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Urban furniture design and ergonomic assessment in neighborhood parks: the case of Fabrika District, Diyarbakır, Türkiye

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ABSTRACT: Neighborhood parks are essential public spaces encouraging socialization, physical activity, and relaxation. Their effective use is closely tied to the ergonomic design of urban furniture. This study evaluates the ergonomic suitability of urban furniture in four parks in the Fabrika Neighborhood, Yenişehir District, Diyarbakır by using a qualitative assessment method. The research was conducted in four stages: (1) A literature review identified 13 sub-criteria under six main categories: material, ergonomics, inclusive design, color, safety, and vandalism. (2) Fieldwork conducted between November and December 2024 assessed 18 types of urban furniture using a 0–5 rating scale. (3) Parks were classified based on their ergonomic performance. (4) Recommendations were developed to enhance usability. The findings revealed that NP1 (42.1%), NP2 (42.0%), and NP3 (41.6%) were "moderately suitable" while NP4 (26.4%) was "less suitable." Deficiencies were particularly noted in ergonomics, safety, and inclusive design. Unlike previous studies, this research integrates ergonomic criteria for a comprehensive evaluation. Future studies should prioritize sustainable, technology-based solutions to enhance urban furniture design.

Keywords: Urban furniture, Ergonomics, Urban life quality, Neighbourhood parks

Mahalle parklarında kent mobilyası tasarımı ve ergonomik değerlendirme: Fabrika Mahallesi örneği, Diyarbakır-Türkiye

ÖZ: Mahalle parkları, sosyalleşme, fiziksel aktivite ve dinlenme imkânı sunan önemli kamusal alanlardır. Bu alanların etkin kullanımı, büyük ölçüde kent mobilyalarının ergonomik tasarımına bağlıdır. Bu çalışma, Diyarbakır ili Yenişehir ilçesi Fabrika Mahallesi'ndeki dört parkta (NP1, NP2, NP3 ve NP4) yer alan kent mobilyalarının ergonomik uygunluğunu nitel bir değerlendirme yöntemiyle incelemektedir. Araştırma dört aşamada yürütülmüştür: (1) Literatür taraması sonucunda malzeme, ergonomi, kapsayıcı tasarım, renk, güvenlik ve vandalizm olmak üzere altı ana başlık altında 13 alt kriter belirlenmiştir. (2) Kasım–Aralık 2024 tarihleri arasında sahada 18 farklı kent mobilyası türü 0–5 puanlama ölçeğiyle değerlendirilmiştir. (3) Parklar ergonomik uygunluk düzeylerine göre sınıflandırılmıştır. (4) Kullanılabilirliği artırmaya yönelik öneriler geliştirilmiştir. Bulgulara göre NP1 (%42,1), NP2 (%42,0) ve NP3 (%41,6) "orta düzeyde uygun," NP4 (%26,4) ise "düşük düzeyde uygun" bulunmuştur. Özellikle ergonomi, güvenlik ve kapsayıcı tasarım konularında eksiklikler tespit edilmiştir. Çalışma, ergonomik kriterleri içeren kapsamlı bir değerlendirme sunarak önceki araştırmalardan ayrılmaktadır. Gelecekteki çalışmalarda, kent mobilyası tasarımını geliştirmek için sürdürülebilir, teknoloji tabanlı çözümlere öncelik verilmelidir.

Anahtar kelimeler: Kent mobilyaları, Ergonomi, Kentsel yaşam kalitesi, Mahalle parkları

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1 Introduction

Cities require careful planning, particularly for public spaces, as these areas meet social, cultural, and physical needs. Neighborhood parks (NPs) with rapid urbanization have become vital to sustainable urban development, providing essential recreational spaces for residents (Gehl, 2011). These parks foster social interaction across diverse age and socio-economic groups while supporting physical and mental well-being (Brown and Gillespie, 1995). The ergonomic and design features of urban furniture in NPs play a significant role in ensuring the effective and sustainable use of these spaces. Furniture is expected to be user-friendly, accessible, durable, and adaptable to environmental conditions. Properly designed elements that follow ergonomic principles enhance user comfort and contribute to long-term urban resilience (Tilley, 2002). Moreover, the rise in vandalism incidents alongside urbanization necessitates a careful evaluation of materials and durability in urban furniture design (Olgun, 2013). Literature indicates that urban furniture is assessed based on functionality, aesthetics, ergonomics, materials, color, and resistance to vandalism (Şahin et al., 2019; Olgun, 2013; Arat, 2020; Yeler et al., 2022). Key factors influencing park usability include comfortable seating, safe playgrounds, and accessible sports equipment (Arat, 2020). However, effective use depends on the presence of such equipment and its placement, maintenance, and user-friendliness (UN-Habitat, 2016). Therefore, both qualitative and quantitative evaluations of park furnishings are essential for promoting public health and social cohesion.

Studies on materials emphasize the importance of durability, sustainability, and user preferences. Innovative materials, such as lightweight concrete, provide resilience and modular flexibility (Thamrin et al., 2018; Kara et al., 2024) while sustainability efforts promote the use of recyclable and non-toxic local materials (Şatiroğlu et al., 2023). Nonetheless, traditional materials like concrete and polypropylene still raise concerns over carbon emissions (Sipahi and Sipahi, 2024), and wood and plastic-based components are particularly vulnerable to vandalism. (Olgun, 2013; Şahin et al., 2019). Ergonomic design enhances user comfort, health, and park usability while color planning improves perception and navigation (Gamito and Silva, 2016) and human-centered designs increase comfort (Külekçi, 2018). Ergonomic assessment tools link furniture design to health outcomes (Appolloni et al., 2020) while accessibility remains crucial for all users (Arat, 2020). Color choice also significantly affects park furniture's visibility, identity, and satisfaction; uniform color schemes improve legibility (Mazaherian et al., 2020) while excessive variation causes visual clutter (Gamito and Silva, 2020). Harmonizing furniture colors with the natural environment enhances the user experience (Saeedi and Dabbagh, 2020). Additionally, Gamito and Sousa (2019) stressed the importance of grounding color planning in scientific principles by suggesting that regional color schemes should be developed through community and expert feedback. Inclusive design principles emphasize that urban furniture must serve users of all ages and physical abilities, and urban pathways must ensure accessibility for individuals with disabilities (Özdemir Işık et al., 2016). A study on Altındere Valley National Park highlighted how incompatible furniture negatively impacts user experiences in natural spaces, advocating for design modifications to improve environmental integration (Aksu, 2015). Finally, vandalism and safety are critical factors; physical deterioration discourages park usage (Bhaskaran et al., 2024; Douglas et al., 2018; Echeverría et al., 2014; Marquet et al., 2019) while traditional neighborhood designs and Crime Prevention Through Environmental Design (CPTED) principles improve security, but note the absence of systematic guidelines (Sohn et al., 2015). McCabe and Strauss (2022) reveal that vandalism in parks increases bullying, particularly among adolescents with asthma. Marquet et al. (2019) and Echeverría et al. (2014) find that higher crime rates near parks discourage children and young people from using these spaces and reduce physical activity. Well-maintained parks foster community bonds and improve safety perceptions (Suminski et al., 2015; Zhai et al., 2020).

This study aims to evaluate the ergonomic and design characteristics of urban furniture in four NPs in the Fabrika neighborhood of the Yenişehir district, Diyarbakır, Türkiye. The study identifies existing issues by examining the suitability of urban furniture in terms of materials, ergonomics, inclusive design, color, safety, and resistance to vandalism. Analyses have been conducted to propose recommendations for enhancing the functionality and inclusivity of NPs based on literature reviews and field observations. Unlike earlier studies that often focus on isolated aspects such as materials, ergonomics, color, safety, or vandalism, this research comprehensively assesses all key components of urban furniture. It introduces a systematic and adaptable methodology for evaluating ergonomic and design features across different green spaces. Furthermore, beyond theoretical analysis, the study provides empirical and practical recommendations for municipalities and urban planners. The study advances the existing literature, delivering a more holistic assessment of urban furniture to support the creation of more functional, inclusive, and sustainable NPs by integrating these aspects.

2 Materials and Methods

2.1 Study Area

This study examines the Fabrika Neighborhood in the Yenişehir district of Diyarbakır, a region characterized by high population density and strategic importance for urban development. Diyarbakır, located in southeastern Türkiye, has a population of 1,810,366, making it one of the country's fastest-growing cities (TÜİK, 2023) (Figure 1).

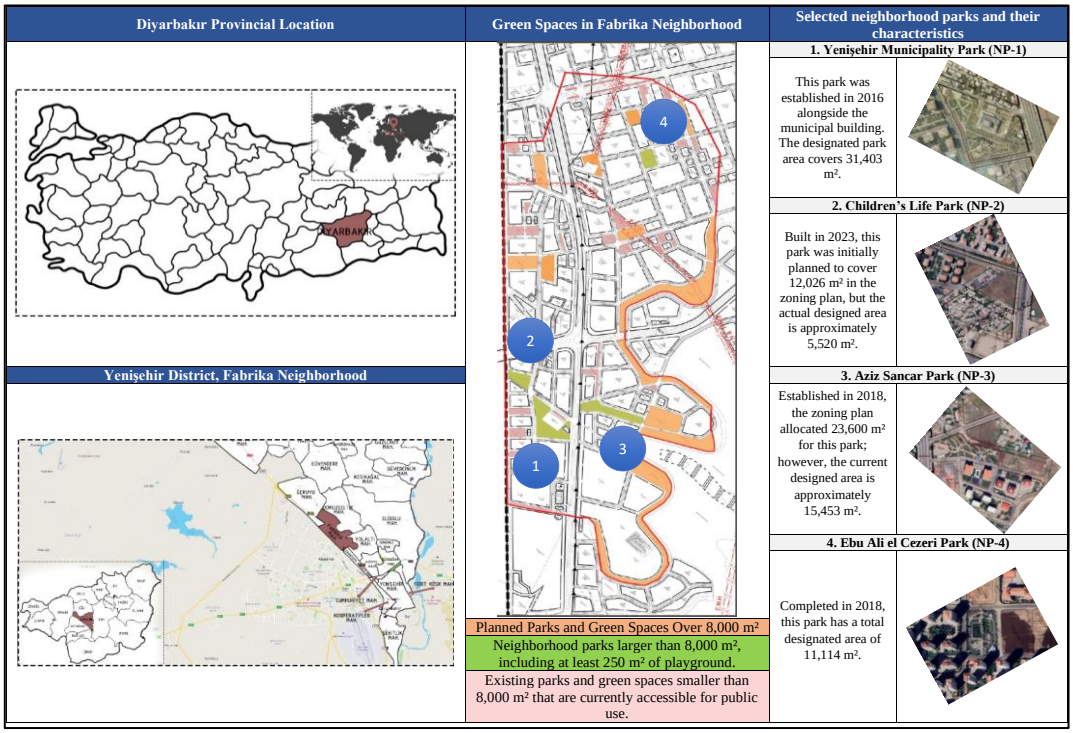

Figure 1. The study area of Diyarbakır, Turkey

The Yenişehir district, home to approximately 215,000 residents, is key in distributing green spaces and public furniture (TÜİK, 2023). Data from the Diyarbakır Yenişehir Municipality indicates that Fabrika Neighborhood contains 39 green spaces, covering 326,797.3 m², equating to 3,267.97 m² of green space per capita. These figures provide a basis for assessing the adequacy of green space distribution in line with urban planning standards. According to Yıldızcı (1982), NPs should have a minimum area of 8,000 m² while Uzun (1990) recommends that a playground within such a park should be at least 250 m². Among the 39 green spaces in Fabrika Neighborhood, 19 meet the minimum area requirement of

8,000 m²; however, only four meet both criteria. Therefore, this study focuses on the observation and analysis of these four parks: Yenişehir Municipality Park (NP-1), Children's Life Park (NP-2), Aziz Sancar Park (NP-3), and Ebu Ali el-Cezeri Park (NP-4) (Figure 1).

2.2 Methods

The research methodology consists of four main stages:

- Identifying the main and sub-criteria for evaluation through a literature review and expert opinions.
- Rating the characteristics of the evaluation criteria.
- Conduct field studies to assess the equipment in NPs and determine their suitability classifications.
- Developing recommendations based on the findings.

2.2.1 Determination of evaluation criteria

The criteria for evaluating the equipment in NPs reflect the park's fundamental structure. The condition of this structure, both in its entirety and components, reveals the park's qualitative and quantitative characteristics. In this context, the criteria for assessing the qualitative and quantitative attributes of NPs and their furniture were derived from national and international scientific studies (Table 1).

Table 1. Criteria used in the literature for evaluating urban furniture in NPs

Previous studies	Aksu (2015)	Appolloni et al. (2019)	Arat (2020)	Bhaskaran et al. (2024)	Douglas et al. (2018)	Echeverria (2019)	Gamito and Silva (2016)	Gamito and Silva (2020)	Gamito and Sousa (2019)	Grabiec et al. (2022)	Özdemir Işık and ark. (2016)	İnak (2017)	Kahvecioğlu ve Sağlık (2023)	Kesik ve ark. (2014)	Külekçi (2018)	Lee (2021)	Marquet et al. (2019)	Mazaherian et al. (2020)	McCabe and Strauss (2022)	Olgun (2013)	Saeedi and Dabbagh (2020)	Sipahi and Sipahi (2024)	Sohn et al. (2015)	Suminski et al. (2015)	Şahin et al. (2019)	Şatıroğlu et al. (2023)	Thamrin et al. (2018)	Tilford Centers (2019)	Ünal and Uslu (2018)	Zhai et al. (2020)
City/Country	Kastomonu, Türkiye	Rome, Italy	Konya, Türkiye	Delhi, Hindistan	Los Angeles, USA	Los Angeles, ABD	Lisbon, Portugal	Porto, Portugal	Lajes, Portugal	Warsaw, Poland	Trabzon, Türkiye	Ankara, Türkiye	Çanakkale, Türkiye	İstanbul, Türkiye	Ankara, Türkiye	New York, USA	Chicago, USA	Isfahan, Iran	NewYork, USA	Antalya, Türkiye	Tehran, Iran	İzmir, Türkiye	Busan, South Korea	Kansas, USA	Türkiye	İstanbul, India	Jakarta, Indonesia	Norfolk, USA	Adana, Türkiye	Beijing, China
Materials	+									+												+				+	+		+	
Ergonomic		+	+				+	+	+	+	+	+	+	+	+													+	+	
Color							+	+	+	+								+			+									
Inclusive design	+	+		+						+	+	+		+		+							+	+				+	+	+
Vandalizm and Security				+	+	+				+						+	+		+	+			+	+	+				+	

This study evaluated six main criteria and eleven sub-criteria determined through field research and expert consultations as outlined in Table 1. Since inclusive design and color did not fall under any specific category, they were added separately increasing the total number of evaluation criteria to thirteen. Given the variation in park furniture design, ergonomics, material selection, color harmony, inclusive design, vandalism resistance, and safety, a comprehensive approach was adopted to identify essential elements. Six distinct amenity groups were defined to ensure that NPs meet user expectations and function as sustainable public spaces. These groups encompass various types of urban furniture and recreational elements crucial for accessibility, comfort, and durability. A detailed ergonomic and functional assessment was conducted on nineteen different pieces of equipment within these groups (Table 2) providing insights into their suitability, deficiencies, and potential improvements for more user-friendly and inclusive public spaces.

Table 2. Evaluation criteria (left side) and furniture (right side)

EVALUATION CRITERIA	
MAIN CRITERIA	**SUB-CRITERIA**
Materials	Material type
	Material properties
	Surface materials
Ergonomic	Compliance with standards
Inclusive design	
Color	
Safety	Maintenance
	Infrastructural stability
	Safe design
Vandalism	Breaking and Shattering
	Cutting, Scratching, and Carving
	Burn
	Graffiti and Paint

FURNITURES	
Urban Furniture	Benches
	Gazebos/Pergolas
	Trash bins
	Lightings
	Information Boards
Water Features	Fountains
	Ornamental pools
Boundary	Walls
	Fences
	Vegetative boundaries
Playgrounds and Sports areas	Playgrounds
	Sports fields
Pathways	Pedestrian paths
	Bicycle lanes
	Vehicle roads/Parking areas
Others	Restrooms
	Security booth
	Sculptures/Art Installations

2.2.2 Rating of evaluation criteria

To evaluate the conditions of the 13 criteria listed in Table 2, each criteria was scored between 0 and 5 to identify the strengths and weaknesses of NPs furniture. Suitable characteristics were determined using sources from Table 1, expert opinions, and Turkish Standards Institution (TSE) guidelines which ensure national standards for product quality and safety (Appendix 1). The criteria were categorized into two groups: scalable and non-scalable. Scalable criteria covering multiple features were rated from 0 to 5. In contrast, non-scalable criteria were evaluated as "present/absent" or "suitable/unsuitable," receiving a score of 0 (absent/unsuitable), 3 (partially suitable), or 5 (present/suitable) depending on the degree of compliance. This method provides an objective and adaptable evaluation framework tailored to local conditions.

2.2.3 Determination of suitability classes

A quantitative and qualitative scoring method was employed to assess parks based on equipment quality, design, color harmony, accessibility, safety, and resistance to vandalism. The suitability percentage for each park was determined by dividing its total score by the maximum possible score. Parks were then categorized into five groups based on this percentage: least suitable (0–20%), less suitable (21–40%), moderately suitable (41–60%), suitable (61–80%), and most suitable (81–100%). This structured evaluation enabled the identification of deficiencies, assessment of overall functionality and safety, and guided improvements for more effective and user-friendly urban green spaces.

3 Results

3.1 Identifying Furniture and Features in Neighborhood Parks

This study assessed the condition of furniture and facilities in NPs located in the Fabrika Neighborhood, Yenişehir District, Diyarbakır. Fieldwork conducted between November and December 2024 evaluated the existing elements and identified deficiencies, detailed in Table 3, regarding materials and colors. The findings revealed several shortcomings: NP3 and NP4 lacked gazebos/pergolas; NP1, NP3, and NP4 were missing informational signs and panels; NP2, NP3, and NP4 had no fountains; NP1, NP2, and NP4 lacked pools. NP4 had no walls, NP1 and NP4 lacked fences, and none of the parks had vegetative boundaries. Sports facilities and bicycle paths were absent in NP2 and NP3, and none of the parks included vehicle roads or parking areas, which limited accessibility. Additionally, there was no toilet in NP1, no security booth in NP4, and no artistic sculptures in NP3 and NP4.

These deficiencies negatively affect comfort, safety, and usability of the parks and these diminish visitor satisfaction. Variations in materials and color choices also affect the visual appeal and functionality of the park. The absence of essential features such as signage, water elements, and recreational infrastructure underscores the need for standardized, inclusive, and comprehensive planning to improve accessibility and user experience in NPs.

Table 3. Material and color properties of furniture

FURNITURES	NPs / Furniture	NP1	NP2	NP3	NP4
MATERIAL TYPES					
URBAN FURNITURE	*Benches*	Metal+Wood	Concrete + Wood	Wood, Metal, Concrete	Concrete + Wood
	Gazebos/Pergolas	Wood	Wood		
	Trash bins	Metal	Metal+Wood	Metal	Metal
	Lighting	Metal+Glass	Metal+Glass	Metal+Glass	Metal+Glass
	Information Boards		Metal+Glass		
WATER FEATURES	*Fountains*	Concrete			
	Ornamental pools			Concrete+Mosaic	
BOUNDARY	*Walls*	Concrete	Concrete	Concrete	
	Fences		Steel	Steel	
	Vegetative boundaries				
PLAYGROUNDS AND SPORTS AREAS	*Playgrounds*	Wood, Rubber Plastic	Wood, Rubber, Plastic	Plastic	Plastic
	Sports fields	Metal+Plastic			Metal+Plastic
PATHWAYS	*Pedestrian paths*	Concrete Bloks Rubber	Concrete Bloks	Concrete Bloks	Concrete Bloks Rubber
	Bicycle lanes	Rubber			Rubber
	Vehicle roads/Parking areas				
OTHER FURNITURE	*Restrooms*		Concrete	Concrete	Prefabricated
	Security booth	Concrete	Concrete	Concrete	
	Sculptures/Art Installations	Metal	Metal		
COLOR CHARACTERISTIC					
URBAN FURNITURE	*Benches*	Black+Brown	Gray+Brown	Brown+ Black/Gray	Gray+Brown
	Gazebos/Pergolas	Brown	Brown		
	Trash bins	Black+Brown	Gray+Brown	Gray+Brown	Gray+Brown
	Lighting	Black Pole+ White LED	Black/Yellow/Blue /Green Pole+ White LED	Black Pole+ White LED	Black Pole+ White LED
	Information Boards			White pano + Gray Pole	
WATER FEATURES	*Fountains*	Dark Gray			
	Ornamental pools			Gray + Blue	
BOUNDARY	*Walls*	Gray	Gray	Gray	
	Fences		Dark green	Dark green	
	Vegetative boundaries				
PLAYGROUNDS AND SPORTS AREAS	*Playgrounds*	Brown, Red, Blue, Yellow	Brown, Red, Blue, Yellow	Red, Blue, Yellow	Red, Blue, Yellow
	Sports fields	Gray+ Yellow+Burgundy			Gray+ Yellow+Burgundy
PATHWAYS	*Pedestrian paths*	Gray+ Burgundy	Gray	Gray	Gray+ Burgundy
	Bicycle lanes	Burgundy			Burgundy
OTHER FURNITURE	*Restrooms*		Gray	Green	Gray
	Security booth	Green	Gray	Green	
	Sculptures/Art Installations	Black+ Blue+Yellow+ Orange	Black+ Blue+Yellow+ Orange		
	There is no equipment to be evaluated in the NPs.				

3.2 Rating the NPs' furniture

Secondly, scores ranging from 0 to 5 were assigned to each criteria to assess the different conditions of the 13 listed criteria in the field. This evaluation, conducted through on-site observations, aimed to determine the positive and negative aspects of the urban furniture in NPs. Initially, the features suitable for urban furniture in NPs were considered based on the characteristics and rating guidelines outlined in Appendix 1. Accordingly, the scores assigned to each urban furniture is presented in Table 4. The key findings identified are as follows:

- **Material:** NP1 and NP2 received the highest scores while NP4 had the lowest regarding material quality and diversity. In NP3, the ornamental pool's glass mosaic coating and the prefabricated toilet in NP4 were deemed partially durable. Rubber-coated pedestrian and bicycle paths and sports areas were ergonomically favorable, whereas NP4's concrete blocks were considered insufficient.
- **Ergonomics:** NP1 received the highest score, whereas NP2, NP3, and NP4 exhibited several shortcomings. These included backs lacking back support, inadequate waste disposal angles in trash bins, the absence of solar-powered lighting, highly reflective information boards in NP3, and poor placement of the fountain in NP1 which obstructed the walking path.
- **Inclusive Design:** NP1 was the most compliant with inclusive design principles while NP4 was the least. Key deficiencies included the absence of wheelchair waiting areas, a lack of tactile surfaces for the visually impaired, and inaccessibility of toilets and security booths.
- **Color:** Urban furniture colors were generally appropriate, but inconsistencies were observed. The white LED lighting in NP3 was suitable, but multicolored lighting poles were only partially suitable. The dark gray fountain in NP1 had a negative impact on the user's perception and comfort.
- **Safety:** Urban furnitures in NP1 and NP2 were moderately well-maintained, NP3 was in good condition while NP4 was neglected. Though the electrical safety infrastructure was adequate, the lack of drainage in NP3 and NP4 was a concern. Some furniture in NP4 was also inadequately secured.
- **Vandalism:** Damages (breakage, graffiti, and unauthorized painting) were observed across parks. NP2 and NP3 showed fewer signs of vandalism because they were newer or recently renovated. In contrast, vandalism was more prevalent in NP1 and NP4.

NP1 and NP2 were the most suitable parks for urban furniture while NP4 was the least suitable. While material suitability was mostly met, deficiencies in ergonomics, Inclusive Design, and safety were noted. Municipalities are advised to renew urban furniture, adopt inclusive design standards, and implement anti-vandalism measures.

3.3 Determination of suitability classes

Finally, the maximum achievable total score for each NPs across all criteria was calculated. The highest possible score was 1270 points, 40 points for ground materials, 95 points for compliance standards, user diversity, and material suitability, and 105 points for other criteria. Based on these calculations, the ergonomic suitability percentages of park furniture and its total scores were assessed to classify their suitability as presented in Table 5.

Table 4. Rating of furniture

			URBAN FURNITURE					WATER		BOUNDARY			PLAY/ SPORTS		PATHWAYS			OTHER			
CRITERIA		NPs ID	Benches	Gazebos/Pergolas	Trash bins	Lightings	Information boards	Fountains	Ornamental pools	Walls	Fences	Vegetative boundaries	Playgrounds	Spor Fields	Pedestrian paths	Bicycle lanes	Parking areas	Restroom	Security booth	Sculptures/Art Installations	TOTAL
Material	Material type	NP1	5	5	5	5		5		5			5	5	5	5			5	5	60
		NP2	5	5	5	5				5	5		5		5			5	5	3	53
		NP3	5		5	5	5		3	5	5		5		5			5	5		53
		NP4	5		5	5							5	5	5	5		3			38
	Material properties	NP1	5	5	5	5		4		3			5	3	4	5			3	4	51
		NP2	4	5	5	5				3	4		5		4			3	3	4	45
		NP3	4		5	5	5		3	3	4		4		3			3	3		42
		NP4	4		5	5							4	4	3	5		4			34
	Surface materials	NP1											5	4	4	5					18
		NP2											5		4						9
		NP3											5		4						9
		NP4											5	5	3	5					18
Ergonomic	Compliance with standards	NP1	5	5	3	3		3		5			5	5	5	5			3		47
		NP2	3	5	3	3				0	0		5		5			3	3		30
		NP3	3		3	3	3			0	0		5		5			3	3		28
		NP4	5		3	3							5	5	5	5		0			31
Inclusive design		NP1	3	3	5	3		3					0	0	3	5			0		25
		NP2	0	5	5	3							0		3			0	0		16
		NP3	0		5	3	5		0				0		3			0	0		16
		NP4	0		5	3							0	0	0	5		0			13
Color		NP1	5	5	5	5		0		5			5	5	5	5			5	3	53
		NP2	5	5	5	3				5	5		5		5			5	5	3	51
		NP3	5		5	5	0		5	5	5		5		5			5	5		50
		NP4	5		5	5							5	5	5	5		5			40
Safety	Maintenance	NP1	3	3	3	3		3		3			3	3	3	3			3	3	36
		NP2	3	3	3	5				5	5		3		3			5	5	5	45
		NP3	5		5	5	3		3	3	5		5		5			5	5		49
		NP4	0		0	0							0	0	0	0		0			0
	Infrastructural stability	NP1	5	5	5	5		5		5			5	5	5	5			5	5	60
		NP2	5	5	5	5				5	5		5		5			5	5	5	55
		NP3	3		3	3	3		3	3	3		3		3			3	3	3	36
		NP4	3		3	3							3	3	3	3		3			24
	Safe design	NP1	5	4	4	5		4		5			5	4	5	5			5	4	55
		NP2	5	4	4	5				5	4		5		5			4	4	5	50
		NP3	5		4	5	3		5	5	4		5		5			4	5		50
		NP4	5		4	5							5	4	5	5		4			37
Vandalism	Breaking and Shattering	NP1	0	0	0	5		0		0			0	5	0	0			5	5	20
		NP2	0	0	0	5				5	5		0		0			5	5	5	30
		NP3	5		5	5	0		0	5	5		5		0			5	5		40
		NP4	0		0	5							0	0	0	0		5			10
	Cutting, Scratching, and Carving	NP1	0	0	0	5		5		0			0	0	5	0			5	5	25
		NP2	5	0	5	5				5	5		0		5			5	5	5	45
		NP3	5		5	5	0		5	0	5		5		5			5	5		45
		NP4	0		5	5							0	5	0	0		5			20
	Burn	NP1	5	5	0	5		0		5			5	5	5	5			5	5	50
		NP2	5	5	5	5				5	5		5		5			5	5	5	55
		NP3	5		5	5	5		5	5	5		5		5			5	5		55
		NP4	5		5	5							0	5	5	5		5			35
	Graffiti and Paint	NP1	0	0	5	5		0		0			5	0	5	5			5	5	35
		NP2	5	0	5	5				5	5		5		5			5	5	5	50
		NP3	5		5	5	5		5	5	5		5		5			5	5		55
		NP4	5		0	5							5	5	5	5		5			35

There is no equipment to be evaluated in the NPs.

The criteria were not considered in the evaluation of the relevant furniture.

Table 5. Determination of suitability classes based on furniture in NPs

Main Criteria	Sub-criteria \ NPs	Yenişehir Municipality Park (NP1)		Child's Life Park (NP2)		Aziz Sancar Park (NP3)		Ebu Ali el Cezeri Park (NP4)	
		∑	%	∑	%	∑	%	∑	%
Materials	Material type	60	57.1	53	50.5	53	50.5	38	36.2
	Material properties	51	48.6	45	42.9	42	40.0	34	32.4
	Surface materials	18	45.0	9	22.5	9	22.5	18	45.0
Ergonomic	Compliance with standards	47	49.5	30	31.6	28	29.5	31	32.6
Inclusive design		14	26.3	16	16.8	16	16.8	13	38.1
Color		57	55.8	51	53.7	50	52.6	40	42.1
Safety	Maintenance	36	34.3	45	42.9	49	46.7	0	0.0
	Infrastructural stability	60	57.1	55	52.4	36	34.3	24	22.9
	Safe design	55	52.4	50	47.6	50	47.6	37	35.2
Vandalism	Breaking and Shattering	20	19.0	30	28.6	40	38.1	10	9.5
	Cutting, Scratching, and Carving	25	23.8	45	42.9	45	42.9	20	19.0
	Burn	50	4.6	55	52.4	55	52.4	35	33.3
	Graffiti and Paint	35	33.3	50	47.6	55	52.4	35	33.3
Suitability score and percentage		**535**	**42.1**	**534**	**42.0**	**528**	**41.6**	**335**	**26.4**
Suitability class		Moderate Suitable		Moderate Suitable		Moderate Suitable		Less Suitable	

- **Material:** NP1 received the highest score (57.1%) while NP4 had the lowest (36.2%). Regarding material properties, NP1 was the most suitable park, whereas NP4 had the lowest rating with a 32.4% suitability score. For surface materials, NP1 and NP4 scored the highest at 45.0% while NP2 and NP3 had a lower suitability percentage of 22.5%.
- **Ergonomics:** NP1 had the highest compliance rate with standards at 49.5% while NP3 and NP4 received lower scores at 29.5% and 32.6%, respectively. In terms of user diversity, NP1 scored highest at 26.3%, whereas NP4 recorded the lowest score at 38.1%.
- **User Diversity:** NP1 had the highest suitability rate at 26.3% while NP4 had the lowest at 38.1%. NP2 and NP3 both scored 16.8%. These findings suggest NPs do not fully adhere to inclusive design principles and demonstrate shortcomings in supporting user diversity.
- **Color:** NP1 had the highest suitability level (55.8%) while NP4 had the lowest (42.1%). This suggests that color coordination varied across the parks.
- **Safety:** Regarding maintenance, NP3 had the highest compliance level (46.7%), whereas NP4 scored the lowest (0%). For secure anchoring and infrastructure, NP1 scored the highest (57.1%) while NP4 had the lowest (22.9%). In terms of appropriate design, NP1 (52.4%) and NP2 (47.6%) scored the highest while NP4 scored the lowest (35.2%).
- **Vandalism:** NP3 was the most affected park by breakage and destruction (38.1%) while NP4 had the lowest impact (9.5%). NP2 and NP3 (42.9%) were the most affected by cutting, scratching, and graffiti, whereas NP4 had the lowest score (19.0%). Fire-related vandalism was more common in NP2 and NP3 (52.4%) and less in NP4 (33.3%). Paint-related vandalism was most frequent in NP3 (52.4%) while NP1 and NP4 had lower rates (33.3%).

Considering the overall suitability scores and percentages, NP1 (42.1%), NP2 (42.0%), and NP3 (41.6%) were classified as moderately suitable. NP4 was categorized as less suitable with a suitability rate of 26.4%. Based on these evaluations, NP1 and NP2 were identified as the most appropriate parks in terms of furniture while NP4 required improvements and furniture enhancements. Addressing ergonomics, safety, and user diversity deficiencies is crucial for making NPs more functional and user-friendly.

4 Discussion and Conclusion

This study evaluated the NPs in the Fabrika Neighborhood of Yenişehir District, Diyarbakır, Türkiye, in terms of urban furniture criteria: material quality, ergonomics, user diversity, color coordination, safety, and resistance to vandalism. The findings revealed a generally moderate level of suitability across the parks, but also identified several critical deficiencies requiring attention.

- Material: Durability, sustainability, and safety are essential for effective park design (Sipahi and Sipahi, 2024; Grabiec et al., 2022). Concrete, though common, poses environmental concerns due to its non-recyclable nature, highlighting a shift toward more eco-friendly alternatives. Preferred materials such as wood, recyclable metals, and composites offer improved longevity and ecological performance (Aksu, 2015). For water features, epoxy-based waterproof coatings and specialized ceramics are recommended over fragile glass mosaics. Playgrounds should prioritize sustainable and safe materials for children (Bhaskaran et al., 2024) replacing plastic elements with wood or recyclable composites. Similarly, toilets should integrate natural materials such as wood, stone-textured panels, and green roofs for aesthetic harmony. Balancing cost, user safety, and sustainability ensures eco-friendly, functional, and visually cohesive park environments.
- Ergonomic: Ensuring that park furniture aligns with ergonomic principles enhances user-friendliness and accessibility (Appolloni et al., 2020; Gamito and Sousa, 2019). Benches should include backrests and armrests to improve comfort while their strategic arrangement and designated waiting areas for individuals with disabilities enhance accessibility. Trash bins should feature a 45–60° inclined opening for easier use and be positioned in high-traffic areas. Information boards must be made from non-reflective materials to improve readability under sunlight while including park maps, emergency contacts, and directional signs will enhance the user experience. Drinking fountains should be easily accessible and unobstructive to pedestrian pathways. Additionally, they should meet height standards suitable for individuals with disabilities and children. These improvements will encourage park usage, promote inclusivity, and enhance overall functionality, ensuring that parks cater to the diverse needs of all visitors.
- Accessibility and user diversity: Ensuring accessibility for individuals of all ages and abilities is fundamental to inclusive park design (Kesik et al., 2014; Lee, 2021). Assessments of NPs have identified several shortcomings in providing equal access for individuals with disabilities. Therefore, key modifications must be implemented to enhance accessibility. Benches and gazebos should be systematically arranged to ensure equitable park use, and designated waiting areas for wheelchair users should be established. Additionally, integrating tactile paving on pedestrian pathways will enable visually impaired individuals to navigate the park more comfortably. Restroom facilities often fail to meet accessibility standards as their dimensions are inadequate. Restrooms should be expanded to a minimum size of 2.25 x 2.25 meters to comply with accessibility regulations. These improvements will promote inclusivity and ensure that all users can enjoy public parks safely and comfortably.

- Safety and Vandalism: Maintenance conditions revealed that NP1 and NP2 were partially maintained while NP3 and NP4 exhibited maintenance deficiencies. Addressing these issues is crucial for ensuring the longevity of parks and enhancing user comfort (Douglas et al., 2018). Vandalism remains one of the most significant challenges faced by NPs. Studies indicate that the most common forms of vandalism in park areas are destruction and graffiti (Marquet et al., 2019). These issues negatively impact the aesthetic value and usability of parks. Awareness campaigns should be organized to mitigate vandalism, and damaged furniture should be promptly repaired (Echeverría et al., 2014). Additionally, park lighting should be optimized to improve nighttime security, and durable, vandal-resistant materials must be used. Maintenance deficiencies in NP3 and NP4 should be resolved through regular upkeep efforts.
- Emergency Response Capabilities: The lack of vehicle access roads in national parks significantly impedes emergency response efforts. Situations requiring urgent medical or security interventions are at substantial risk due to the absence of designated access routes at park entrances (Sohn et al., 2015). Therefore, park designs must incorporate pathways that enable emergency vehicles to enter efficiently.
- Designing parks with a sustainable and user-friendly approach is essential for enhancing urban quality of life. Municipalities should address the identified deficiencies by upgrading urban furniture, ensuring equitable distribution, and applying universal design principles. These improvements will foster the development of more functional, accessible, and welcoming NPs. Moreover, this study underlines the importance of integrating quantitative and qualitative data in future research. While this study primarily focused on quantitative analysis, incorporating qualitative insights will provide more comprehensive guidance for urban planners and policymakers. This integration will support the development of resilient, user-friendly, and sustainable green spaces that meet the evolving needs of urban populations.

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Authors' contribution
Kübra Aktaş Akın: Conceptualization (development of the research idea and objectives), Methodology design, Investigation. **Müge Ünal:** Conceptualization, Data analysis, Data curation, Resources, Supervision, Validation, Visualization, Draft preparation, Writing – the original draft, Reviewing and editing.

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Appendix 1. The characteristics of the evolution criteria and rating scores

	THE CHARACTERISTICS OF EVALUATION CRITERIA	SCORE
MATERIALS	**MATERIAL TYPE:** The material type was examined on-site and evaluated based on its suitability for the intended use, with scoring assigned according to the presence of appropriate materials. • **Benches and Gazebos:** While wood and natural stone are preferred as primary materials, combinations of concrete and metal can also be incorporated into the design. • **Trash Bins:** Metal, wood, fiberglass, and cast concrete • **Lighting:** Stainless steel, aluminum, wood, and cast iron • **Signage:** UV-resistant metal, wood, and plexiglass are preferred materials. • **Fountains:** Stainless steel, cast stone, natural stone, and concrete • **Pools:** Natural stone, marble, stainless steel, fiberglass, and concrete. Stone or metal mosaic can be added. • **Walls and Fences:** Recommended materials include natural stone, concrete, brick, metal (such as wrought iron), and wood. Innovative materials like polymer-coated metal or bamboo can also be used for fencing. • **Playgrounds and Equipment:** Wood, plastic, metal, rubber coatings, and soft flooring materials such as rubber tiles or artificial turf • **Sports Areas:** Suitable flooring materials include Rubber, acrylic coatings, and concrete. Durable stainless steel and PVC coatings are recommended for sports equipment. • **Pedestrian and Bicycle Paths:** Concrete, asphalt, interlocking paving stones, and eco-friendly permeable coatings are suitable. Bicycle paths should have non-slip surfaces to ensure safety. • **Vehicle Roads:** Asphalt, concrete, or interlocking paving stones • **Restrooms:** Stainless steel, fiberglass, and concrete are recommended materials, with ceramic coatings for interior surfaces • **Sculptures:** Marble, stone, bronze, stainless steel, wood, and, for modern designs, fiberglass and polymer materials with UV-resistant coatings for outdoor durability.	Not suitable: 0 Partially suitable: 3 Suitable: 5
	MATERIAL PROPERTIES: Material properties are crucial in ensuring a design's functionality, safety, and aesthetics. The selection of appropriate materials was based on the following key criteria: • **Durability and Longevity:** The material should resist wear, breakage, and environmental conditions (e.g., rain, snow, and sunlight). • **Ease of Cleaning:** Maintenance and cleaning should be straightforward, particularly in public spaces where hygiene is essential. • **Temperature and Climate Resistance:** The material must withstand sudden temperature changes and diverse climatic conditions (e.g., preventing wood decay or metal corrosion). • **Natural and Aesthetic Compatibility:** The material should harmonize with the surrounding environment and provide a natural appearance (e.g., wood and stone). • **Eco-Friendly and Recyclable:** Environmentally sustainable and recyclable materials should be prioritized to minimize environmental impact.	Not suitable: 0 1 feature present: 1 2 features present: 2 3 features present: 3 4 features present: 4 5 or more features present: 5
	SURFACE MATERIALS: The assessment of this criteria was based on the suitability of the following material properties: 1. **Pedestrian-Friendly Surfaces:** The surface should not hinder pedestrian movement, avoiding excessive roughness, depressions, or bumps. 2. **Appropriate Joint Spacing and Width:** Ensuring pedestrian safety and comfort through proper joint placement. 3. **Surface Reflectivity:** Consider the albedo value to enhance energy efficiency and user comfort. 4. **Non-Slip Properties in Wet Conditions:** Surfaces should not become slippery during rainfall. 5. **Sufficient Road Infrastructure:** Durable sublayers, such as compacted soil, stabilized fill, or blocking layers, should support surface materials. This evaluation was applied to the **ground materials used in playgrounds, sports fields, recreational areas, and pathways**, ensuring functionality, safety, and durability.	Not suitable: 0 1 feature present: 1 2 features present: 2 3 features present: 3 4 features present: 4 5 or more features present: 5
INCLUSIVE DESIGN	**INCLUSIVE DESIGN:** Inclusive Design was assessed based on the following criteria: • Sensory Accessibility: Structural and vegetative designs should integrate color, texture, scent, and sound stimuli to enhance perception, especially for individuals with disabilities. • Placement of Elements: Lighting, signs, hanging plants, and trees should be positioned within a 75-120 cm strip, while tree branches should begin at least 220 cm to prevent obstructions. • Seating Areas: Benches should be placed at 100-200 m intervals for accessibility. The seating height should be 45 cm, with a 70 cm backrest, and wheelchair spaces should be allocated next to seating areas. • Trash Bins: Positioned at least 40 cm from the curb, installed at a 90-120 cm height, and made of non-hazardous materials to prevent injuries. • Rest Area Tables: Table height should be 75-90 cm, with a 60 cm minimum clearance underneath for wheelchair access. • Fountains: Installed at a height of 85 cm for wheelchair accessibility. • Tree Planting & Vegetation: Trees should be planted within a 75-120 cm strip. Vegetation near ramps and staircases should not shed fruit or create slippery surfaces. • Pedestrian Walkways should have a minimum width of 1.5 meters. • Restrooms (WC): Must be at least 2.25 x 2.25 meters for accessibility.	Not suitable: 0 Partially suitable: 3 Suitable: 5
VANDALISM	**VANDALISM:** Vandalism, defined as the intentional damage to an object valued by individuals or the public, through breaking, destroying, cutting, burning, or defacing with paint, leads to a decline in the visual quality of the area. It also threatens users' physical and psychological well-being (Şahin et al,, 2019; Kara et al., 2024). The types of vandalism in equipment elements will be identified and evaluated in the study area through a scoring system.	Present: 0 Absent: 5

	THE CHARACTERISTICS OF EVALUATION CRITERIA	SCORE
ERGONOMIC	**COMPLIANCE WITH STANDARDS:** Public furniture and structures were assessed based on ergonomic characteristics and relevant standards from the literature. • **Benches:** a) Seat height/depth: 40-45 cm / 45-50 cm; b) Backrest: 45-50 cm height; 10-15° tilt; c) Armrest Dimensions: Width: 5-7 cm, Height: 20-25 cm; d) Weight capacity: Minimum 250 kg; e) Seat inclination: 3-5° • **Trash Bins:** a) Height: 90-110 cm; b) Opening/closing mechanism: Pedal-operated or manual for easy use; c) Capacity: 30-50 liters (individual use); 60-100 liters (public use); d) Stability: Securely fixed to the ground; e) Waste disposal angle: 45-60° • **Lighting:** a) Height: 3-5 m (for pedestrians), 8-12 m (for roadways); b) Suitability for nighttime use; c) Glare and reflection prevention; d) Energy efficiency: LED or solar-powered systems • **Signage and Information Panels:** a) Height: 1.2-1.5 m (for pedestrians); b) Visual accessibility & readability; c) Illumination for night visibility • **Drinking Fountains:** a) Height: 85-95 cm (75 cm for accessible areas); b) Minimum open space around unit: 1.5 x 1.5 m • **Boundary Elements:** a) Height: 50-70 cm (low barriers), 100-120 cm (high barriers); b) Metal fence spacing: 10-12 cm between bars • **Playgrounds:** a) Age-appropriate equipment selection: Proper slide slope, width, step spacing, swing height, chain length, seat width, seesaw length, and height; b) Diversity of play equipment: At least three different elements for varying age groups; c) Suitable vegetation for shade and aesthetics; d) Safe and controlled location • **Pathways & Pedestrian Areas:** a) Pedestrian traffic density: >6 m² per person (very spacious), 6-4 m² per person (comfortable), 4-2.5 m² per person (moderate), 2.5-1.5 m² per person (crowded), <0.75 m² per person (overcrowded); b) Physical accessibility: Sidewalks and ramps must meet accessibility standards (maximum 8% slope**)** (Unal and Uslu, 2018) • **Sports Areas:** a) Orientation: North-South alignment for optimal sun exposure control **Other furniture** must be of adequate quantity and quality within the designated space.	Not suitable: 0 Partially suitable: 3 Suitable: 5
COLOR	**COLOR:** It is a crucial element in industrial product design, strengthening the connection between the product and the user while enhancing functionality and aesthetics. Although often seen as secondary to form, color completes the design and directly impacts usability, durability, and visual harmony. Appropriate colors for different urban furniture elements ensure a cohesive, attractive, and functional environment. • **Benches and Gazebos:** For wood and natural stone elements, use neutral, natural tones such as light brown, walnut, and gray stone. Pastel or matte shades like dark green, anthracite, and beige create visual cohesion for concrete and metal combinations. • **Trash Bins:** Metal bins should be black, dark green, or gray to complement natural materials, while fiberglass bins should use bright, durable colors like blue or green for visibility. • **Lighting Elements:** Lamp posts should be finished in black, anthracite gray, or dark bronze for a classic and resilient appearance. Warm white or natural LED lighting minimizes eye strain and improves comfort. • **Drinking Fountains and Pools:** Stone or ceramic finishes in white, light blue, or beige convey cleanliness and freshness, while metal components should use stainless steel gray or matte black. • **Walls and Fences:** Natural stone tones like beige and gray should be preserved for stone walls, and metal fences should be finished in matte black or dark gray to ensure durability and aesthetic balance. • **Pedestrian paths** should feature light gray or beige for better heat reflection and aesthetic integration. • **Bicycle Paths:** should use red or green for increased visibility and safety. • **Vehicle Roads:** Traditional dark gray asphalt or light-colored concrete • **Restrooms:** Exterior colors like light gray, white, or dark green are easy to clean and maintain. • **Sculptures:** Natural materials such as bronze or marble should retain their original color. Modern concrete sculptures with metallic tones (gray, black) or contrasting colors may stand out. • **Children's Play Equipment:** Wooden structures should maintain natural wood tones, while plastic elements should feature bright, engaging colors like red, blue, green, and yellow. Ground surfaces should use soft natural tones like green, beige, or light gray for comfort. • **Sports Fields:** Court flooring should contrast with white boundary lines to improve visibility, such as red flooring with white lines for safety and clarity.	Not suitable: 0 Partially suitable: 3 Suitable: 5
SAFETY	**MAINTENANCE:** The equipment elements were scored based on their maintenance condition	Neglected: 0 Partially: 3 Well-maintained: 5
	INFRASTRUCTURAL STABILITY: Equipment should have appropriate anchoring and infrastructure features. To prevent displacement or tipping, furniture and flooring materials must be tamper-resistant and stable. The electrical connections of lighting elements are a critical safety consideration. Additionally, proper drainage must be ensured for water-related installations and throughout the entire equipment area.	Not suitable: 0 points Partially suitable: 3 points Suitable: 5 points
	SAFE DESIGN: The evaluation of this criteria considers the presence of the following features: 1. **Appropriate Spatial Features** 2. **Prevention of Sharp Edges:** All elements must be free of sharp edges to ensure safety. Rounded edges should be used, especially in children's play equipment. 3. **Non-Slip Surfaces:** Non-slip surfaces are essential for pedestrian paths, bicycle lanes, and sports fields 4. **Weather Resistance:** Materials should be durable against rain, wind, and temperature fluctuations. 5. **Ease of Maintenance and Cleaning:** All elements should be made of materials that are easy to clean and require minimal maintenance. 6. **Accessible Design for Individuals with Disabilities:** Restrooms, pedestrian paths, and signage should be accessible to everyone.	Not suitable: 0 1 feature present: 1 2 features present: 2 3 features present: 3 4 features present: 4 5 or more features present: 5