janeiro but also to that of Brazil. Even so,

it is an unstable space that, like other areas of the city, is subject to the pressures of real estate speculation and is shaped by the processes of capitalist spatial production. The UFRJ 2030 Master Plan addressed territorial and infrastructural challenges through sustainability, heritage preservation, and strategic spatial planning. However, the plan faced shortcomings, particularly in participatory practices. Limited engagement from the academic community, despite efforts through forums and surveys, hindered the co-creation of strategies reflecting the institution's diverse needs. These challenges underscore the importance of inclusive participation in future urban and institutional development initiatives [8].

Recognizing the necessity for participatory design and planning practices within the campus, we established an internal, multidisciplinary network comprising university staff and academic researchers from fields such as Computer Science, Architecture and Urbanism, and Occupational Therapy. This collaboration addressed the central question: How can we develop a participatory approach involving the university community in campus design and planning?

This article introduces the Participatory Model for Urban Design on University Campuses, developed using a Map-Based Approach that emphasizes interactions with physical maps during synchronous, in-person meetings. We detail the development of the model through a design thinking approach, integrating the diverse expertise of our multidisciplinary team (architecture, occupational therapy, psychosociology, social ecology, and systems and computer engineering), and its application and evaluation through a series of workshops held on the university campus. In these workshops, we conducted a sequence of activities (which will be explained in more detail in the following sections): Walk and Talk Map, Ecomap, Agent Game, and Collaborative Sketching Workshop.

Although previous studies [9,10,11,12] explored participatory planning in university campuses, they did not integrate model design with practice. This work advances the field by co-creating and applying a structured participation model. It also evaluates the model as a sociotechnical artifact, marking a novel contribution. This work offers valuable insights for administrators, planners, architects, and others interested in applying participatory processes. It provides a detailed framework for developing similar models or using the dynamics we present. Additionally, the article contributes to academic discourse by demonstrating design thinking as a methodologically rigorous tool. It also offers perspectives for researchers focused on collective intelligence and mapping activities, whether conducted on paper or implemented through information systems.

This paper is organized as follows: Section 2 presents the background and theoretical framework relevant to the study. Section 3 outlines the methodology employed in the research. Section 4 describes the conception of the model using a Design Thinking approach. Section 5 provides the empirical evaluation of the proposed model. Finally, Section 6 provides a brief discussion, and Section 7 presents the conclusions.

2 Background

2.1 Participatory approaches and spatial studies: from cities to university campus

This section presents fundamental concepts of participation, a brief historical context, and key authors who ground this research by offering essential theoretical foundations for discussing participation in urban space and university campus studies. The history of design practices reflects a dynamic evolution, especially since the mid-20th century. Beginning in the 1960s, various architects, acting independently or through collectives, began to critique modernist epistemologies and proposed transformations in the field of architecture and urban design to address indeterminacy, temporal evolution, flexibility, and the notion of open form. This shift was paralleled in the social sciences and humanities, where there was a renewed interest in the micro-scale of everyday life and the macro-scale of global flows. In architecture and urbanism, new methodologies inspired by structuralist thought emerged, aiming to incorporate local context and identity into the design process.

This article adopts the perspective offered by the second generation of methods from the Design Methods Movement, particularly the approach of Rittel [13], who emphasized the inclusion of users in the design process, thus redefining the role of the architect-designer and advancing participatory design. This approach was better suited to complex, ill-defined problems involving multiple variables and subjectivities, the so-called wicked problems [14]. Among the foundational references is the work of Alexander [15], who proposed a pattern language theory in which design goes beyond physical form to address the relationship between form and context. Alexander tested this theory through participatory design methodology, notably in his experiment at the University of Oregon, where he prioritized collaboration and flexibility, showc asing the potential of participatory processes in institutional settings. He also underscored the limitations of rigid design approaches and emphasized the need to engage users in confronting wicked problems.

Further methodological grounding comes from Sanoff [16], who developed systematic tools and strategies for engaging with users through non-verbal and visual techniques to define and discuss design challenges. His work includes non-verbal interviews using strategically selected images, visual representations of landscapes, descriptive, constructive elements (visual clues), and image categorization exercises to elicit users' perceptions. Sanoff's contributions also offer a critical lens on conventional planning practices, particularly in educational environments where architects often monopolize knowledge and decision-making authority. His research spans diverse educational institutions, from childcare centers to universities, consistently emphasizing the benefits of participatory approaches.

In the Brazilian context, Santos [17] developed playful tools to capture the complexity of urban spaces and their dialectical relationship with user identity. Arteiro [18] systematized interactive and prospective methods tailored to educational spaces. These local adaptations align with the perspectives found in Heinrich et al. [19], whose handbook presents a comprehensive collection of qualitative and visual methodologies used in recent interdisciplinary spatial research. The work offers

theoretical and methodological insights into knowledge production through observation, storytelling, and lived experience, reinforcing the contemporary relevance of participatory spatial research.

The social and institutional setting of the Federal University of Rio de Janeiro (UFRJ), a large, tuition-free public university with approximately 60,000 students and a democratically elected administration, adds a layer of complexity to participatory practices. Its infrastructure spans multiple campuses dispersed throughout the city of Rio de Janeiro, a metropolis marked by deep contradictions. Despite its challenges, this context presents a unique laboratory for developing and refining methodologies to address urban and environmental issues. To navigate this landscape, this research adopts the concept of urban care as an ethical guide in developing its participatory model. Inspired by Chatzidakis et al. [20] (The Care Manifesto), the model embraces care as both a capacity and a social activity oriented toward sustaining life and collective well-being. Gabauer et al. [21] further refine this notion by examining how care can be operationalized in design and planning contexts, providing a robust ethical and methodological foundation for this work.

Recent literature highlights diverse participatory methodologies applied to the planning and design of university campuses. For instance, a study conducted at the Universidad de Magallanes in Chile [9] employed a "walking methodology" as a participatory diagnostic tool, combining commented walks, interviews, and mapping sessions to capture user experiences and inform the master plan development. Similarly, a participatory landscape design project engaged students, faculty, and stakeholders in Turkey through structured workshops and surveys to co-create a vegetative landscape design for the Van campus, reflecting cultural identity and user preferences [10]. In the United States, Texas A&M University implemented a living laboratory approach, where students participated in the conceptualization and installation of sustainable green infrastructure, fostering experiential learning and stakeholder engagement [11]. Complementing these examples, an analysis of over 50 master plans from American universities revealed that participatory processes increasingly guide strategic campus planning, emphasizing spatial cohesion, user-driven sustainability goals, and integration with urban environments [12]. Together, these studies demonstrate the efficacy of participatory design in aligning campus development with the values and needs of academic communities. However, no studies were identified that simultaneously combine the practical application of participatory dynamics with the co-creation of a participatory model, one that not only structures and sequences the participatory dynamics but also evaluates the model’s acceptance as a sociotechnical artifact. This gap highlights the innovative character of the present work, which advances the field by proposing and validating such an integrative approach.

2.2 Collective Intelligence and Interactions in map based artifacts

Collective Intelligence (CI), as defined by Levy [22], represents a "form of universally distributed intelligence, constantly enhanced, coordinated in real time, and resulting in the effective mobilization of skills." This definition captures the

transformative potential of CI to leverage the "wisdom of crowds," where innovative solutions arise through collective efforts addressing shared challenges [23].

The application of CI approaches has increased in recent years, including in urban participatory processes [33], tackling diverse and complex problems across domains. Suran, Pattanaik, et al. [24] highlight that many CI systems have inspired domain-specific models and frameworks, though these are often based on intuitive approaches rather than structured methodologies. To address this gap, Suran and colleagues propose a generic CI system model that revolves around five key questions: (i) What is being accomplished? (ii) How is it being done? (iii) Who is performing the task? (iv) Why are they doing it? and (v) What are the inputs and outputs? The "how" question is particularly critical, focusing on understanding the processes and interactions that drive CI systems.

Suran et al. present additional insights into these processes, categorizing them along two key dimensions: create versus decide activities and dependent versus independent interactions. Creating activities involves generating new ideas or artifacts while deciding activities center on evaluating or selecting among alternatives. These activities can occur independently, as individual contributions, or dependently through collaborative group efforts. This classification underscores the versatility of CI systems, ranging from individual initiatives to collective decision-making, revealing the layered interactions that sustain them.

Maps play a crucial role in enabling and operationalizing Collective Intelligence (CI) processes, acting as shared media that facilitate visualization, interaction, and collaborative design, providing a platform where diverse actors can contribute, analyze, and engage with spatial data in real time [25]. This functionality makes maps invaluable for aggregating inputs, performing spatial analyses, and supporting participatory decision-making processes. In the context of CI, maps go beyond their traditional role as static representational tools. Instead, they become dynamic platforms for active engagement, allowing contributors to explore spatial complexities and address shared challenges collaboratively.

3 Materials and methods

3.1 Methodology

The methodology for developing the participatory model for urban design was structured around iterative cycles of Design Thinking and successive applications of prototyped procedures. These cycles involved empirically testing and refining the prototype through subsequent field applications. Given that the developed participatory model must be empirically evaluated, and that the participatory dynamics employed with the public are one of its core components, it is essential to assess these dynamics. This evaluation draws inspiration from approaches to technological acceptance evaluation, focusing on participants' acceptance as the primary measure. Specifically, we will utilize the UTAUT2 model [26].

The UTAUT2 model, or "Unified Theory of Acceptance and Use of Technology 2," is an extension of the original UTAUT model. It was designed to understand and predict users' acceptance of technology, encompassing seven constructs: Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Price Value, and Habit. These constructs influence the dependent variables, Behavioral Intention, and Use Behavior moderated by gender, age, and experience. UTAUT2 provides a comprehensive understanding of the determinants impacting technology adoption across various contexts and is widely applied in research within organizations, education, and healthcare. The limitation of using UTAUT to evaluate the participatory model lies in the fact that participants may have difficulty understanding the artifact being assessed. Moreover, the set of participatory instruments and processes employed may not be perceived as a technology in its entirety.

The model also incorporates visual methods for socio-spatial research, drawing on the works of Sanoff [16] and Heinrich et al. [19]. The participatory dynamics were designed to gather both qualitative and quantitative data from UFRJ's social body through structured dialogue involving images and predefined questions. Maps, photos, drawings, and diagrams were crafted to capture participants' information and opinions about campus spaces, producing combined verbal and visual data.

The visual and verbal data generated during the research process fall into three categories, as described in Heinrich [19]:

- Researcher-generated data, such as field notes or hand-drawn sketches created by researchers.
- Participant-generated data, including photos taken during the Walk and Talk Map (D1) and drawings created individually on A4 sheets during the first station of the Collaborative Sketch Workshop (D4).
- Co-produced data, created in close collaboration between researchers and participants, such as interventions on the campus map during the second station of the Collaborative Sketch Workshop (D4), diagrams from the Ecomap (D2), group of people who work on campus demands and relationships through the Agents Game (D3), and summary boards generated throughout the dynamics.

Integration of these data types occurred throughout each cycle. D2 complemented results from D1, articulated through activities in D3, and consolidated in D4. The research questions and objectives structured this integration. Inspired by the experiences of Arteiro with children from public schools in the city of Rio de Janeiro, when establishing the objectives of “mapping and building” to guide the participatory process [18], also in the development of the model the objectives of mapping and constructing guided how the data were processed and incorporated into the outcomes.

3.2 Participants and Apparatus

The participants involved in the research to develop the participatory model can be categorized into two groups: those who directly participated in the Design Thinking (DT) sessions and those who participated in field evaluations during the execution of the participatory dynamics. The DT participants included 10 individuals, divided into

two main groups: those who participated in the Design Thinking (DT) sessions and those who contributed through field evaluations during the implementation of the participatory dynamics. Subsequently, all participants acted as facilitators for the general public during the participatory dynamics. The model design process served as a preparatory space, allowing the team to develop and strengthen essential skills before engaging the general public in discussions about everyday urban challenges, contributing to the fight against what Maricato [27] calls "urban illiteracy."

This broader audience consisted of voluntary participants from UFRJ's social body, including undergraduate and graduate students, tenured and substitute professors, collaborators or visiting faculty, administrative staff, outsourced service providers, and users of UFRJ's services. The four dynamics were applied sequentially during field sessions involving 40 participants. The activities took place in a 3m x 3m tent set up in an open area near the entrance to the campus. The tent environment, organized with tables, chairs, various plastic materials, games, mats, posters, and campus maps, aimed to attract the interest of passersby, explore the lived space, and facilitate communication and engagement. People were invited to participate in the activities, enjoy refreshments, and share their stories about UFRJ's urban space. The following section will present further details regarding the materials and tools used in each dynamic.

Fig. 1. Tent and space used for participatory dynamics

4 Model conceptualization

This section presents the application of Design Thinking (DT) in developing a participatory model for urban project planning at UFRJ. During the first two months, the team conducted initial meetings to define workflows, identify key problems, and establish project objectives. The group focused on building the theoretical foundation through lectures and presentations in the third and fourth months. In the fifth month, a series of DT-based activities were carried out to analyze and synthesize insights drawn from the theoretical research. These activities centered around the guiding question: “How can we develop a participatory approach that actively involves the university community in campus design and planning?” Design Thinking was adopted

as the core methodological framework to support a creative and collaborative process, fostering interdisciplinary engagement and harnessing collective intelligence.

The participatory model was systematically conceptualized through the five stages of DT defined by Stanford d.school [28]: Empathize, Define, Ideate, Prototype, and Test. Various DT dynamics were utilized, including Insight Cards, Conceptual Maps, Personas, User Journeys, Service Blueprints, and techniques such as Brainstorming, Dot Voting, and Dogfooding. Each method provided a structured approach to organize and analyze participant input, enabling the creation of a comprehensive framework for urban campus planning. The detailed data and insights derived from these activities are presented below.

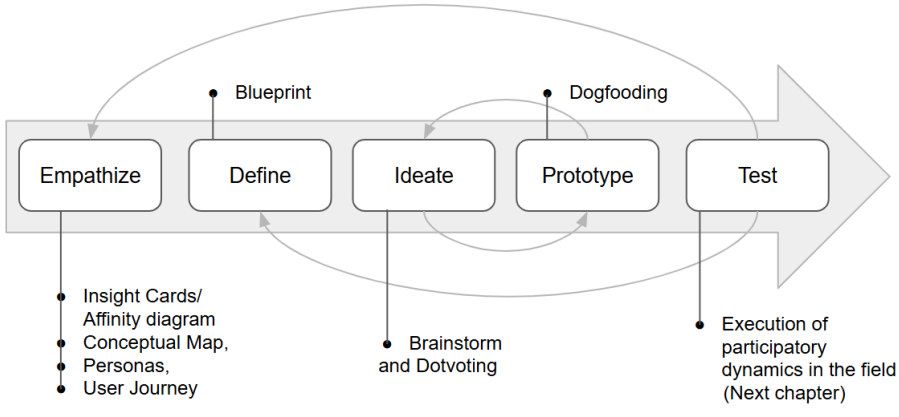

Fig. 2. Flow of activities in Design Thinking, adapted from [28]

4.1 Insight Cards

This process involves documenting participants' observations from their interpretation of bibliographic research and interviews with experts, aiming to facilitate the project team's consultation and manipulation of information. These cards are organized in a way that simplifies the identification of patterns and the creation of challenges, contributing to a deeper understanding of the issues. The table below presents the main themes that emerged from the clustering of obtained insights and the conceptualization employed by the group.

Table 1. Themes identified during the Insight Cards activity

Theme	Conceptualization
Dissemination	Spreading what is produced, communicating actions, articles, and the process itself
Care	Being present, accompanying, offering support

Uncertainties	The unpredictability of potential failure, unknown aspects of the future - dealing with the uncontrollable
Mapping	Discovering, locating, spatially representing
Phases	Parts of a flow
Literacy	The process of teaching and learning about the city
Subjects and stories	Who are the people involved, their backgrounds, and where they want to go
Activities	Participatory dynamics
Indicators	Markers that highlight the progress of processes and their results

The Insight Cards technique, combined with an affinity diagram, allowed participants to document their observations and group insights into cohesive themes. Based on the defined set of themes, an affinity diagram was created. This step consisted of a matrix in which participants identified and explicitly outlined the affinities between the various themes. The following table presents the affinities found among the identified themes:

Table 2. Affinities found among themes during the Affinity Diagram activity

Theme 1	Theme 2	Affinity between themes
Disclosure	Care	Disclosure as a time marker for care
Care	Uncertainties	Uncertainty increases the need for care
Care	Mapping	Mapping as a form of care
Disclosure	Phases	Disclosure as the initial phase of the activity and also of the feedback
Care	Literacy	To know
Uncertainties	Subjects and stories	Recognizing uncertainties allows better listening to subjects and stories
Phases	Subjects and stories	To approach
Literacy	Subjects and stories	Understanding the role of the subject in the city
Subjects and stories	Activities	Activities allow knowing subjects and stories
Disclosure	Indicators	Indicators make the disclosure of results more tangible and legitimate
Care	Indicators	How people engage with city care
Mapping	Indicators	Form of representation
Literacy	Indicators	How to measure the subject's level of knowledge about the city?
Activities	Indicators	Indicators evaluate activities

4.2 Conceptual Map

The Conceptual Map synthesized the broader findings from Insight Cards, visually organizing complex themes and their interrelations. Each insight addresses a layer of the participant experience. The conceptual map presented below highlights several key insights. First, individuals, along with their unique stories, engage in daily occupations and inhabit or frequent diverse urban spaces. These factors collectively shape their perceptions of the quality of these spaces. Second, these individuals participate in activities that are guided by distinct phases or objectives. Third, such activities foster literacy and spatial understanding while also enabling the creation of indicators to measure the level of engagement generated. Lastly, the activities, their outcomes, and the associated indicators are grounded in an ethic of care for urban spaces, serving as a way to connect more meaningfully with participants.

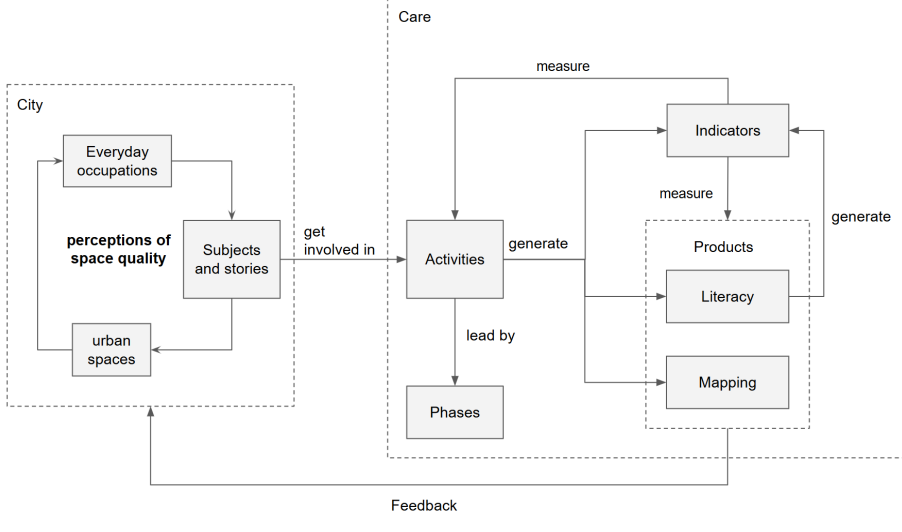

Fig. 3. Conceptual Map

4.3 Personas

Personas brought specificity to the process by embodying different user archetypes, allowing the team to empathize with various stakeholder perspectives. Two key personas were identified.

Table 3. Identified personas and their characteristics

Figure	Basic Data	Activity	Key Challenges	Relevance
	Fernanda 35 years old Black Woman Middle income	Substitute Professor	Balancing work, study, childcare, and dissatisfaction with campus infrastructure.	The professor highlighted the need for better infrastructure and a supportive environment, emphasizing care and accessibility as crucial aspects.
	João Pedro 22 years old White Man High Income	Economics Student	Limited engagement, dissatisfaction with campus facilities, and focus on academic goals.	His profile underscored the importance of inviting activities that encourage Participation and critical thinking, linking to care, dissemination, and literacy themes.

4.4 User Journey

The User Journey is a visual mapping that encompasses all phases of the relationship between a persona and the products or services offered by an organization. This map outlines each interaction and touchpoint step by step, presenting the participant's perspective. Furthermore, it highlights the emotions and experiences felt by participants at each stage of the process, providing a comprehensive and participant-centered understanding of their journey.

The following figure shows that the journey consists of four main stages: invitation, warm-up, activity, and feedback. The invitation is conducted through various channels, such as emails sent via the institutional system, social media, physical promotion spaces, and printed materials like flyers. Personalized oral invitations may also be extended to potential participants. The warm-up stage involves sending reminders and thought-provoking messages after the invitation and before the activity. These messages can include sharing relevant content or confirming Participation via email.

The activity phase begins with welcoming participants and providing necessary orientation and instructions. It culminates in the execution of the planned activity. After the activity, it is essential to include a moment for evaluation and conclusion to consolidate outcomes. The final stage, feedback, involves delivering results through emails, social media, or external media channels outside the university. Feedback can also take the form of regular follow-up activities, crucial for maintaining and strengthening the relationship between the project team and campus participants. This structured approach ensures a meaningful and engaging experience for all participants throughout the journey.

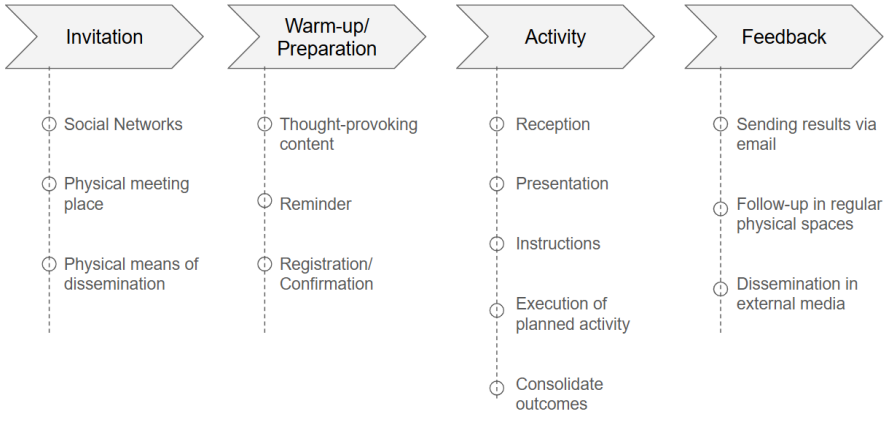

Fig. 4. User Journey

4.5 Blueprint

The blueprint aims to facilitate the mapping and standardization of interactions within the services conducted during the participatory activity. It achieves this through a simple and intuitive visual representation that encompasses all touchpoints with the participants. Based on the user journey, as shown in the following figure, a table was created to associate each touchpoint with specific aspects. These aspects include physical evidence, which refers to tangible items involved at each stage; participant actions, which are the tasks they need to perform; interaction barriers, which are obstacles preventing the expected actions; employee actions, detailing what the activity team must do alongside participants to complete the stage; backstage actions, which involve internal preparations by the team; and a stress meter, which reflects the emotions participants may experience during each stage.

Several guidelines were established from the intersection of the user journey with these aspects. Invitations will be sent via email and social media, providing links for participants to register. One possible barrier to this action is the high volume of emails received daily, which could lead to the invitation being overlooked. To mitigate this, concise and engaging email titles should be used. Simultaneously, a physical space with regular availability should be established to foster interactions between the organizing team and potential participants. This space, ideally a tent, should be set up during scheduled times and dismantled afterward. It is recommended that a comfortable environment, offering water and small snacks, be created to pique the curiosity of passersby and encourage them to engage. The tent should be positioned in an easily reachable and noticeable location to ensure maximum accessibility. However, the tight schedules of campus members occupied with work and study could hinder or discourage their approach.

In addition to the invitation and the physical tent space, the call should be expanded with flyers and posters distributed across the campus. These materials need to capture the readers' interest effectively. The organizing team can enhance this by distributing pamphlets and delivering brief, engaging messages. Following the

invitation phase, the preparation and warm-up stage begins. During the time window between the invitation and the activity, strategically provocative content related to the activity theme should be created and distributed via email, social media posts, and creatively designed flyers. Oral and in-person interactions on campus should also communicate this information. It is also essential that registered participants receive confirmation emails and reminders as the activity date approaches.

Before the activity day, the organizing team must prepare all necessary materials, train facilitators, and establish clear and straightforward rules for the event. On the day itself, the first step is to welcome participants. This step involves preparing the venue by ensuring all required furniture, decorations, posters, and food are in place to create a pleasant and comfortable atmosphere. Initial conversations with participants are also meaningful, providing welcoming remarks and general explanations.

Next, presentations and instructions for the dynamics should be delivered clearly and effectively. Some team members should document the process through photographs and notes during the activity. At the conclusion, a brief wrap-up is followed by the distribution of individual questionnaires to gather participants' perceptions and evaluations. This structured process ensures all participants a seamless and engaging experience, fostering meaningful interaction and feedback.

In the days following the activity, the organizing team should disseminate the dynamics results via email, social media, and external media channels. Additionally, the team should continue with follow-up activities to engage with the campus community

	Invitation	Warm-up/ Preparation	Activity	Feedback
Physical Evidence	Social media, tent, flyer/poster.	Provocative speech, creative posting, space transformation.	Beach fair ambiance, maps, drawings, photos, models/projectors, materials, stationery.	Sending results by email, sharing outcomes on social media, follow-up on physical spaces, extension projects, tent/city.
User Actions	Access digital folders, offer comfort, commute, read/store materials.	Express interest, register.	Dedicate time, participate, fill out forms.	Read emails, review materials.
Interaction Barriers	Lack of engaging access, tight schedules, lack of interest in the topic.	Lack of social interaction habits, platform algorithm issues.	Difficulty understanding instructions, complex rules, unforeseen climatic events, lack of materials, competing events.	Lack of access to communication means.
Employee Actions	Create compelling/concise titles, set up an attractive environment (snacks and water), deliver short speeches, distribute flyers.	Prepare related texts for activities, guide participants.	Engage users, train facilitators, photograph/record events, organize materials.	Provide follow-up through emails, social media, and regular physical space activities.
Backstage Actions	Evaluate engagement, prepare/print materials, reserve and prepare spaces.	Design creative flyers.	Research and prepare materials, take notes on events, create forms.	Spatialize results.
Stressometer	Anxiety, curiosity, indifference.	Outrage, mobilization.	Comfort, interest, satisfaction.	Satisfaction, disinterest.

Fig. 5. Blueprint services

4.6 Brainstorms and Dotvotings

After defining a generic service blueprint, we initiated brainstorming sessions to identify the specific participatory dynamics to be included in our schedule. Aware that these activities would soon be tested with participants in a real-world context, we selected various participatory techniques from the literature that could be applied. These were organized into a list, accompanied by a brief description of the objectives they fulfilled, the expected outcomes, and their alignment with the group's goals. From this synthesis, the team recognized the need to establish its own dynamics based on existing ones to address the objectives and the specific context of UFRJ fully. Subsequently, through a process of grouping, adaptation, and voting, four participatory dynamics were developed, inspired by the previous experiences highlighted in the literature review: (D1) Walk and Talk Map, (D2) Ecomap, (D3) Agents Game, and (D4) Collaborative Sketch Workshop.

Walk and Talk Map (D1) results from a combination of existing dynamics to map a given physical space, its qualities, and users' perceptions. From the *walkthrough analysis* [18] and the *awareness walk* [16], the idea of the interview-walk was adopted, which is useful for quickly understanding a given environment's positive and negative aspects. From the *affective mapping* [32], the concept of mapping places that are meaningful to participants, marking areas they cannot or usually do not access, and observing their level of familiarity with the territory was selected. From the *image-based walk* [18] and the *sequential recording of a path or route* [16], the idea of documenting the route taken during the walk through photographs and drawings was incorporated.

The *Ecopamap (D2)* is a well-established methodology [31] and was applied in the research in a manner similar to its original form. The main adaptations involved linking the identified agents to the significant spaces identified in D1 to spatialize the relationships and interactions.

The *Agents Game (D3)* was the result of integrating two dynamics: the *Agents Game* [17] and the *Desires Panel* [18]. From the former, the idea of negotiating over the territory was adopted, understanding spaces as objects of dispute among different agents. Participants create urban proposals based on what they imagine to be the interests and perspectives of the agents they are representing, highlighting conflicts and tensions among diverse stakeholders. The *Desires Panel* was used to synthesize the proposals outlined during the Agents Game. In this panel, participants express their needs, feelings, and desires related to the context in question, using words recorded on a collective medium.

The *Collaborative Sketch Workshop* was also a compilation of different dynamics. From *Baguncidade* [18], the idea of using a physical model to simulate spatial interventions was adopted. Implant(ação) [18] incorporated the concept of mapping participants' desires and intervention proposals onto a map. Additionally, inspired by Sannoff [16], the group created an additional workstation where participants could express their ideas through drawings, using perspective sketches of significant campus areas as a base.

The adaptations were also necessary to ensure that the dynamics were not isolated from one another but functioned as a set of interconnected activities, with the ultimate goal of developing spatial proposals for the university campus. Moreover, the

initiative advanced by creating an unprecedented methodology within the university, establishing both a dynamic and a space for debate to address institutional urban issues through a bottom-up structure. This approach brought together administrative staff, faculty, and students around the topic, organized within an interdisciplinary research project.

4.7 Dogfooding

During the prototyping phase, internal testing, or "dogfooding," was conducted for the four participatory dynamics: Walk and Talk Map, Ecomap, Agents Game, and Collaborative Sketch Workshop. This process enabled the research team to simulate the activities, identify necessary adjustments, and refine both materials and facilitation strategies before engaging external participants.

For the Walk and Talk Map, adjustments were made to improve map readability, timing, and instructions for group roles, while a collection of photographs was gathered for future discussions. The Ecomap activity was tested to refine the visual coding system and ensure the clarity of instructions for mapping social networks and categorizing relationships. During the Agents Game, role-playing exercises highlighted the need for clearer guidelines for role assignments and proposal prioritization. Lastly, the Collaborative Sketch Workshop tested the integration of creative brainstorming and visual scenario-building, leading to improved facilitation and synthesis of outputs. The dogfooding process ensured the dynamics were clear, engaging, and effective for real-world implementation.

5 Empirical evaluation

In this section, we explain how the developed model was applied and evaluated through the four participative dynamics, which are interconnected, with each one building on the results of the previous one. Each dynamic lasted approximately two hours, was conducted entirely in person, and was spaced about two weeks apart.

As illustrated in Figure 6, D1, the "Walk and Talk Map" activity involves exploring the campus and collaboratively mapping significant areas using draft maps and photographs. This process results in a Shared Central Map that synthesizes key findings. The Shared Central Map created in D1 served as the foundation for D2, where it was expanded into an Ecomap supported by narratives. This Ecomap incorporated social relationships and connections between campus spaces and agents, building upon the spatial insights of D1. In D3, the "Agents Game," a role-playing approach, utilized both the Ecomap and the Shared Central Map to simulate interactions among campus agents. This activity culminated in the creation of a summary table of project guidelines. Finally, D4, the "Collaborative Sketch Workshop," integrated the outcomes from D1, D2, and D3 to design urban interventions using both perspectives and maps. The Shared Central Map, first established in D1, remained a pivotal artifact throughout all the dynamics, providing a consistent foundation for envisioning improvements that address both spatial and social contexts.

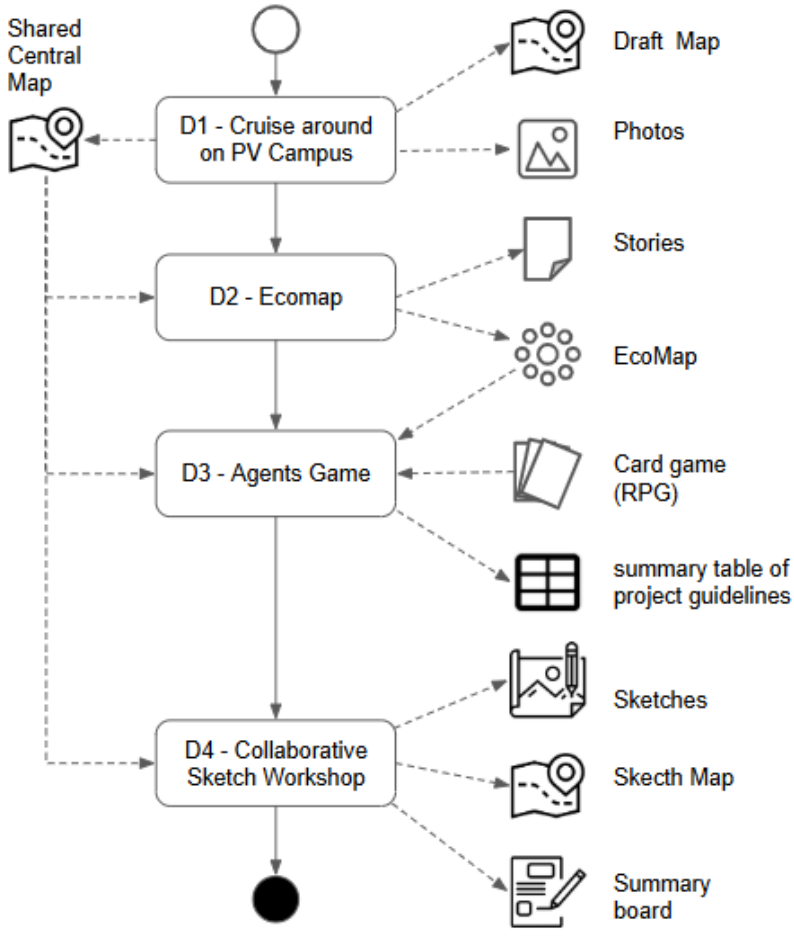

Fig. 6. Participative Dynamics and Artifacts

The participatory dynamics presented in this section center on collective intelligence, where group interactions generate shared knowledge about urban spaces. Based on Suran et al.'s framework [24], the accompanying diagrams illustrate how individual actions and subgroup interactions lead to collective outcomes through collaboration, collection, and decision-making. This analysis explores the roles and contributions of participants, facilitators, and subgroups in mapping relevant territories, highlighting the interplay between independent and interdependent actions. Role division within subgroups ensures coordinated contributions, where each participant's actions build upon the others. For example, in D1, photographers depend on plaque holders for written descriptions, while draftspeople rely on group input for mapping. Similarly, some decisions, such as prioritizing guidelines in D3, are made collectively, showcasing the balance of individual and group decision-making.

Artifacts like maps, photos, and written records are central to capturing both individual and collective knowledge. These artifacts mediate collective intelligence by visually and materially representing participant contributions, enabling reflection and analysis. Facilitators are crucial in transforming individual inputs into a cohesive group vision, ensuring inclusivity and mediating discussions.

5.1 Walk and Talk Map

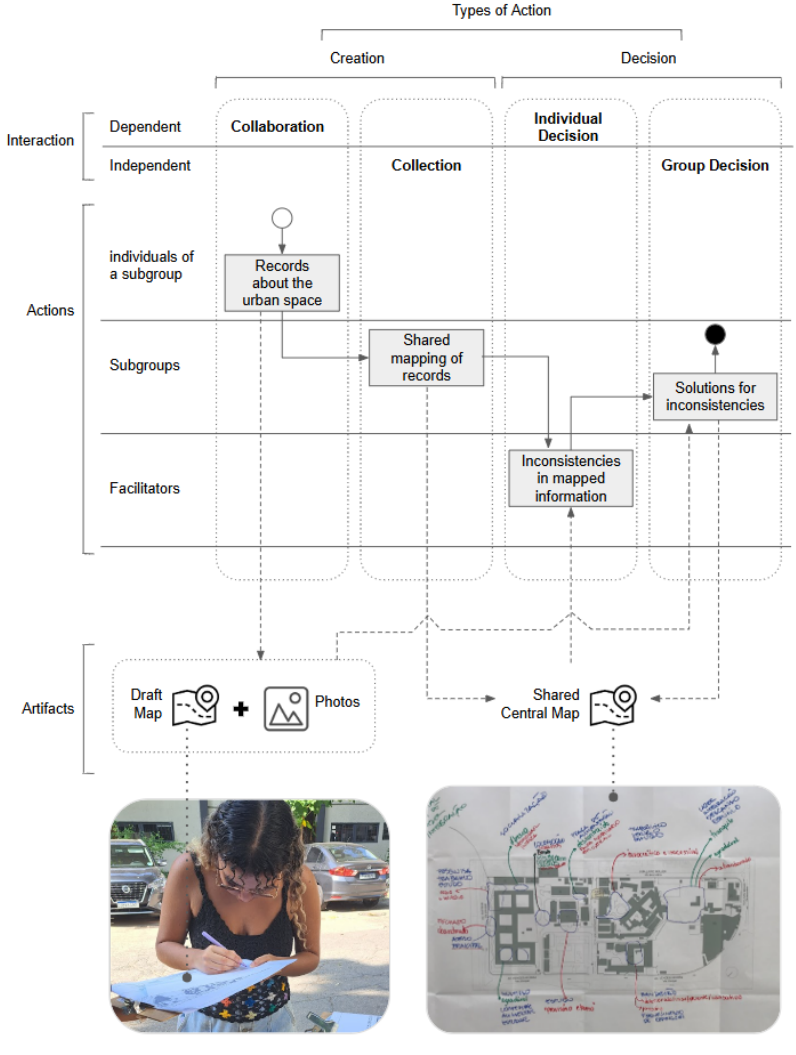

Fig. 7. Walk and Talk actions and interactions

The D1 activity's "Walk and Talk Map" objective is to explore the campus on foot to identify significant territories, their uses, and characteristics. Initially, the facilitators

should guide participants in reading the map, including its representations and symbols. Photos of essential campus buildings can be presented and located on the map to facilitate this process. Next, participants are instructed to form subgroups of approximately three to five people. Each group member will take on a specific role: photographer, model (or sign-holder), and sketcher. The participants are then asked to walk from the meeting point to a location that holds meaning.

As shown in the diagram, individuals in each subgroup collaboratively create records about the urban space through a dependent interaction process. They discuss its characteristics and uses at the chosen location, recording this information on the draft map. Meanwhile, the sketcher should mark the route taken and highlight the area of interest on the draft map. Next, the model finds a scene that represents the location and stands in front of it, holding the sign with the recorded information, while the photographer takes a picture that captures both the scene and the sign. This process is repeated at all significant locations visited.

After the walk, the groups should return to the meeting point to consolidate their findings. A large A0 urban map is provided, and each subgroup must transfer their notes to it, including the routes taken, locations visited, uses, and characteristics. In this way, as demonstrated in the diagram, subgroups independently create a shared collection of records on a central shared map. Additionally, it can be requested that positive characteristics be marked in one color and negative in another.

Once this is done, the lead facilitator may decide, through a dependent interaction process, which inconsistencies are apparent in the shared map. For example, inconsistencies could relate to the mapped spaces' qualities or geographic boundaries. Once identified, the facilitator engages the subgroups that presented conflicting notes in a negotiation process to find solutions for these inconsistencies. During this time, the draft maps made on A0 paper and the photos taken may be used as references. Finally, these solutions are noted on the shared central map.

Role division within subgroups ensures coordinated contributions, where each participant's actions build upon the others. For example, in D1, photographers depend on plaque holders for written descriptions, while draftspeople rely on group input for mapping. Similarly, some decisions, such as prioritizing guidelines in D3, are made collectively, showcasing the balance of individual and group decision-making.

Artifacts like maps, photos, and written records are central to capturing both individual and collective knowledge. These artifacts mediate collective intelligence by visually and materially representing participant contributions, enabling reflection and analysis. Facilitators are crucial in transforming individual inputs into a cohesive group vision, ensuring inclusivity and mediating discussions.

5.2 Ecomap

The purpose of the D2 - Ecomap exercise is to map individuals' or groups' perceptions of their Participation within a social support network. It helps capture immediate memories related to people, places, and activities in their everyday lives. Engagement relies on cognitive and emotional elements, which, when understood, enhance Participation in social structures.

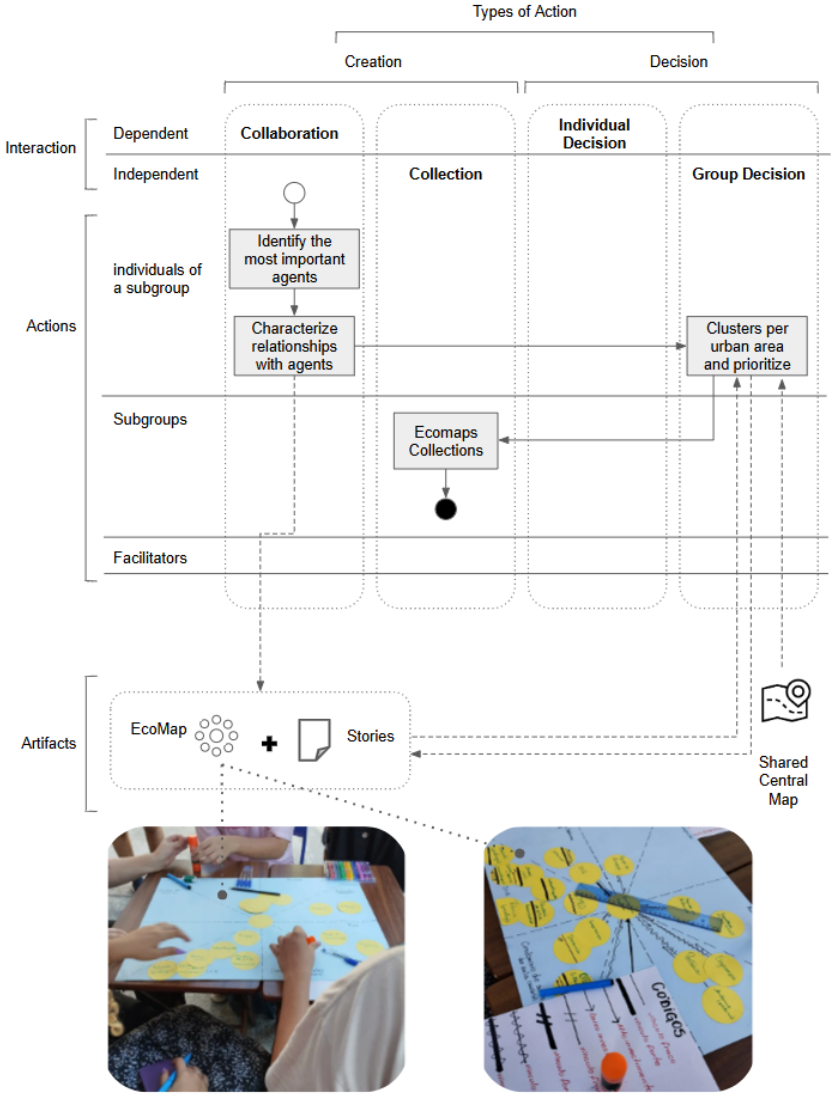

Fig. 8. Ecomap actions and interactions

Facilitators prepare paper circles, with one glued to the center of a poster board and the rest to be added during the activity. Each group chooses a name written in the center, and additional circles are used for participants to document their university interactions. The facilitator guides participants without leading their answers. In this way, participants in each subgroup collaboratively identify the critical agents in their environment through a dependent interaction process.

After reflecting on the group's support network, the facilitator introduces graphic material that includes codes representing the type of bond with social structures.

Bonds can be strong, weak, conflicted, or interrupted, indicating high or low investment. Strong and weak ties reflect the perceived importance of a relationship, while investment refers to the effort put into maintaining it. Interrupted bonds are important but inactive, and conflicts involve problems or disputes.

Participants are then asked to reflect on their relationships with the agents identified in the ecomap and apply the codes to the diagram in progress. At the end of this stage, they are asked to consider how they understand their support network after mapping the structures and bonds and whether they can identify any structures that could be modified or strengthened. In other words, participants in each subgroup collaboratively characterize their relationships with these agents in their social space. All these annotations contribute to creating the ecomap and a set of stories recorded by the facilitators.

Lastly, facilitators engage participants in a group decision to create clusters or groupings that help identify the predominant agents in each area and which groups seem to be the most significant. The central shared map from D1 is consulted to support this task, and all decisions are directly incorporated into the ecomap.

5.3 Agents game

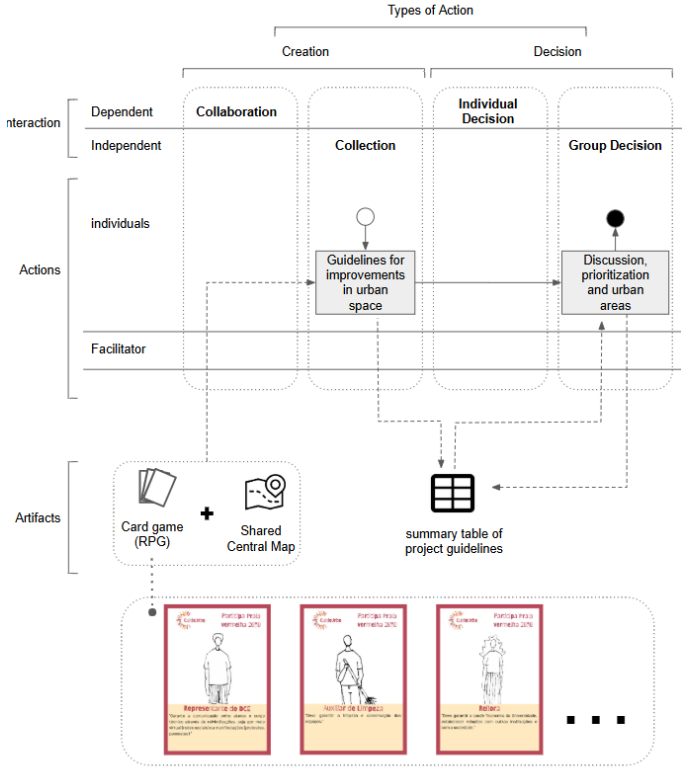

Fig. 9. Agents game actions and interactions

The goal of the D3 Agent Game is to explore the desires of participants and agents for the campus, followed by the creation of non-graphical guidelines in textual and synthesis table formats.

The facilitation team must begin by briefly presenting the participants with the results of previous dynamics. After this introduction, the mediator will explain the identified agents within the studied territories, detailing their roles and responsibilities. Each participant will receive a card with an agent's name and image and a printed A4 table. The table will include three columns: one for the identified territory, another for the identified problems, and the last for proposed guidelines. The shared central map produced during D1 will remain accessible for consultation.

Similar to a Role-Playing Game (RPG), participants are encouraged to step into the shoes of the agent they were assigned, aligning their aspirations with the agent's profile. Based on this personification, participants will fill out the guideline table, select a territory, identify its issues, and propose actionable guidelines. The proposed guidelines should be direct and specific, avoiding superficial plans. For example: "Create new accessible pathways." By engaging in this interactive and independent process, participants collectively produce a set of guidelines for urban space improvements.

Once individual tables are completed, the dynamic progresses to its second phase: an assembly. This phase simulates discussions and meetings typical in urban planning processes, where diverse societal agents gather to debate urban guidelines and parameters. The mediator will present a summary table of project guidelines to facilitate this stage, categorizing them by temporal horizons (short-term, medium-term, and long-term). In a Group Decision Process, each participant will then present their guidelines, explaining their significance. As proposals are shared, a facilitator will record the responses on a general guideline board. After all proposals are documented, participants will work to reach a consensus on prioritizing the guidelines for the discussed territories across the short, medium, and long term.

5.4 Collaborative Sketch Workshop

The objective of this dynamic is to explore intervention possibilities by planning the landscape, developing proposals, and envisioning future scenarios. Two distinct workstations should be created for this activity to facilitate different approaches.

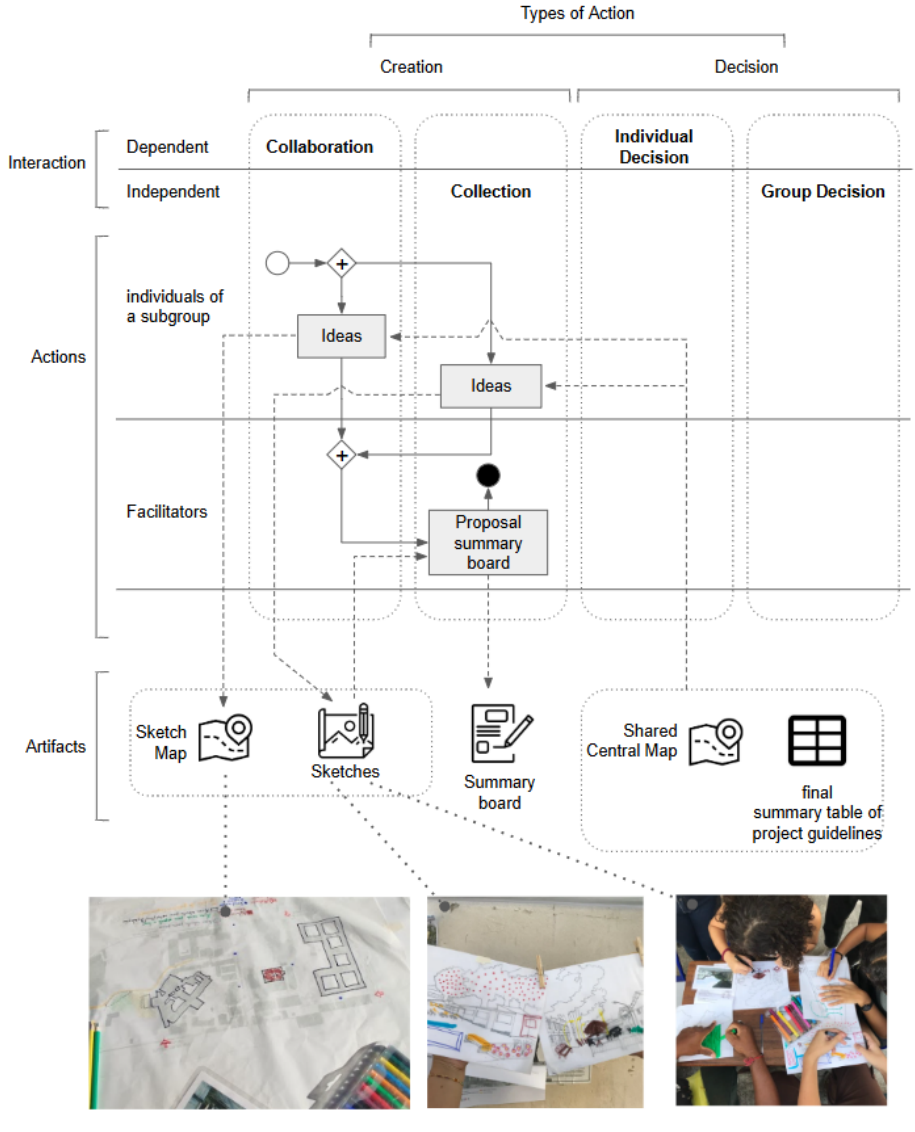

Fig. 10. Collaborative Sketch Workshop actions and interactions

The first workstation focuses on designing future scenarios using graphical representations of significant campus territories. Participants at this station will work with photographs and drawings of various spaces, translucent paper for overlaying and creating new scenarios, and colorful markers to bring their ideas to life. The second workstation centers on proposal development using a large printed A0-size campus map, where participants will brainstorm and mark interventions directly on the map with colorful markers.

The dynamic begins with the facilitator presenting the guideline board created during the Agent Game. They briefly explain the previous activity's context and clarify the session's purpose. Participants are then introduced to the two workstations and encouraged to choose where to start. Each station will have a mediator to guide discussions and a recorder to document the ideas being developed. Participants are also encouraged to move freely between the workstations, contributing to multiple aspects of the activity.

While participants work, those at the map station collaboratively generate new ideas for urban spaces through reflection and discussion. Meanwhile, those working with graphical representations approach the task more individually, collection-based, using visual materials to explore and propose future scenarios. As the ideas take shape, mediators may display the drawings on a clothesline, allowing everyone to view and be inspired by the ongoing work.

At the end of the session, participants are invited to present the proposals they have developed. The facilitators then synthesize the results into a summary board collection, compiling all the drawings and ideas produced during the dynamic into a cohesive representation of the envisioned interventions.

5.5 Model Assessment

The empirical evaluation was conducted using the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) framework. The dynamics implemented in the activities were evaluated by the 40 participants across six dimensions: Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, and Habit. Below, we present a detailed analysis based on the feedback received.

Table 4. Scores obtained in the evaluation of participatory dynamics

Dynamic	Performance Expectancy	Effort Expectancy	Social Influence	Facilitating Conditions	Hedonic Motivation	Habit
1 - Walk and Talk Map	4.33	1.33	2.33	2.83	4.5	4.17
2 - Ecomap	5.0	4.5	3.75	3.75	4.25	4.25
3 - Agents Game	5.0	4.67	4.67	4.67	5.0	4.67
4 - Collaborative Sketch Workshop	5.0	5.0	4.17	4.67	5.0	4.83

As seen in Table 4, the evaluation underscores the overall effectiveness of the dynamics in meeting participant expectations and fostering engagement. Activities like D4 (Collaborative Sketch Workshop) and D3 (Agents Game) consistently outperformed others across most criteria, highlighting their role in promoting collaboration and enjoyment. However, challenges in effort expectancy and

facilitating conditions for D1 (Walk and Talk Map) suggest areas for refinement, particularly regarding clarity and safety. This feedback provides valuable insights for optimizing future participatory models and enhancing their alignment with UTAUT2 dimensions.

Performance Expectancy: Participants rated highly the ability of the dynamics to meet their performance expectations. For example, D2 (Ecomap), D3 (Agents Game), and D4 (Collaborative Sketch Workshop) achieved a perfect score of 5. Participants emphasized the value of these dynamics in fostering engagement with the campus environment. One participant in D3 (Agents Game) highlighted that the event was "constructive and valuable for encouraging public participation in decision-making." Similarly, feedback from D1 (Walk and Talk Map) indicated that participants found the exercise productive for understanding spatial dynamics despite the occasional confusion expressed by some attendees.

Effort Expectancy: Effort expectancy revealed mixed results. While D4 received a perfect score of 5 for ease of Participation, other dynamics, such as D1, scored lower (1.33 on average), reflecting challenges in engaging participants consistently. One participant mentioned confusion in D1, suggesting the need for more precise instructions and pacing adjustments. A participant in D3 noted that while the activity was informative and enjoyable, the dissemination process could be improved to increase accessibility and reduce the effort required for engagement.

Social Influence: Social influence, measuring peer encouragement and collective engagement, varied significantly across dynamics. D3 (Agents Game) stood out with a score of 4.67, indicating strong social interactions and collaboration. A participant commented on the importance of "I think it is very important to engage students in learning about the campus," underscoring the role of group dynamics in enhancing individual Participation. On the other hand, D1 received a lower score of 2.33, highlighting limited peer-driven motivation, likely influenced by the activity's solitary aspects.

Facilitating Conditions: Facilitating conditions were rated favorably, with D3 and D4 receiving scores of 4.67 each, demonstrating that these activities were well-supported regarding resources and organization. The use of diverse materials in D4 was particularly praised, as one participant noted, "I enjoyed the variety of materials provided to think about the campus." However, in D1, the score of 2.83 suggests that logistical or environmental factors might have posed challenges, possibly due to it being the first activity undertaken.

Hedonic Motivation: Hedonic motivation, measuring the pleasure derived from Participation, achieved the highest scores across all dynamics. D4 and D3 received a perfect score of 5, with participants describing the activities as "creative and enjoyable." One participant in D3 expressed enthusiasm for the initiative, stating, "I loved the idea of the project." This perception suggests that the dynamics successfully engaged participants emotionally, enhancing the overall experience.

Habit: Finally, habit, reflecting participants' inclination to engage in future activities, scored consistently high. D4 achieved the highest score of 4.83, followed by D3 with 4.67. This score indicates a strong potential for sustained engagement through similar participatory methods. As one participant in D3 noted, the initiative was crucial for building connections with the campus and fostering a sense of belonging.

6 Discussion

Implementing participatory practices in the urban planning of UFRJ campuses has highligheted significant gains in ways of mapping demands and creating programs tailored to needs. These practices are part of an interdisciplinary field and an alternative to those traditionally conducted by public and private managers, in which participation is understood as mere adherence to evaluation activities. Even under these circumstances, challenges were identified, particularly the limitations of co-creation in urban projects. Although the activities were designed to involve the academic community in the definition and transformation of campus spaces, the autonomy granted to participants in selecting areas and aspects to be addressed did not consistently interrupt the traditional dominance of specialists. Variations in participant engagement at different stages, particularly in D4, revealed limitations in urban literacy, spontaneity, and interaction with architectural plans. This restricted discussions to specific sections of the campus and hindered the exploration of broader issues such as daily activities, mobility, and safety. These findings align with Steen and van Bueren's [29] identification of the challenges in effectively integrating diverse participant contributions in Urban Life Labs, where co-creation dynamics often face obstacles in balancing expert and non-expert contributions. Furthermore, Mahmoud and Morello [30] emphasize the importance of shared governance structures in co-creation processes, noting that participatory initiatives may not produce actionable results without clear structures for collaboration. These insights highlight the need for more flexible and deliberately interdisciplinary strategies that take into account both objective and subjective aspects of participants' ability to interact and project their desires, to overcome the inherent limitations of co-creation in urban projects, ensuring that participatory practices are genuinely inclusive and impactful.

7 Conclusion

Numerous studies highlight how the built environment influences perceptions and behaviors in public spaces, including university campuses. Despite this, gaps persist between research and practice due to institutional fragmentation and limited participatory planning. At UFRJ, the 2030 Master Plan faced significant challenges in engaging the academic community, emphasizing the urgent need for interdisciplinary, multidimensional, and inclusive approaches to campus development. To address this, we developed and evaluated the Participatory Model for Urban Design on University Campuses, demonstrating its effectiveness in meeting participants' expectations and

fostering engagement. The integration of maps with other artifacts allowed participants to collaborate on the proposed activities. However, some aspects needed to be strengthened and deepened, such as: facilitating more multidimensional and interdisciplinary approaches that incorporate participants' psychosocial experience and their abilities to express and design spaces; developing urban literacy strategies to support the development of skills and motivation among participants to engage in non-traditional activities in urban projects; and create more effective spaces for sharing and monitoring the results of activity cycles with the institution's relevant stakeholders, since the lack of guaranteed funding to execute projects is a significant obstacle to participation. Nevertheless, this article offers valuable insights for administrators, planners, architects, and others interested in implementing participatory processes. It provides a detailed framework for replicating similar models or adopting the dynamics presented. Furthermore, the article contributes to academic discourse by presenting design thinking as a rigorous methodological tool and offering perspectives for researchers interested in collective intelligence and mapping activities, whether carried out on paper or through digital systems. The limitations of this study are primarily related to the development of information systems and applications to expand participation. Future work will use the mappings created here to derive business rules for developing applications that offer flexible and fluid user interactions, similar to the engagement observed with paper maps.

Acknowledgments. This study was financed in part by the UFRJ Technology Park and by the Higher Education Personnel Training Coordination (CAPES) - Finance Code 001. The statements made herein are solely the responsibility of the authors.

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