

Article

An Inclusive Park Design Based on a Research Process: A Case Study of Thammasat Water Sport Center, Pathum Thani, Thailand

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Abstract: Public parks are vital for community well-being, yet often fail to cater to the needs of people with disabilities, restricting their safe and independent use. This paper details a pragmatic study aimed at crafting the design for an inclusive park on the outskirts of Bangkok, addressing these limitations. Through a comprehensive mixed-methods approach—encompassing literature reviews, semi-structured interviews, and surveys with stakeholders, including individuals with disabilities—this research gathered diverse perspectives on inclusive design. Participants underscored the importance of social and recreational activities in universally accessible spaces, providing valuable spatial insights. This research aims to employ pragmatic research methods to develop the design of an inclusive park for people with disabilities at the Thammasat University Rangsit Campus Water Sport Center. This study seeks to integrate the perspectives and needs of people with disabilities into the park design, ensuring that the space is accessible and meets a wide range of needs. The research aims to bridge socio-environmental considerations with practical design applications, creating a model that can serve as a template for similar developments in other urban settings. This study's findings informed the creation of a design that harmoniously integrates green spaces with the specific requirements of disabled users, promoting inclusivity and accessibility within the fast-growing urban areas of Southeast Asia. This research not only offers a template for addressing the gaps in public space provision for people with disabilities but also illustrates how designers can interpret and meet socio-environmental and health-related needs through inclusive planning. It extends the discussion on overcoming WHO-identified inequalities in urban settings and lays the groundwork for interdisciplinary studies aimed at enriching the fabric of urban life through research processes and scientific inquiry. This paper asserts the pivotal role of inclusive design in enhancing urban livability, advocating for a design methodology that responds to the nuanced demands of inclusivity, thereby contributing to the broader discourse on equality, accessibility, and the right to the city for people with disabilities.

Keywords: inclusive park; disabilities; public space for disabilities; designing by research



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1. Introduction

1.1. Introduction

The prevalence of disability, affecting over 15% of the global population as reported by the WHO [1] is often underestimated, particularly in densely populated areas where the exclusion of disabled individuals in design processes is a significant concern. In reality, the population size of those living with disabilities can be considered even larger given the chance of contracting a disability during over the lifespan [2,3], as well as the wide range of disabilities [1–3]. This underestimation overlooks the dynamic nature of disability, encompassing a broad spectrum of conditions and the potential for acquiring disabilities throughout one's life. The development of inclusive parks is crucial for ensuring equitable access to recreational spaces, which supports social inclusion, improves quality of life, and

fosters community for individuals with disabilities. By offering safe, accessible outdoor environments for exercise, relaxation, and connection with nature, inclusive parks not only benefit people with disabilities but also enhance the collective experience of public spaces, promoting diversity and equality. The number of disabled people in each context is often underappreciated and underestimated.

Inclusive parks are crucial for promoting social inclusion, physical activity, and the well-being of communities. They address systemic barriers that restrict access for individuals with disabilities, offering spaces where people of all abilities can enjoy recreational activities and build social connections. Such parks encourage physical health among disabled individuals by providing opportunities for exercise and outdoor recreation, leading to improved fitness and overall health. Beyond accessibility, inclusive parks symbolize a shift towards a more equitable society, challenging traditional norms and fostering acceptance and diversity. This research advocates for the rights and inclusion of all community members, aiming to create environments where everyone can participate fully and independently. Emphasizing inclusive park designs represents a significant step towards a more inclusive, empathetic, and equitable world.

In this regard, the UN Disability Inclusion Strategy states that “the lack of disability-related data, including qualitative and disaggregated data, is one of the major barriers to the accurate assessment of disability inclusion in the development and humanitarian contexts” [4]. Moreover, the more blurred and liminal situation of those marginalized with invisible conditions such as depression and schizophrenia must also be considered when holistically identifying the population living with disability [2]. The difficulty in accurately estimating the number of people living with disability is that the impacts extend beyond the traditional health sciences and include those connected to the personal and social isolation of the affected individuals [5] and are linked to issues of loneliness [6]. The interrelationships between traditional healthcare and its related disciplines can be rendered as factors of inequity [2,3], as represented in Figure 1.

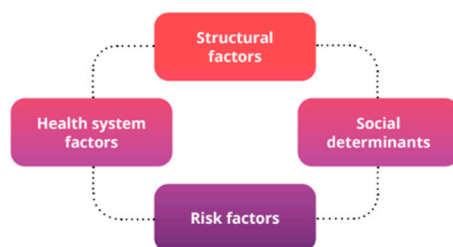


Figure 1. The 4 factors of inequity. Image from, From WHO, 2022b.

The four factors of inequity that contribute to the definition of individual health and wellbeing can be described as follows:

Structural factors account for the ‘very broad socioeconomic and political context and the mechanisms that generate social stratification’ [3]. This factor affects the key components that shape the base of the healthcare system, for example, the capacity of the State to structure its welfare programs.

Social determinants include the social life conditions of a given person. The social sphere existing around a single individual is a relevant factor in defining life possibilities, for instance, a social network which can affect their social behavior.

Risk factor considers issues of noncommunicable diseases, environmental factors, and a healthy and active lifestyle. It is a holistic view of the topic that includes the private sphere and the behaviors of an individual.

Health system factors include the accessibility of the health services, information, medical support, etc. It is a factor dependent on the conditions of welfare within the State, by the organization of the general healthcare system, and it affects the possibilities of individuals to receive care and medical assistance at different levels.

The general underappreciation of these factors by the public and urban stakeholders results in an underestimation of the needs of people with disabilities and to a lack of physical spaces of inclusion, especially in peripheral metropolitan areas. In this study, we employ the pragmatic epistemology of designing by research, which incorporates elements of the (post)positivist, constructivist, and advocacy/participatory epistemologies [7]. Post(positivist) epistemology evaluates project performance, exploring the effectiveness of universal design for diverse disabilities. Constructivist epistemology focuses on the designer's ability to create landscapes, employing ideation and reflective techniques tailored to community engagement. Advocacy/participatory epistemology involves the community in problem identification and data gathering. This research, aiming to redevelop a park, utilized pragmatic design research, interpreting inequity factors as opportunities. These guided this study's four phases: literature review, data collection, data analysis, and park design, with each phase highlighting specific opportunities for addressing inequity.

1.2. The Research Gap

This research intends to fill in the gaps that arise from these premises and its territory. The context is part of the metropolitan peri-urban development and its present diversities and characteristics. In this context, a well-established industrial economy providing a 6th of the GDP of the country, a social and ethnically diverse population, the loss of agricultural destinations despite urbanized lands, and a new land use plan which aims for more intense urban development have emerged [8,9]. All these emerging facts do not constitute elements in favor of the topics of the provision of public spaces, green spaces, inclusiveness, and social bonding. In the instances analyzed, there is no mention of the topic of disability, which is still treated as a health rather than a social issue disconnected from any territorial instance [8,9]. Subsequently, the gaps highlighted and tackled by this research are a blend of social and physical aspects which further marginalize weak actors and general social bonding within this context.

This research prioritizes the engagement of individuals with disabilities as crucial contributors, bringing their unique firsthand knowledge and experiences to the forefront of accessibility and inclusivity in park design. Their involvement through pragmatic design via research methods guarantees that the outcomes are deeply user-centered, addressing a spectrum of needs and ensuring that the parks are accessible to everyone. This process of active collaboration not only meets the requisite legal and ethical standards but also paves the way for innovation, as it allows designers to uncover and mitigate potential accessibility barriers through direct feedback. Such collaborative efforts result in the development of practical features and amenities that significantly enhance the usability of these public spaces for individuals with disabilities.

Moreover, this study advocates for a paradigm shift towards the social model of disability, which recognizes disability as a complex interplay of social, environmental, and institutional barriers, rather than merely a medical or individual issue. This model calls for an overhaul of systemic biases, advocating for changes that ensure full participation and inclusion of people with disabilities in all facets of society. It highlights the necessity of designing public spaces that are not just physically accessible but also inclusive, fostering a sense of belonging and community.

In essence, the involvement of people with disabilities in the creation of inclusive parks is pivotal. It not only ensures that these spaces cater effectively to the needs of individuals with disabilities but also advances the broader goals of social inclusion, diversity, and equity. By valuing and integrating the perspectives of those with lived experiences of disability, park designs can become more than just accessible; they can become spaces that celebrate diversity and facilitate community integration, embodying the principles of social justice and equality. This approach not only enriches the lives of individuals with disabilities but also enhances the communal fabric by creating more welcoming and inclusive environments for everyone.

This research plays a vital role in expanding the ongoing discussions about equality, accessibility, and urban rights for individuals with disabilities. By delving into these issues, this research can provide valuable insights and evidence to support the development of more inclusive policies and practices. This contribution is crucial for enhancing the understanding of the barriers that people with disabilities face in urban environments. Additionally, thorough research can help to identify effective strategies for removing these obstacles, thus promoting a more equitable access to city spaces and resources. In this way, this research not only enriches the discourse on the rights of people with disabilities but also actively supports the pursuit of these rights in practical and meaningful ways.

1.3. Questions and Objectives of the Research

This article develops the aforementioned four opportunities, following the definition of the principles for inclusive and accessible parks in Pathum Thani Province, Thailand [8], and the selection of a green existent area (The Thammasat Water Sport Center) within this provincial context where a possible redevelopment into an inclusive and accessible park for people with disabilities is expected to have potential success [9].

The research questions of this article expand these considerations, dividing them into two main strains. In reference to the socioeconomic features of the context, we asked “How a research process that involves stakeholder engagement on green and inclusive spaces, can provide insightful information from disabled population?” In reference to the physical and environmental aspects, and to the selected site deemed as the best in the province to redevelop an existent underutilized green space into an inclusive park for the autonomous access by the weak actors [8], we asked “How to transfer the insights information from the research process into an inclusive park, keeping these into account and localizing them in a real site”. These questions aim to bridge the gaps with the subsequent objective of this research.

The objective of this research presented herein is a product of the convergence of the two questions and is to employ pragmatic research to develop the design for an inclusive park for people with disabilities in the selected context. This article develops the questions and answer them, illustrating the process of research and the result of the pragmatic research: the new redeveloped park. The contribution of this article is consequentially theoretical (illustrating a process) and pragmatical, illustrating the tangible results of the theoretical and participative research processes.

We begin by introducing a quantitative study with questionnaire surveys conducted with local stakeholders and people with disabilities. Secondly, we describe the rationale and the choices taken in the phase of insight analysis, and we explore limitations and constraints emerging from the perception of the users, the context, and the design process. The design project developed from the combined analysis is then discussed and evaluated, including the exploration of limitations existent between the perception of the users and the design features. This research aims to utilize pragmatic research methodologies to create an inclusive park design at Thammasat University Rangsit Campus Water Sport Center, tailored specifically for individuals with disabilities. This study’s primary objective is to incorporate the diverse perspectives and requirements of disabled individuals directly into the park’s design, ensuring the space is universally accessible and meets a broad spectrum of needs. By synthesizing socio-environmental considerations with practical design strategies, this project endeavors to serve as a replicable model for inclusive urban development in various settings.

1.4. Site Area and Context

This project is located within the perimeter of the Thammasat University (TU), Rangsit Campus, Pathum Thani Province, in an open space used at the moment as a parking lot overlooking the entrance of the Water Sport Complex Building (Figure 2). The space is surrounded by commercial activities (small shops and cafes) and cultural and sportive

recreation spaces (gym and multi-purpose room); the presence of this landmark influenced several design choices especially in terms of accessibility and layout.

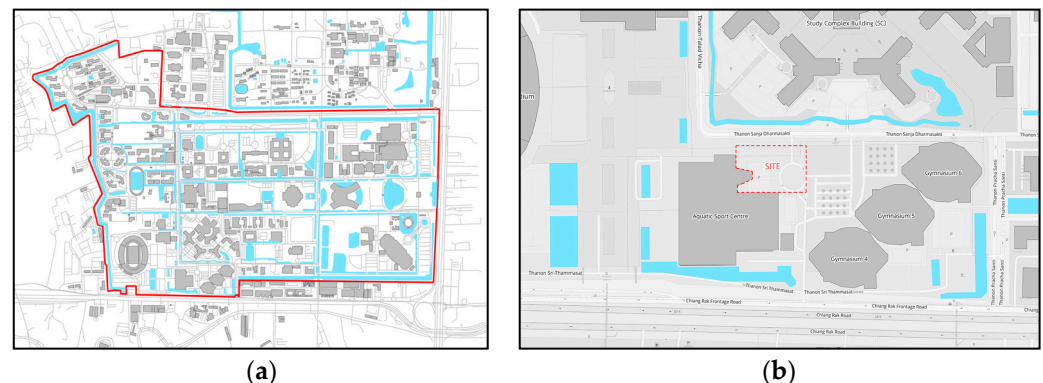


Figure 2. Aerial view of the site and surroundings. (a) Site in macro scale and (b) site in micro scale. Credit: Google Maps, GIS data, and the Author.

The site has a surface area of 2334 sqm (roughly 54×43 m) and is bordered on the north side by Sanya Dharmasakti Road; the road and park are separated by a cyclo-pedestrian sidewalk which runs parallel to the road. The main entrance is located on the opposite side facing the main parking lot, and it is only opened for occasions of special events. On the west, the space is bordered by the iconic semi-covered access stairway of the Water Sport Complex Building. Wheelchair access to the complex is provided behind the staircase.

On the south, the site is bordered by the aforementioned commercial activities, recreational spaces, and a parking lot; on the east, it is bordered by a wide-open space connected to the three Gymnasiums. This open space, the Water Sports Complex Building, the three Gymnasiums and the Main Stadium with its Plaza were architectural landmarks of the masterplan designed for the 1998 Asian Games and were subsequently integrated in TU's Master planning for the campus, blending all the spaces with green corridors during the years.

At the moment, the detailed layout of the area consists of a space divided in two sections: one is an open space of pavement with limited green provision, separated from the road and bordering the commercial activities on the south, located outside the Complex to the east; the other area is a space for cars, with parking lots surrounding a green roundabout which directs and organizes the traffic coming from the Sanya Dharmasakti Road. The project inputs provided by the stakeholder allows the repurposing of this space with a project that overwrites the existing layout with a new, more rational organization of the access lane and traffic and the overall design of an inclusive and accessible park which follows the main conceptual key-points established in the first phase of the research [8].

This space would represent the only ad hoc dedicated space for users with disabilities in the Pathum Thani province [9]; hence, it aims to be a recognizable, functional, easy to access, and well-known green landmark in the province and in the TU Campus area. The disabled community in general would be able to see in this space a tangible help and support for the enjoyment of social life, of multi-sensorial green spaces and water bodies, and of specific sportive, playful, and recreational activities, regardless of their disabilities.

2. Literature Review

The social concept of disability sees an individual suffering from a particular disability as being a deviation to the norm, which can result in marginalization. The International Classification of Functioning, Disability, and Health [10] provides a generally accepted definition of disability. The document, updated periodically (lastly, in January 2023), establishes three main areas of disability: impairment; activity limitation; and participation restriction. In the Thai context, the normative framework sets up seven different categories

of disabilities [11], with no further specifications. The research adapted this categorization in the first phase of the research, regarding the questionnaire.

Disabilities in Public Spaces

The inclusion of consideration of disabilities in public spaces is prioritized in various documents from the United Nations (UN) under the definition of the concept of accessibility. The 2006 Convention on the Rights of Persons with Disabilities is central to the international recognition of persons living with disabilities in that it defines the principles for inclusion. Specifically, Article 9 defines the principle of accessibility in the built environment “to ensure to persons with disabilities access, on an equal basis with others, to the physical environment, to transportation, [...] and to other facilities and services open or provided to the public, both in urban and in rural areas” [4]. The 2006 principle becomes a key concept, in an expanded definition of accessibility [4].

The latest Global Report on Health Equity for Persons with Disabilities titled *Physical Declines*, a Primary Healthcare (PHC)-targeted action for the inclusion of persons with disabilities to the built environment, pushes to “incorporate a universal design-based approach to the development or refurbishment of health” [12]. The document also advises to include a budget for inclusiveness and accessibility in the preliminary phase of design work, noting the potential for lost opportunities in terms of social possibilities for the disability carriers [12], and how the interrelation of the strategic entry points can strengthen the Sustainable Development Goal (SDG) 3—Good Health and Well-Being [12] empowering the participation of marginalized individuals in public life.

In relation to the built environment, beside the aforementioned SDG 3, the SDG goals connect disabilities and built environment tightly in two goals, namely SDG 10—Reduce Inequalities—and SDG 11—Sustainable Cities and Communities—as a most impactful way for improving accessibility in the built environment [13,14]. SDG 10 remains more connected to general policymaking, while SDG 11 aims to directly tackle the built environment in two specific measures. SDG 11.3 aims to “enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management” [15]; SDG 11.7 mentions the need for green park and public spaces “to provide universal access to safe, inclusive, and accessible green and public spaces, in particular for women and children, older persons, and persons with disabilities” [13–15].

Current Park Circumstances for Disabilities and Case Studies of Inclusive Parks

Parks are crucial elements of the urban environment as physical activities and social interaction within the parks can provide a positive impact on urban residents’ quality of life [16]. Parks should be places that respond to the needs of people from different social and cultural backgrounds with a diversity of user groups in mind [17]. The best-used public parks are sociable places with a variety of people in groups [18]. However, many aspects of parks are not designed with people with disabilities in mind [19]. For those parks that have been designed for people with disabilities, universal standards often have not been fully considered as part of the design process [20,21]. As a result, parks often lack consideration of the distance that people with disabilities can comfortably negotiate. Some parks may have designed walkways that are wide enough for wheelchair access; however, these walkways do not fully cover the park area. Some parks have obstacles to the use of wheelchairs while others provide rides and equipment that are not suitable for people with disabilities. People with disabilities, therefore, are often unable to use the park space effectively. Additionally, most parks for people with disabilities do not facilitate social interaction with the broader public. Behind such considerations is the basic idea that green spaces must be accessible, safe, and offer both comfort and maximum enjoyment. This awareness should be enhanced by offering proper amenities such as having properly designed walkways with ramps and railings, accessible public toilets, and usable telephone booths in greenspaces. The built environment must incorporate certain aspects of sound, texture, and other design elements to assist a person with disability in their surroundings. Knowing the necessities of the disabilities will assist the designers and planners to improve the built environment.

Studies on designing inclusive parks and urban spaces for use by people with disabilities provide insights into design criteria, such as the following case studies:

1. **Case Study One: Study on requirements of children with disabilities in public playgrounds, 2012.** Case Study One investigated the needs of children with disabilities in public playgrounds through behavior observations and interviews with 37 participants, including disabled youth, parents, teachers, and doctors. The study, focusing on Setia City Mall Park, Pusat Sains Negara Park, and Taman Jaya Park, found that these areas were not designed with the intentional support for individuals with disabilities in mind [22].
2. **Case Study Two: Beit Issie Shapiro Park, Willie and Celia Trump Campus, Israel, 2005.** The design concept for the park focuses on using its infrastructure to facilitate learning, social interaction, and self-awareness, aiming at societal equity and inclusion. It follows ten guiding principles: Universality, Continuum of Accessibility, Adaptations for Disabilities, Movement Convenience, Integrated Play, Safety, Independence, Durability, Harmony, and Sensory Stimulation [23].
3. **Case Study Three: Public Space Universal Design for People with Disabilities in Tehran, Iran, 2018.** The study proposes design guidelines for accommodating individuals with disabilities, focusing on five key aspects: sidewalk standards and quality, obstacle-free paths with braille blocks for the visually impaired, enhanced crossing clarity through colors and symbols, the installation of crossing and traffic lights with warning signs for safety, and the inclusion of braille on signage to aid the visually impaired [24].
4. **Case Study Four: Workshop for Elderly People and People with Disabilities for Barrier Free Parks in Prizren, Republic of Kosovo, 2018.** The study, through a workshop in collaboration with the Municipality of Prizren, engaged 22 participants, including the elderly and individuals with disabilities, to develop inclusive public park design guidelines. The recommendations, presented to the municipality, emphasized universal design through connecting green spaces by removing barriers and controlling vehicle speed, ensuring barrier-free parking with minimal curbs and braille blocks for the visually impaired, and creating parks that support both active and passive recreational activities for everyone [25].
5. **Case Study Five: Research on Accessibility of Urban Parks for People with Disabilities: The Case Study of Birlik Park, Konya-Turkey, 2016.** The study evaluated the accessibility of Birlik Park for individuals with disabilities, focusing on its design elements that accommodate disabilities. It identified eleven features crucial for inclusive design: entrance and exit areas, walkways and ramps, parking, relaxation spaces, restrooms, zones for active and passive recreation, lighting, garbage bins, fountains, telephone booths, and vegetation, all designed to support both active and passive leisure activities [26].

As presented in Table 1, to address the notable gap in the availability of inclusive recreational spaces that cater comprehensively to the spectrum of disabilities, this study endeavors to integrate the perspectives and needs of individuals across various disability categories. The objective is to ensure that the design and implementation of the park not only achieves a broad level of inclusivity but also maintains its adherence to principles of universal design. By involving participants with a diverse range of disabilities in the research process, this study seeks to create a park environment that is genuinely inclusive. This approach enables the identification and incorporation of specific design elements and features that facilitate access, engagement, and enjoyment for all users, regardless of their physical or sensory capabilities. The inclusive design methodology adopted in this research underscores the importance of participatory planning in creating public spaces that reflect the diverse needs of the community it serves, thereby contributing significantly to the discourse on accessibility and inclusivity in urban development. This research endeavors to establish an inclusive park catering to individuals with disabilities across various categories, encompassing not only physical attributes but also mental aspects.

Table 1. Summary of the case studies.

Case Study	Design Guideline for People with Disabilities
Study on Requirements of Children with Disabilities in Public Playgrounds, 2014	Satisfaction assessment on the use of public parks that meets the needs of people with disabilities.
Beit Issie Shapiro Park, Willie and Celia Trump Campus, Israel, 2005	The public park design was a success in both physical and social aspects as well as having served as a design model for other parks.
Public Space Universal Design for People with Disabilities in Tehran, Iran, 2018	Inclusive public space design guidelines that reduce physical and social barriers.
Workshop for Elderly People and People with Disabilities for Barrier Free Parks in Prizren, Republic of Kosovo, 2018	Public space design guidelines for people with disabilities and for the local government, to be used for further work.
Research on Accessibility of Urban Parks for People with Disabilities: The Case Study of Birlik Park, Konya-Turkey, 2016	Problematic schemes of the park that are not suitable for people with disabilities, as well as suitable design features.

Types of Disabilities and Their Specific Requirement for Inclusive Parks

Classification and scope of people with disabilities which this research targets comprises (1) visual impairment; (2) hearing or communication disability; (3) movement or physical disability; (4) intellectual disability; (5) learning disability; (6) autism; (7) emotional or behavioral disability; and (8) multiple disabilities.

Visual impairment: People with visual impairments, also known as visually impaired individuals or individuals with vision loss, encompass a diverse group with varying degrees of visual impairment. Visual impairment can also be identified in the categories of disability listed below [27]. Visual impairments range from blindness, where individuals have minimal or no vision and may use aids like canes or guide dogs, to low vision, where people have limited vision that affects daily activities and might use technologies like magnifiers. Partially sighted individuals have mild-to-moderate vision loss, affecting their activities. Legally blind individuals have a visual acuity of 20/200 or worse in the better eye with correction or a very narrow field of vision. Deaf blindness combines hearing and visual impairments, requiring unique communication methods such as tactile sign language or braille [27].

Hearing or communication disability: People with hearing or communication disabilities encompass a diverse group with varying needs and abilities [28]. Deaf individuals have significant hearing loss and might use sign language, lip-reading, or technology like hearing aids for communication. Hard of hearing people have partial hearing loss and often use hearing aids or assistive devices. Deafblind individuals have both hearing and visual impairments, using tactile communication methods. Those with speech disorders may struggle with speech production and might rely on AAC devices, sign language, or alternative communication methods [28].

Movement or physical disabilities impact an individual's mobility or physical capabilities, ranging widely in severity and origin (congenital or acquired) [29]. Categories include the following:

Mobility impairments: conditions like paraplegia and quadriplegia (often from spinal cord injuries), cerebral palsy (movement and coordination disorders due to brain damage), muscular dystrophy (genetic diseases causing muscle weakness), and amputation (loss of a limb);

Physical disabilities: include arthritis (joint inflammation), osteoporosis (weakening bones), spina bifida (spinal defect), and multiple sclerosis (MS, a disease affecting the nervous system and movement).

Intellectual disability (formerly known as mental retardation) is characterized by significant limitations in intellectual functioning and adaptive behavior. These limitations manifest during childhood and impact the individual's ability to learn and function independently. Intellectual disability may be caused by genetic factors, prenatal exposure to toxins or infections, or complications during childbirth. Individuals with intellectual

disabilities may require support in areas such as communication, social skills, and daily living activities [10].

Learning disabilities refer to a group of neurodevelopmental disorders that affect the acquisition and use of academic skills. These disabilities may impact reading (dyslexia), writing (dysgraphia), mathematics (dyscalculia), or other cognitive processes involved in learning. Learning disabilities are not indicative of low intelligence but rather difficulties with specific areas of learning. Individuals with learning disabilities may benefit from specialized instruction, accommodations, and support to succeed academically and function effectively in daily life [30].

Autism spectrum disorder (ASD) is a developmental disorder characterized by persistent challenges in social interaction, communication, and behavior. The severity of symptoms can vary widely among individuals, leading to the term “spectrum”. Common features of ASD include difficulty with social skills, repetitive behaviors, sensory sensitivities, and restricted interests. Autism is typically diagnosed in early childhood, and early intervention and support services can help individuals with ASD thrive and reach their full potential [31].

Emotional or behavioral disability: Emotional or behavioral disabilities encompass a range of conditions that affect cognitive function, emotional regulation, and behavior [32]. These disabilities may include conditions such as the following:

- A. Depression: a mood disorder characterized by persistent feelings of sadness, hopelessness, and loss of interest in activities;
- B. Anxiety disorders: conditions characterized by excessive worry, fear, or nervousness that interfere with daily functioning;
- C. Bipolar disorder: a mood disorder characterized by episodes of manic highs and depressive lows;
- D. Schizophrenia: a chronic mental disorder characterized by hallucinations, delusions, disorganized thinking, and impaired social functioning;
- E. Post-traumatic stress disorder (PTSD): a mental health condition triggered by experiencing or witnessing a traumatic event, leading to symptoms such as flashbacks, nightmares, and severe anxiety.

Multiple disability: The term “multiple disabilities” refers to individuals who experience a combination of impairments, such as sensory and motor disabilities. In the United States, this classification falls under the Individuals with Disabilities Education Act (IDEA), which provides special education services to eligible students [33]. However, not all educational entities adopt this classification.

State-specific legislation often stipulates that for a student to be classified under “multiple disabilities”, one of the disabilities documented must be an intellectual disability [34]. Typically, individuals with multiple disabilities possess several substantial impairments, including orthopedic, sensory, and/or emotional and behavioral disabilities. According to IDEA, the classification of multiple disabilities is applied when a student’s educational needs surpass the services provided for any single disability. For example, a student with developmental, emotional, and visual impairments might be categorized as having multiple disabilities. Nonetheless, not all students with multiple impairments receive this designation [33,34].

According to the Department of Health (2003) [35], people with disabilities are more likely to develop complications caused by low physical activity. People with disabilities have different physical pathologies; therefore, the appropriate exercise methods are different. It is necessary to exercise properly to reduce the risk of disease. Critical recommendations on exercise activity for people with disabilities are the following:

- (1) Aerobic exercise:
 - Objective: to increase the stamina to do activities and the performance of the heart and lungs;

- Type of exercise: walk on ground level for 6–12 min, walk on designed walkway, walk up and down stairs, and hands and feet cycling;
 - Duration: 15–60 min and should be performed 3–5 times in a week;
- (2) Muscle strength training:
- Objective: to increase the strength of arm and leg muscles and movements;
 - Type of exercise: focus on exercising muscle parts that are used to resist earth's gravity as well as the parts that are used to control sitting, standing, and walking positions;
 - Duration: 8–12 times for a muscle part, 3 times a day, and 2 times a week;
- (3) Exercise for muscle flexibility
- Objective: to increase the range of motion in joints and to prevent joint adhesions;
 - Type of exercise: arm muscle stretching, lower body and hip stretching, and toe muscle stretching;
 - Duration: hold each position for 15–20 s every day, 3 times a day, especially before and after aerobic exercise or muscle strength training;
- (4) Exercise for increased balance:
- Objective: to improve ability to engage in activities;
 - Type of exercise: balancing the body while sitting still by move the body's center of gravity forward and back, or left and right, and balancing the body in a standing position by pressing weight on both feet or switch pressing weight on the left and right foot;
 - Duration: perform the exercise often every day.

In Table 2 are the existing studies considering factors relating to exercise activities for people with disabilities in the design of public spaces and parks.

Table 2. Exercise guidelines for each type of disability.

Types of Disability	Constraints to Exercise	Recommendations for Exercising for People with Disabilities			
		Aerobic Exercise	Muscle Strength Training	Exercise for Muscle Flexibility	Exercise for Increased Balance
1. Visual Impairment	People who are visually impaired may have poor balance ability and decreased awareness of the surrounding environment.	Walking and hand or feet cycling with caretakers	Assisted resistance exercises with caretakers	Assisted body stretching with caretakers	Supported standing and walking exercise with caretakers
2. Hearing or communication disability	Hearing impaired people may have poor balance ability.	Running and jogging	Weight-lifting exercise	Yoga and slow-dancing/body movement	Exercise with equipment, e.g., balance board
3. Movement or physical disability	People with movement or physical disabilities have unstable balance.	Seating aerobics and hand or feet cycling	Resistance exercise with equipment, e.g., bands	Assisted body stretching	Seated balance exercise (sitting position)
4. Mental or behavioral disability	People with mental or behavioral disabilities will feel anxious and afraid of the environment.	Group dancing, walking, or cycling	Body weight exercise with safe environment	Body stretching with calm and quiet environment	Body balancing exercise in comfortable environment
5. Intellectual disability	People with intellectual disabilities have problems with perception of joints and balance.	Repeated movement exercise, e.g., jumping jacks	Lightweight body resistance training	Body stretching routines	Body balancing exercise with visual guiding support
6. Learning disabilities	People with learning disabilities have problems walking more slowly than people of the same age and have skills with hands or movement that is not fluent.	Adapted and problem-solving exercise, e.g., trail walking with caretakers	Strength training with multi-function activities to encourage individual abilities	Body stretching routine in learning environment	Individual body balancing exercise
7. Autism disability	People with autism disabilities have physical problems with slow development.	Hand or feet cycling in controlled environment	Simple weight-lifting exercise	Assisted body stretching	Body balancing exercise with visual guiding support

3. Method of this Study

As remarked in Section 1.2, this study intends to demonstrate the process of the transformation of an underutilized space into an inclusive park that people with disabilities can easily access through research-based design approach in four stages. The research

started with rationale formulation focusing on a literature review to obtain information on the main research features which are (1) disabilities in public spaces and importance of universal design, (2) current park circumstances and case studies on public parks for people with disabilities, and (3) types of disabilities and their specific requirements for inclusive parks. Literature searches were conducted on two electronic academic databases through the online search engines Scopus and Google Scholar. This study then involved questionnaire development and surveying including investigating the perceptions and needs of people with disabilities. The data were analyzed with mixed-methods using IBM SPSS 24 through descriptive statistics of the background information of the respondents, public park recommendations and interests, and spaces and facilities requirements. The analyzed data become the design guidelines and criteria in designing the inclusive park at Thammasat University Rangsit Campus Water Sport Center for multi-purpose usages and inclusiveness, illustrating the subsequent design realized by the research team, as explained in Figure 3 below.

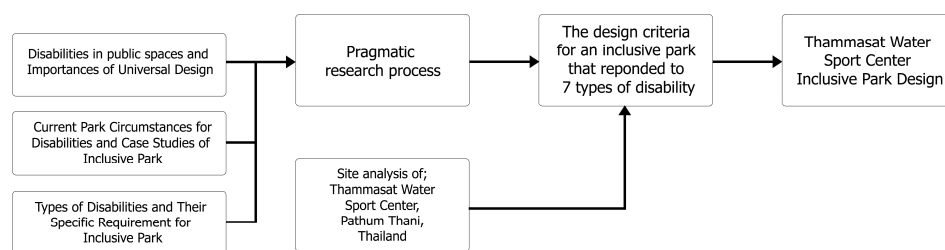


Figure 3. Research methodology framework.

The questionnaire survey was designed to explore perceptions and needs of the disabilities towards (1) active physical activities in public spaces and (2) spatial configuration of the public spaces. The sample size was selected with a purposive sampling method from determining the characteristics of the population calculated with an unknown population size (Cohen et al., 2018 [36]) through the formula $N = \frac{p(1-p)z^2}{d^2}$ where N = required sample size, p = population size, z = margin error of 0.01 which is equal to 2.58 (99% confident), and d = level of precision. The sample size was calculated where the population is equal to 0.40, the confidence level is equal to 95%, and the error margin is 5%, i.e., $0.40 \times (1 - 0.40) \times 1.962/0.052 = 368.64$ which resulted in a minimum of 369 people from various areas of the extended Bangkok Metropolitan Area.

Therefore, this study was able to employ a sample size (N) of 384 people classified into 8 groups which are (1) vision impairments, (2) hearing impairments, (3) physical disability, (4) intellectual disability, (5) learning disability, (6) autism, (7) emotional disability, and (8) multiple disabilities. The informants can be categorized into 3 age groups which are (1) young, 13–14 years old where $n = 126$, (2) adult, 15–59 years old where $n = 132$, and (3) elderly, 60 years old and above where $n = 126$. Genders can be grouped into male, $n = 187$, and female, $n = 197$. All respondents or their guardians were required to sign, giving consent prior to the questionnaire survey. The duration of the questionnaire survey was approximately 3 months.

Figure 4 demonstrates geographical areas of the sample size that are urban residents in Bangkok, Thailand. The survey collected data from several districts, including Huai Khwang, Nong Chok, Bang Na, Sai Mai, Min Buri, and Thawi Watthana. The urban residents are considered as the future potential users of the park, where they are multi-modally connected to the park's location by private vehicles, public bus, and red-line extension train. Figure 4 also shows non-urban residents, who were referred to as people living in suburban and rural areas. Various provinces were observed in the study, including Nonthaburi, Pathum Thani, Samut Prakan, and Nakhon Pathom. These provinces are in a moderate proximity to the study area with travel time by private vehicles being less than 30 min.

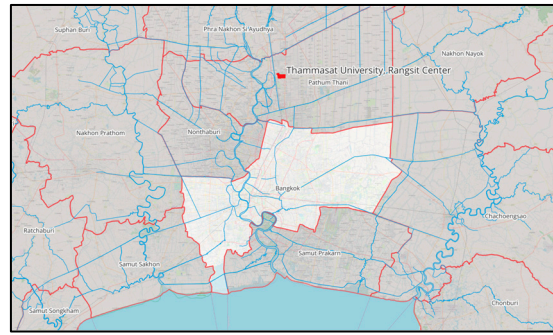


Figure 4. Provenience of the participants and its context.

The survey was divided into two sections aimed to collect information to be analyzed with descriptive statistics: (1) general information which are type of disabilities, age interval, gender groups, and occupations and (2) needs and interests in active recreation activities which are walking-jogging, bicycle, multi-purpose sports, relaxation activities, walking up and down stairs or ramps, field sports, and wheelchair exercise activities. The close-ended, but also open-ended questions, enabled participants to elaborate on their perceptions. The open-ended questions were suggestions in regards to the disabilities' needs towards (1) active physical activities in public spaces and (2) spatial configuration of the public spaces.

The purpose of the data processing and analysis is to formulate inclusive public park design criteria and guidelines for the disabilities. Qualitative results from the surveys were quantified using descriptive statistics in Microsoft Excel to examine the patterns of the informants in different types of groups as well as the types of interest in public space (active and passive) activities. Quantified data of perceptions and suggestions of the needs and interests in active recreation activities are the baseline information. The analysis integrated the data, including zoning configuration, park usability, connectivity and accessibility, safeness and cleanliness, and inclusiveness, that structured a pathway towards the design criteria and guidelines for the disabilities.

4. Results

4.1. Background of the Survey Participants

The background of the survey participants provides the demographic base for the project elaboration.

A sample of 384 persons with disabilities participated in the survey; their disabilities were categorized into eight groups: (1) people with vision impairments, 14.06%, (2) people with hearing problems, 14.06%, (3) people with mobility skills or physical problems, 14.06%, (4) people experiencing mental health issues or behavioral problems, 14.06%, (5) people with intellectual challenges, 14.06%, (6) people with learning difficulties, 14.06%, (7) people experiencing some form of autism, 14.06%, and (8) people with multiple disabilities, 1.58% (Figure 5a).

There was a slightly greater proportion of female respondents at 51.30%. The age distribution of the participants can be classified into three categories: (1) 32.81% children, ages 13–14 years, (2) 34.38% adults between 15 and 59 years, and (3) 32.81% elderly with ages of 60–65 (Figure 5b). In Figure 5c, occupations of the respondents were (1) students at 34.64% and (2) self-employed at 24.74% (3) personal business at 17.19% (4) office worker at 10.16% (5) government employees at 6.25% (6) retiree at 2.86% (7) housekeeper 2.08% (8) unemployed at 1.30% and (9) others at 0.78%. With respect to living assistance, 66.41% were able to help themselves and did not require a caregiver's assistance, while 49.50% did require some help from the caregivers (Figure 6).

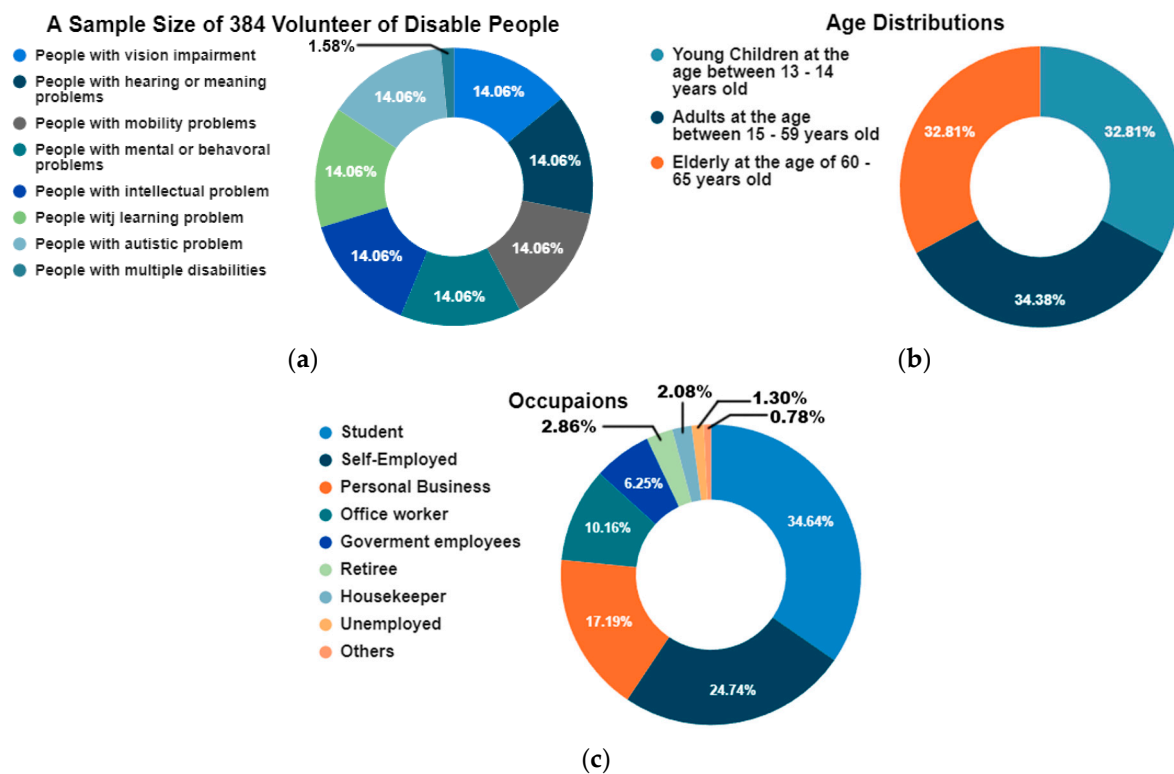


Figure 5. Results of survey in regards to participant age distributions and occupations. (a) A sample size of 384 volunteers of people with disabilities. (b) Age distributions and (c) occupation.

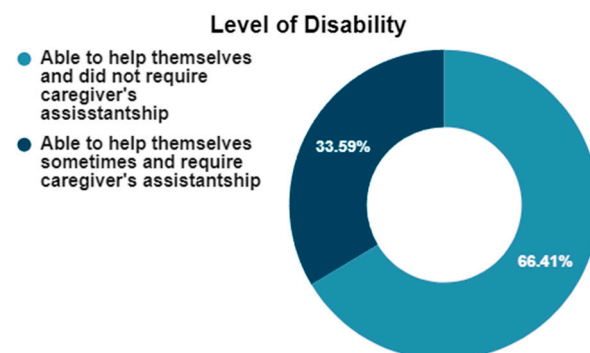


Figure 6. Results of survey in regards to level of disability.

Three considerations emerged. No disability prevailed over the others; middle aged group are the most present; and no need for caregivers forms the majority of participants.

4.2. Need for Programs and Facilities in a Public Park

The answers provided the research team with a functional and typological base to orient design choices.

The overwhelming majority of respondents, 98.70%, preferred to exercise with the general public. Furthermore, 58.70% preferred individual exercise, 29.60% would enjoy a group of 2–3 people, and 10.70% would like to exercise with a group larger than 3 people.

Outdoor exercise behaviors can be summarized as follows: (1) 35.80% of the respondents favored walking–running activities, (2) 20.90% preferred cycling, (3) 14.30% suggested multi-purpose exercises such as balancing, stretching exercises, yoga, aerobics, tai chi, etc., and (4) 2.90% required exercise in wheelchairs for disabled people (Table 3).

Table 3. Interest in exercising outdoors.

Exercise Items	Frequency	Percentage
Walking—Jogging	320	35.80
Bicycle	187	20.90
Multi-purpose sports such as balancing, yoga, tai chi, etc.	128	14.30
Relaxation activities in the green area	106	11.80
Walking up and down stairs or ramps	95	10.60
Field sports such as handball or basketball, etc.	33	3.70
Wheelchair exercise activities	26	2.90
Total	895	100

The interests in passive recreation activities for public spaces can be summarized as follows: (1) 46.50% for meeting point activity, (2) 39.90% for picnic activity, (3) 11.70% for drawing activity, and (4) 2.00% for other modes of activities.

In addressing public park space and facilities requirements, six items were discussed. First, the results revealed that accommodation pavilions were desirable for 30.70% of people with intellectual disabilities (with no physical indication of any design, but just as a general idea of construction), 26.90% for people with hearing disabilities, and 23.50% for people with autism. Second, a multi-purpose exercise activity yard was preferred by people with learning disabilities (19.00%) and people with multiple disabilities (15.20%). Third, parking space for people with disabilities was a top priority for people with mobility disabilities, at 15.50%. Fourth, social spaces were most important for people with visual impairment (14.20%). Fifth, 14.20% of people with visual impairment and 15.20% of people with multiple disabilities (highest value item) would like access to specialized exercise equipment. In addition, the highest response for people with mental health disabilities (13.90%) were bathroom areas and a recreation space. This is summarized in Table 4.

Table 4. Space requirements and facilities in public park by type of disability.

Items	Frequency (Percentage)							
	Disabilities							
	Blind	Hearing	Mobility	Mental Health	Intellectual	Learning	Autistic	Multiple Disabilities
Pavilion	27 (7.80)	47 (26.90)	8 (2.40)	48 (13.60)	50 (30.70)	27 (9.90)	47 (23.50)	4 (12.10)
Multi-Purpose Exercise Area	47 (13.60)	29 (16.60)	32 (9.70)	29 (8.20)	29 (17.80)	52 (19.00)	29 (14.50)	5(15.20)
Drink Shop	47 (13.60)	24 (13.70)	47 (14.20)	47 (13.30)	7 (4.30)	49 (17.90)	25 (12.50)	2 (6.10)
Restroom	27 (7.80)	9 (5.10)	47 (14.20)	49 (13.90)	28 (17.20)	49 (17.90)	26 (13.00)	3 (9.10)
Exercise Equipment	47 (13.60)	26 (14.90)	47 (14.20)	47 (13.30)	26 (16.00)	28 (10.20)	7 (3.50)	5 (15.20)
Passive Rest Area	47 (13.60)	8 (4.60)	22 (6.70)	49 (13.90)	7 (4.30)	27 (9.90)	27 (13.50)	4 (12.10)
Meeting Area	49 (14.20)	9 (5.10)	45 (13.60)	26 (7.40)	3 (1.80)	27 (9.90)	6 (3.00)	4 (12.10)
Parking	25 (7.20)	9 (5.10)	51 (15.50)	27 (7.60)	7 (4.30)	5 (1.80)	5 (2.50)	2 (6.10)
Social Area	26 (7.50)	8 (4.60)	29 (8.80)	25 (7.10)	5 (3.10)	6 (2.20)	25 (12.50)	3 (9.10)
Etc.	1 (0.30)	-	-	-	-	-	2 (1.00)	-
Total	346 (100)	175 (100)	330 (100)	353 (100)	163 (100)	274 (100)	200 (100)	33 (100)

Activities that relied on balancing and coordination and movement of the body such as Tai Chi and yoga are often engaged in as a group with lead performers and with or

without rhythmic music, and this results in higher social interactions. These activities can be performed at either indoor or outdoor spaces.

Physical enjoyment activities desired by the respondents can be categorized into two types as follows: (1) dancing activities such as imitating dance moves, creative dancing, etc., and (2) playing music, including band music and independent musical activity, etc.

It can be clearly seen that people with disabilities have a great demand for physical recreation activities. In addition, alternative recreational supporting activities were identified, including meditation and mindfulness activities. Indeed, some of the respondents expressed interest in religious and spirituality-related activities such as meditation and mindfulness which required trainers and caretakers to ensure safety of the participants. Some suggestions to facilitate these activities included having a peaceful area by a pond in the absence of disturbing noises from traffic. The benefits of these activities for people living with disabilities include better daily activities performance and improved working efficiency.

We also see an opportunity to add new activities that are shared between people with disabilities and general users. These two groups can exchange views in a social setting and collaborative participation would provide an opportunity for the general public to better understand and appreciate living with a disability. Some respondents suggested that using a public park by themselves was an issue of concern. Therefore, an assistance service should ensure equal and safe access to the park. It appears that all groups with disabilities included in this study would benefit from guardians to help them access public spaces, especially those with multiple disabilities and who may have difficulties in accessing information, equipment, or asking for help in case an accident occurs.

In short, the insights that emerged with more recurrency are the following: a preference of walking for the active space activities and of social meeting for the passive ones; preference for individual exercise and interest in other open-air recreational uses; and claim for a general undefined pavilion and other general services. All the activities of the redeveloped park are desired to be conducted in an environment blended with the general public and assisted by a general stewardship facilitating the accessibility and the fruition.

4.3. Recommendations of Participants from the Survey

“Parks should be designed in a way that the disabled people can use safely on their own”, one of the research’s participants added. Other recommendations were provided in regards to the physical qualities of the spaces.

Key recommendations for balancing-exercise guidelines were to install handrails, as well as having walking sticks and crutches available. Furthermore, advice on choosing smooth, non-slippery, and soft surface materials was provided, to help those with disabilities to reduce the probability of a fall and the risk of injury. Moreover, the selection of fitness accessories should consider ease of use, convenience, light weight, and safety as the utmost important risk prevention measure. In addition, a caregiver assistantship may be considered in choosing equipment and methods of exercise.

Some major recommendations for hands and arm muscle exercises were provided for ball accessories. Consideration must be allocated to ball size where a small size is appropriate for hand compression and a moderate size for ball throwing, receiving, and passing activities. The balls also should have appropriate weight to prevent accidents during exercise. Moreover, a high-level handrail node including single and double railings should be established, and stocked with body protection equipment such as gloves, helmets, sleeves, etc.

The guidelines for enhancing physical activity spaces in sports fields emphasize several structural and accessibility improvements. Firstly, the installation of sun and rain protection roofs, along with increased tree coverage, is recommended to provide shaded areas that facilitate outdoor activities in various weather conditions. Additionally, the guidelines advocate for the removal of obstacles within exercise areas and the selection

of soft materials for surface cladding, particularly in corner areas, to minimize the risk of injuries resulting from collisions.

Regarding the usability of spaces, the guidelines suggest providing an adequate number of seating options, including cushions and other resting facilities, to enhance comfort during activities. Furthermore, the installation of information signboards that clearly display directions and details is advised to improve the navigability of the space.

To better accommodate individuals with hearing impairments, the guidelines also recommend equipping some physical activity resources, such as balls used in sports like basketball and table tennis, with sound-producing devices. This modification aims to make these activities more accessible and enjoyable for everyone, ensuring inclusivity in sports field environments.

Considering protection measures for some activities, net installation can prevent balls from leaving the activity area and make it easier to collect the balls as well as preventing their interference with other activities in another area. Moreover, it was suggested to have assistants for informing about the proper use and participation for each activity.

Additional suggestions are to provide a special wheelchair service free of charge. Wheelchairs should be rotated freely in all directions and should be regularly maintained and safe to use. The new park should also provide accessories for wheelchairs such as belts for fastening. Activities should be performed on flat smooth surfaces with no physical obstacles and a wider path to support wheelchair movement, as well as supporting ramps for more convenient access. In addition, there should be a specific green physical activities area designed for wheelchair accessibility.

Further recommendations on relaxation and provision of a peaceful atmosphere for relieving stress and worry should include a design having great numbers of trees to provide shade and fresh air. Moreover, there should be lawn areas where children can run, sit, and play, as well as decorations, monuments, and entertainment such as running water, fountains, and music for relaxation.

In summary, based on respondent recommendations, open spaces should have (1) no obstructions, (2) smooth surfaces, (3) no level variations, (4) clear path separation for walkways, jogging, and bicycles, (5) clear and sufficient information boards, (6) easily accessible meeting points, (6) a variety of learning improvement activities, (7) a green area without cars and noise interference, (8) a food distribution area, (9) a bicycle lending service, (10) clean and all-accessible bathrooms, and (11) a close distance to the car parking area, etc.

A set of additional recommendations from the respondents can be describes as follows: (1) there should be a variety of standardized, universally-accessible exercise equipment for supporting every activity, (2) having group exercises together with general users, (3) sponsoring sporting events for people with disabilities, (4) have coaches and caregivers available to help on using equipment, (5) the need for having clean bathrooms, (6) a suitable waiting area, (7) a food distribution point, (8) a vocational training center to provide services to support activities, (9) spaces allocated to people with disabilities proportionately, (10) clear symbols, sound signals, and ramps to facilitate wheelchair access, (11) spaces with tree-shaded areas, (12) installed emergency buttons that allow assistances to reach in case of needing help, and (13) the park should be free of charge.

The set of functional recommendations included in this section constituted the last input provided by the participants and a valuable set of prescriptions to be adapted to the site. The designers' interpretation of all the insights received is discussed in the next section.

4.4. From Insight to Design Criteria

The nature of the open questions offered to the participants produced a diversity of results unrelated to any specific site: to avoid biases, the participants were not instructed on the specific project details, and the specific location of the project was not disclosed nor mentioned. The other set of insights coming from the close-ended questionnaire and graded with the Likert scale produced, similarly, a general appreciation of the statements proposed in connection with the personal views of the participants. Each of these insights was also

remarkably related to the specific disability—or mix of disabilities—of every participant. As a result, the broad range of insights provided a comprehensive ideal impression of a park to be interpreted: an optimal idea, rather than a direct set of inputs to be followed in the design.

The second phase of the research weighted and evaluated these insights: the design team balanced these with the site specifications, opportunities, and constraints, in defining a proposal which tried to create a compromise between the results and the real possibilities. The first consideration was taken on the specificities of the survey sample.

The presence in the demographics of almost one-third of participants aged 13–14 implied a constraint on independence of movement related to the minor age, rather than to their specific disabilities. This issue was considered by the designers in relation to two site specificities: one, the site macro area does not allow an easy movement or reachability of the area at the urban scale—besides the presence of public transportation lines and public vans; two, the site's surroundings are freely accessible but are strongly connected to the community of the Thammasat University, whose staff and students correspond to another demographic and live in the area surrounding the site. For these reasons, the designers determined that autonomous access and autonomous fruition of the park for the demographic 13–14 is less likely to happen. This consideration was received in the design in two ways: creating a space connected to a parking lot and the bus stop (hence, accessible by the external users of the TU), and by the decision to provide activities and playground devices suitable for users of 14 years and above, but not below. Accompanied users of this younger demographic would have to rely on the other spatial provisions (i.e., the open spaces or physical activities of movement), fostering in this way social integration in different manners.

Similarly, consideration was allocated to the 34.60% of the sample's composition that are students of different ages and the 24.70% that were self-employed. The designers aimed to prioritize the areas for social engagement, inclusion, and integration for these demographic transversal groups (not connected to the age) for two specific reasons: to blend in the context of students from diverse school grades and backgrounds and to provide the self-employed an opportunity for public social gatherings with students, a demographic different from their employment status. As such, these principles were conceptualized in the design via open-structured and semi-structured spaces. Another data point strengthened this last spatial consideration: over 73% of the participants affirmed they had no underlying diseases which could additionally affect movement, while over 65% indicated their health satisfaction was 8/10 or higher on a Likert scale. Consequently, open-structured and semi-structured spaces were conceptually imagined as blending into the exercise area to promote a seamless transition between passive and active recreations.

The last element of reflection connected to the demographic is an elaboration of the 99% of users who declared to be willing to use exercise areas in public. Of these, most of the participants would like to conduct individual exercise (58.70%), and secondly, in a group of 2–3 people (29.60%); finally, in 3 or more for the remaining 11.70%. These data were crossed with the consideration that 66.40% of the sample identifies as a self-assisted person, while 93% identified as a person which can explore the space with no constraints. Put together, these insights reinforced the general overall conceptual idea of autonomous use and access of the park by all the seven ranges of disabilities and a general idea of 'unity through difference' furtherly elaborated later in the process and explained in Section 5.2.

An element of reflection about the main environmental and physical aspects of the context were the last factor to be considered in two manners and was indirectly present in the suggestions received. Firstly, the tropical climate drives human behavior and general design choices that limits the overall fruition of open spaces, requiring a particular climatic attention [37–40] and essential considerations on climate change [41].

Secondly, the socially vibrant context would also drive some of the choices in terms of accessibility, inclusion, operational times, and integration into the existent flows of people and vehicles. This is specified in the next section, which describes the design intervention

arising from the insights presented here. The features of the site, of the context, and of the design are illustrated with figures to further clarify the research-through-design methodology that was adopted.

The results of this research highlight the multifaceted preferences and needs of individuals with disabilities concerning public park facilities. Surveying 384 participants with diverse disabilities, the study found a strong preference for inclusive, interactive, and multifunctional recreational spaces. Most respondents (98.70%) expressed a desire to engage in physical activities alongside the general public, with preferences distributed among solitary exercises (58.70%), small group activities (29.60%), and larger group interactions (10.70%). This indicates a significant inclination towards social interaction and community involvement within recreational settings.

The participants also voiced specific needs for park facilities, suggesting a demand for universally accessible designs that accommodate a wide range of disabilities. Key facilities highlighted included accommodation pavilions, multi-purpose yards, and accessible parking, with special attention to the needs of those with intellectual disabilities, hearing impairments, and autism. The survey underscored the importance of safety and accessibility, recommending the installation of handrails, non-slip surfaces, and other adaptive equipment to enhance the usability of park environments.

In conclusion, this study illustrates the critical role of inclusive design in enhancing public parks to better serve diverse communities, particularly those with disabilities. The insights gained underscore the necessity of considering a broad spectrum of needs in park design, advocating for environments that not only accommodate all users but also promote their active participation and engagement. These findings provide valuable guidelines for developing public spaces that are not just accessible but truly inclusive, fostering a sense of community and belonging among all users.

5. Integration of the Result of this Study into the Design of the Inclusive Park

This article summarizes the initial public participation and design process. At the time of writing, Thammasat University has approved the design for construction, following the necessary legal stages, presentations, and public hearings. The project is currently in the funding phase, supported by a collaborative effort between the public and private sectors.

5.1. Project Rationale

The design strongly promotes the inclusion of this often-marginalized share of society, considering differences and unity, as mentioned shortly in Section 4.4.

The main site-specific design concept is “Finding Unity Through Difference”. This guiding concept allows the designers to both maintain and yet integrate the “unity”–“difference” dichotomy in the conceptual and practical dimensions of the design.

“Unity” and “difference” represent the users together, with their differences, and summarizes the goal of creating a unique space where space users and passers-by can meet and gather, with ease of access, no divisions or barriers, and regardless of the presence or the level of disabilities which may affect a user of this space.

From the physical point of view, “unity” and “difference” represent the guidelines for the definition of spatial layouts, materials, activities, furniture, and landscape design solutions which compose the design of the park. These items are materialized here often in a triangular shape with rounded edges. This recurrent shape of the design is present in the main layout of the areas, in the finishing of the pavements, in the shape of “the mountain”, and in other diverse elements. The triangle symbolizes the stability that many users of the park are looking for in the context (as per the survey), the certainty for the park to be a new element which can enrich the disabled users’ life, and a stable presence the users will be able to count on. The rounded edges symbolize the ease of park use for the users.

5.2. Project Features and Description

Firstly, given the nature of the project, a redevelopment, great attention was allocated to mobility, circulation, and pedestrian security—themes particularly felt in the Thai context and in an area which can suffer from traffic congestion in the rush hours and that would affect the space as well. Pursuing inclusivity, safety, and ease of access as the survey suggested, the project connects itself seamlessly to the context, to the cyclo-pedestrian mobility, and to the features surrounding the space (Figure 7). Practically, the design includes also the following:

1. A redefinition of the vehicular traffic for the site, with a redesign of the car alley connecting the parking lots and the creation of a new drop on/off point at the south of the site;
2. A redesign of the access to the close-by parking lots and the creation of safe pedestrian crossings, highlighted by colored pavements directly connected to the park and to other sidewalks;
3. The creation of a service lane surrounding the Water Sport Complex;
4. The connection of the park with the TU Campus' Shuttle EV-Bus stop.



Figure 7. Aerial view of the design with indications of the areas. Credit: the author.

As visible in Figure 7, the park consists of a few main elements distributed in an asymmetrical layout: a green corridor running along the perimeter of the site; another inner ring of green; and a central area. The first two elements surround a central area, a quadrangular core subdivided into two triangular areas—a “main” (with the ‘multi-purpose area’ as a center) and a “secondary” one (with the ‘basketball’ and ‘sitting’ areas).

The green corridor consists of new and existent trees, grass, bushes, and a water body. Another inner ring runs parallel to the main triangular core and contains other trees and a lawn, enclosed by flowerbeds. Their purpose, in accordance with the user consultation emerging from phase one of the research, the site-specific investigations, and the contemporary literature on the topic [8,9], is to provide sensorial enjoyment and pleasantness. Moreover, the physical layout of the trees encloses the area of the activities, providing a sense of visual enclosure and serving as a green barrier to absorb the sound and physically separate the safe area of the park from the surrounding campus and roadways.

The quadrangular core’s space is defined by the design criterion of “passive” and “active” zones, which subdivide the spaces (Figure 8). The “passive zones” are related to the idea of the passive enjoyment of the green space: a sensorial enjoyment which does not imply the exertion of physical exercise in the space. Seating, gathering, resting under the shaded zones, and relaxation are possible in the open spaces connected to these

concepts—as remarked in the survey by the prospected users. While seatings are mostly located on the northern edge of the main triangular core, alongside the concrete walls delimiting the green corridors and the water fountain, the whole design is characterized by a sequence of shaded and open spaces: five “flowers” of metal structures and texture coverings provide shade and complete the design of the open spaces. The pavement is characterized by different colorations. This graphic support, to aid those who are partially sighted and to convey a general message of vibrancy, is paved with a soft layer of blended concrete and rubber which provides comfort and safety. The design additionally includes open green spaces freely accessible for multiple purposes.



Figure 8. East-West section of the site, representing characterization of active and passive zones and, in blue, “the mountain” device. Credit: the Author.

In contrast, the “active” zones facilitate physical activities. Spaces for the structured active enjoyment of the space include fitness equipment and a basketball court in the northern and western portion of the park; a playground and a fitness area; and the two connected elements of an artificial ground and a walking lane which loops around the premises. The provision for spaces of activity is greater than the spaces of passive uses, as emerged by the insights analyzed in the previous sections.

The fitness equipment consists of machines popular with active exercises and that are specifically designed for users with disabilities of the dominant demographics of use (above 14 years of age), to favor the bond with the future users. Similarly, the playground area is designed with equipment for adults that includes swings and seesaws to foster physical and sensory engagement and enjoyment. The active zone is located in the north-west area around the shading devices to guarantee rest and sun protection for the users. The area shares also the activity of basketball, with the installation of a half-court area, the positioning of which does not affect the other users. Basketball is a favorite activity in Thailand and the presence of the basket in an asymmetric context without the normal rectangular court dimension has the benefit of providing the idea of the game stimulating different plays and challenging activities. The rest of the area is a general, free non-shaded open space.

The artificial ground is a hill, 1.65 m high, located on the eastern side of the area. It is reachable through the walking lane by the sides and through “the mountain” by the main open space, a soft and walkable ascent with climbing supports diversely colored. The walking lane extends alongside the perimeter of the main triangular core for a loop of 100 m; it climbs the hill, and it is navigable by wheelchair, respecting the slope design criteria prescribed by the Thai regulations for accessibility and codified design [42].

The minimum width of 1.70 m allows the passage of more people or a combination of wheelchairs with people. Alongside its course, metal parapets protect the users and are present active devices of activity. An anchoring device runs parallel to the path on a metal frame mounted at different heights. It allows the walkers with mobility or visual impairment to hold a moveable handle which can guide them on this path

The unstructured active enjoyment zone is another important feature defining the spaces. It includes, as per the passive zones, the open spaces which allow free movements, walks, runs, and collective exercise by groups of users, in cooperation with the local stakeholders who can promote further interactions within the spaces. These spaces, by their nature, favor an informal gathering of users and social inclusion, allowing people to find new spaces to conduct social or other outdoor activities.

5.3. Social Inclusion of the People with Disabilities in the Park with Physical Activities

Whereas the park blends and encourages sitting and passive enjoyment, the design of recreational activities that can foster active social integration while promoting good health for people with disabilities is a main core of the project. This core is developed with two main principles: one of challenges and the other of sensorial engagement.

The principle of the challenge, emerging from the interpretation of the studies conducted, consists of a balance of inclusive elements that leverage accessible and controlled physical challenges. At the center of the northeast open space, the aforementioned artificial ground is created and paired with another solid element with a triangular base, the “mountain”. It is an artificial hill clad in a soft rubber blend which allows and invites engagement through climbing. This element is constructed with a progressive slope and several anchor points designed to develop a challenge, a sense of achievement, to support sensorial balance and active mobility exercise.

In a similar way, the edge of the hill is designed to encourage the throw of a ball/weight towards the square, in a shot-putting manner, targeting a specific angle which does not harm other visitors or people climbing the mountain. It is possible to conduct this activity on the level of the square also. The involvement of the same dual sense of engagement/challenge is amplified by the design of the floors: parallel lines with different color contrast and distance indicators allows the participants of the activity to measure the length of the throwing. In this sense, the design of the pavement with the color contrast and the parallel lines helps to identify the position of the thrown object. This opens further possibilities of enjoyment, engagement, and research to be developed in the future daily operational routine of the park and in collaboration with sports experts, physiotherapists, and other personnel affiliated with the various Thammasat faculties. Under this aspect, social integration hence constitutes a base for institutional integration, an aspect which goes positively beyond the redevelopment of the park into an inclusive space and targets the largest public stakeholder involved here, Thammasat University.

On the other hand, the topic of sensorial engagement can be enjoyed at the site in both active and passive forms. The park offers a wide variety of possibilities for the engagement of the senses with open space, natural ventilation, sun, water, and greenspace, elements capable of stimulating different sensorial sensations. The position of the park in between a cluster of sportive, recreational, and commercial activities facilitates spontaneous access, thereby enticing unplanned visits to the space. The presence of continuous seating, of generous greenspace, and of a water body with a fountain favors visitor aggregation, while concurrently providing opportunities for private and collective moments of sensorial engagement. For example, the open spaces can host active and reflective activities such as group-classes of mindfulness or meditation in a public space—a further experience of inclusion in the public context for people with different disabilities, as the survey insights suggested.

5.4. Green Landscape Design

The design of green spaces warrants further elaboration. The greenspace was deemed as crucial by the designers in accordance with the results of the survey, the TU Masterplan for a green campus and to provide real possibilities of sensorial engagement while being consistent with concepts of nature-based solutions, relevant nowadays in the landscape discipline [43] and in this context [44]. This empowerment of the greenspace design involves the maintenance of the existent trees with their relocation on the site and the plantation of 22 new trees of different arboreal species. Shrubs and grass are planted in the areas at the edge of the site to accomplish two additional goals other than the visual, sensorial, and environmental ecosystem benefits. The first is water collection: while an irrigation network supplies water in the dry season, permeable soils and water collection hubs facilitate the on-site collection of stormwater runoff and subsequent conveyance for treatment. The secondary goal is the protection and enclosing of the space for the activities. The water fountain is included to provide an element of variety, functioning as a sensorial and material point of engagement which creates a sensorial, acoustic, and visual landmark due to its position on the site, visible to the public road. Figures 9 and 10 provide comprehensive rendered images of the park.



Figure 9. Rendered image of the park. Credit: the author.



Figure 10. Rendered Ariel view image of the park. Credit: the author.

This research project focuses on the latest completed phase, specifically the description and discussion of the design stage. The team has intentionally omitted the approval process and public hearings for two reasons: first, the process is not formally concluded, and second, detailing these steps would deviate from the objectives and scope of this paper. By doing so, the research remains aligned with its stated goals and maintains a clear focus on the relevant aspects of the design process.

The next section discusses results of this study and its limitations, points of convergence, and divergence of the research insights coming from the surveys (as discussed in the Section 4) and their reflection in the design process.

6. Discussion on Results of this Study and Limitation of this Study

Two critical limitations occurred in the process of adapting the insights to the site: one was related to the physical characteristics of the site and the surroundings, and the other to the qualitative principles of the insights received.

The main recurrent structural limit related to the physical characteristics of the site drove many choices in the design phase. The site's surface of 2334 sqm is large enough to accommodate a variety of functions and spaces, but it is inclusive of the vehicular mobility, emergency lane, pedestrian crossings and required greenspace, which have minimum sizes under the local laws and well-known international practices [42]. The designers decided not to disadvantage the mutual distancing and proportion among the elements, the greenspaces, and to keep the existent trees in spite of accommodating all the suggestions that emerged in the survey. The presence of the greenspaces could have been expanded, but only at the expense of the quantity of activities.

Another issue of the design phase was connected to the site positioning. The Water Center constitutes an iconic architecture and an existing hub both for the sportsman and the public given its sportive, commercial, and recreative appeal. The Complex is in need of renovation and restructuring, and needs universal design upgrades of some services, including the accessibility for wheelchairs, and the position and the numbers of toilets. This indirectly affects the park, which needs to rely on the Complex's toilets (accessible from the ground floor of the Complex) and with a poor general access to the swimming pool's floor (accessible from the inside of the Complex) or by the iconic staircase, which is not suitable for those with mobility impairments.

Also, the new layout of the park and the roads separates the vehicular traffic completely from the Complex, creating a safe zone that is fully pedestrian (the surrounding lane is intended to be used for emergency use only). The drop-off area is moderately farther than the actual one, as the general circulation had been restructured, and it may cause confusion in the first operational stages if an adequate signaling system and traffic control are not provided.

The other limitations of the research process are bundled in the nature of the survey and in the qualitative value of the insights. As mentioned, without prejudice to the methodological correctness of the survey and the elaboration of the results, the insights received were not connected to any specific site and therefore required site-specific adaptation. The choices the designers made adapted the survey inputs to the real physical constraints of the site. The design expression of the survey suggestions is summarized in the following Tables 5 and 6, which represent a summary of information from Tables 3 and 4 and of the design choices.

Table 5 summarizes the implementation of the inputs received. It shows how every suggestion was or was not accommodated in the design and provides a short rationale for the design decision. The suggestions were divided into four strands of suggestions that emerged from the survey: active recreational items; passive recreational items; physical enjoyment activities; and complimentary activities.

From Table 6, it appears that no insights from the surveys had been fully excluded from the project. The designers accommodated the majority of the suggestions, tailoring these to the aforementioned site constraints. Most of the survey suggestions were related to generic activities with the designers opting to take them into account by providing flexible space and demanding the implementation of these activities to the relevant stakeholders under the management phase of the site once construction is completed.

Table 5 summarizes specific items that were suggested and the two disability groups that most frequently demanded the item. In the last column of Table 5, the rationale behind the choice is briefly explained, as per the previous Table 4.

The designers were able to implement all the suggestions, except those requiring the edification of a new structure. In these three cases (pavilion, toilets, and drink shop), the reason behind the designers' choices is about the creation of an open space which excluded "walls" and constructions, avoiding also that a built element would become the centerpiece

of the space—which is, that is, the space for the activity, as per the design’s rationale. Importantly, the designers aimed to prioritize social connections in open spaces, dialoging with the immediate surroundings of the Water Sports Complex (that hosts shops and public toilets) and promoting visual connections to strengthen the future integration of the spaces in the context and allow a more immediate recognition and fruition. Thus, shaded artificial devices are constructed, whose design minimize the physical structure on the ground to the bare minimum necessary.

Table 5. Interest in exercising outdoors: implementation of the inputs received in the survey.

	Requests of Recreational Items	Implemented in the Design	Rationale behind the Design Choice
Active Recreational items	Walking–Jogging	Yes	Integrated with paths interconnected with the surroundings
	Bicycle	Partially	The area is not suitable for biking, but it is close to the main cycling path, being easily accessible
	Multi-purpose sports	Yes	Presence of a variety of possible activities
	Relaxation activities in the green area	Partially	The green area could be suitable to host different activities, but relaxation is shared with other activities
	Walking up and down stairs or ramps	Partially	To prioritize safety and engagement, the projects does not include steps, but a soft ramp to climb and “the mountain” device
	Field sports such as handball or basketball, etc.	Partially	A full-sized basketball court was not fitting, nor desirable in the redevelopment; the design provided the space for an irregular basketball court design to convey the idea of the sport
	Wheelchair exercise activities	Yes	Presence of unstructured space for activity; future provision of inclusive exercise machines
Passive recreational items	Meeting point	Yes	The area offers the opportunity for multiple meeting points of different kinds
	Picnic	Partially	The green space provision
	Drawing space	Partially	The design does not include a dedicated space but it leaves room for this activity—up to the future management of the space
	Others	Partially	Multipurpose activity space is suitable to host various other activities—up to the future management of the space
Physical enjoyment and complimentary activities	Dancing (active use of the space)	Partially	Taken into account as space provision—demanded in the operational phase of the design
	Music Playing (active use of the space)	Partially	Taken into account as space provision—demanded in the future management of the space
	Meditation (passive use of the space)	Partially	Taken into account as space provision—demanded in the future management of the space
	Mindfulness (passive use of the space)	Partially	Taken into account as space provision—demanded in the future management of the space

Table 6. Reception of the requirements by type of disability.

Item Requested	Major Category of Disability Requestor	Implemented in the Design	Rationale
Pavilion	Intellectual and hearing	No	A pavilions intended as a ‘building’ would create a physical spatial obstacle and a bold constraint—the design includes the construction of shaded artificial devices
Multi-purpose exercise area	Learning, intellectual	Yes	Taken into account
Drink shop	Learning and mobility	No	The existent surrounding shops are connected to the park; the new design does not feature the construction of new structures
Restroom for disability	Learning, intellectual	Partially	The existent surrounding shops are connected to the park; the new design does not feature the construction of new structures
Exercise equipment	Intellectual, multiple	Yes	Active devices are provided
Passive rest area	Mental health and seeing impairment	Yes	Different kinds of shaded areas for passive rest are provided
Meeting area	Seeing impairment and mobility	Yes	Different kinds of shaded areas for meeting are provided
Parking for disability	Mobility and seeing impairment	Partially	The park does not feature any new parking in itself, but it establishes a direct connection to the parking area located south of the site
Social area	Mobility and autistic	Yes	Different kinds of shaded areas for meeting are provided
Other requests	Autistic	Partially	Points partially or previously addressed

Aside from the tables, we categorized another set of insights as “physical recommendations”. The majority of the recommendations falling under this class of survey results were included in the project since its conceptual phase: accessibility, gratuity, ease of use and access, separation from traffic, and safety from vehicles. Other requests involved more specific physical features, and all were taken into account with no objections, since some were already implicit features of general safety and comfort design: the installation of handrails, the presence of non-slippery and soft surfaces, sunshade protection, sitting areas, and the provision of new trees and greenspace—interpreted also as a multisensory set of devices. Only the request of no level variations in the surfaces is partially taken into account, because of the presence of the “mountain” and of the ramps. However, these items are localized, connected by ramps, and the majority of the site is left flat.

The last set of suggestions received in the surveys were related to the presence of mobile devices such as sticks and crutches and wheelchairs on demand for rental, the presence of balls of different weights and material for various exercises, the presence of user-friendly devices, and the presence of caretakers: these would be considered in the operational stage of the design, after the construction of the park. Potential space for accommodating the storage space could be identified in the Water Complex.

Taking everything into consideration, the design team actively pursued compromises between the survey group’s insights and design choices, highlighting the convergence points coming from the target use, rather than emphasizing the possible divergence points. For the authors, the result, besides the abovementioned limitations, satisfied the inputs received to the greatest extent possible.

Further elaborations on the insights on and considerations of the crossed connections between the specific disabilities and the activity requested (“*who requested what*”) fall beyond the scope of this article and the authors’ expertise and can constitute a dataset for future specific studies on the subject coming from other disciplines. However, how the design

of the inclusive parks can respond to the disabilities will be testified after the park is constructed, and they shall be addressed in future research.

7. Conclusions

This previous section illustrated the value of participation and inclusion at different levels; we integrated theoretical and pragmatic approaches to create a public space that suggests and encourages inclusion, social bonding, and gathering, maximizing the autonomous accessibility by marginalized actors. We filled the research gap and satisfied the research questions, transforming insights coming from marginalized actors into an inclusive park to be realized in a real site. We finally evaluated scientific and practical limitations of the research. Three main conclusions for this research follow from these points.

The park's design features, beside the inner limitations previously discussed, constitute a satisfactory compromise between the insights provided by the target group and the site's features. Designers assumed in this process the role of 'interpreters', creating a method to listen for a marginalized community's insights and translate them into real spaces which empowers the vulnerable stakeholders and the whole social context of the site.

Secondly, we believe this kind of designing by research empowers the whole context not only for the final design but due to the whole research process, whose foundations lay on the interpretation of the four factors of inequality in a proactive way, as specified in the Introduction. Specifically, as per the structural factors, the redevelopment of a park can lead to positive economic turnovers in the small scale and to a more inclusive political agenda by the local administrators, who will be able to count on an enrichment of public spaces. As per the social determinants, and as described in the Section 5, the layout of the areas and the presence of greenspace, sensorial features, and passive and active spaces positively contribute to creating diverse occasions for improving the social engagement of the area. With respect to the risk factor, the renovated park offers to the society a public, free, and protected space that empowers their active lifestyle and reduces negative behaviors from the users. Then, the nature of a free, public, open, inclusive, and accessible park can help the health system factor to establish the park as a gateway to a healthier lifestyle.

Lastly, the park can serve as a platform for various forms of collaboration. A flexible, multi-use and non-predetermined open space equipped with green and diverse devices can allow future collaborative top-up or bottom-up projects among stakeholders (i.e., by institutions, associations, and groups promoting social integration, etc.) within the area. The park can become the study context for research by other disciplines to observe and investigate topics such as social interactions (in the tradition of Whyte's early studies), disabilities, interaction with green spaces, and behavioral, learning, or medical sciences. Finally, leaving aside the tangible result of the design, the described methodology in itself constitutes a precedent to be compared, iterated, implemented, or altered by other scholars, in Thailand or in another context, to stimulate further similar scientific reflections.

However, even though this study on developing an inclusive park at Thammasat University's Rangsit Campus offers valuable insights, its limitations suggest areas for further research. The geographic and cultural specificity of this study provides rich, contextual data but limits generalizability, indicating the need for comparative studies in varied settings. The purposive sampling emphasizes relevance for the local context but could be expanded in future research to include a broader spectrum of disabilities, enhancing applicability. Additionally, reliance on self-reported data through interviews and surveys introduces potential biases, pointing to the opportunity for integrating more objective data collection methods. The absence of a longitudinal follow-up to assess the sustained impact of the park's design invites ongoing evaluations to adapt and optimize inclusive public spaces. These limitations frame this study's contributions and set a clear direction for extending this foundational work to better cater to diverse needs in inclusive environments.

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