

The role of natural elements of interior playgrounds in promoting children's social interactions (case study: Tehran book garden)

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ABSTRACT

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In today's digital age, the rise of the internet and social media has significantly altered how children interact with one another. Many children now spend a considerable portion of their time in virtual environments, rather than engaging in face-to-face play in physical playgrounds. This shift has led to a decline in opportunities for real-life social interactions—experiences that are vital for developing essential social and emotional skills. Research shows that playing and participating in group activities are key ways through which children learn cooperation, empathy, and communication. Given this concern, it is increasingly important to encourage physical play by designing playgrounds that actively draw children in. Among the various factors that make a space appealing, visual attractiveness stands out as one of the most influential. Natural elements—such as sunlight, greenery, and water—have long been recognized for their ability to enhance the visual and emotional quality of a space. This leads to the central question of this study: *Can the presence of natural elements in playgrounds improve social interactions among children?* To explore this, we reviewed existing literature on children's temperaments and spatial features that influence peer interaction. Based on these findings, we developed a close-ended questionnaire aimed at assessing the relationship between natural elements and social engagement. The results revealed a positive correlation between the presence of natural features and increased social interaction. Specifically, elements such as sunlight, green space, water, rooftop gardens, and open space were identified as key contributors to fostering social connections among children. These findings suggest that integrating natural elements into playground design can play a significant role in promoting healthier, more interactive environments for children.

1.Introduction

Social interaction plays a vital role in children's overall growth and development—both educationally and socially. Without opportunities for meaningful interaction, it becomes difficult to nurture children's creativity, learning abilities, and sense of belonging. This quantitative study

explores how natural elements within indoor playgrounds influence children's peer interactions and their willingness to engage in group activities.

The research focused on a range of natural features—including water, green space, natural light, rooftop gardens, and open indoor areas such as central courtyards or lobby atriums—and evaluated their impact on children's behavior. Observations conducted in kindergartens and indoor playgrounds revealed a clear trend: children were more likely to engage in collaborative play in areas that incorporated natural elements. For example, they often gravitated toward artificial grass zones for group activities over other indoor spaces.

These observations led to the central research question: *What are the effects of different natural elements on children's social interactions in indoor environments?* To address this, we examined various environmental variables—including light, color, spatial layout, greenery, visual quality, and visibility—drawing on key studies in environmental psychology and design (e.g., Moore, 2008; Mashburn, 2008; Ittelson, 1974; Jacobs & Appleyard, 1987; Whyte, 1980; Brown & Burger, 1984; Gehl, 2004).

A structured questionnaire was developed and distributed to parents and teachers—individuals who closely observe children's day-to-day social behavior. Their insights helped assess changes in children's group participation, peer communication, sense of freedom, and social connectedness in environments with and without natural elements. The data collected offered valuable evidence of the positive influence that nature-based design features can have on fostering social interaction in indoor play settings.

2.Literature review

Communication is a fundamental human behavior that enables the exchange of information, even when the content may not always be significant (Yildiz, 2019). The ways in which individuals communicate vary across age groups and form the foundation for social interaction. For children, play and group activities serve as the primary modes of communication. Play is not only central to children's social behavior but also represents one of the most natural and effective ways for them to learn (Acar, 2014). As Sutton-Smith (2001) points out, play is a joyful and essential part of childhood. When children play in open spaces rich with natural elements and unexpected features, they tend to explore, set shared goals, and engage in collective experiences that enhance companionship and mutual learning (Bento & Gisela, 2017). These nature-based play environments serve as meaningful contexts that support children's cognitive, physical, emotional, and social development (Bento & Gisela, 2017; Barton et al., 2014).

Access to natural elements such as sunlight and fresh air has also been linked to improved immune function and increased physical activity among children (Dyment & Bell, 2008). Many studies have emphasized the role of key playground features—particularly water, grassy areas, and mud—in encouraging active play and social interaction. Yet, these elements are often overlooked in conventional playground design. Research shows that spaces incorporating natural features promote more social engagement and imaginative play (Herrington & Studtmann, 1998), and that children display more playful behaviors and better performance in grassy or green environments (Berg & Madrich, 1980; Taylor et al., 2001). Enhancing green space in playgrounds is therefore

critical for giving children direct experiences with nature, especially in urban areas where such experiences are limited (Sudo et al., 2021).

A lack of natural elements in children's environments can lead to both physical and mental health challenges, as well as limit opportunities for interactive peer relationships. For instance, replacing asphalt with natural materials like grass and trees in schoolyards has been shown to increase children's physical activity and participation in group play during recess (Raney et al., 2019). Large, open green spaces offer unique opportunities for physical activity—opportunities that cannot be replicated by the technological amenities of modern urban life (Bird, 2007).

Children interact with nature in three primary ways: direct (hands-on, unstructured), indirect (structured but physical), and symbolic (no physical contact) (Kellert, 2002). Among these, direct engagement—where children can touch, see, and hear the natural world—offers the richest opportunities for learning and development (Acar, 2014). This type of engagement fosters cooperative and imaginative play (Chawla, 2015). Hart's interviews with children in the 1970s further highlight their natural inclination toward environments like rivers, hills, bushes, and lawns—places where they can hide, explore, and observe (Hart, 1979). Such spaces allow for both solitary reflection and active discovery, key components in children's developmental journeys.

Incorporating nature-based interventions alongside traditional playground structures has been shown to benefit children of varying abilities, encouraging inclusivity and physical engagement (Barton et al., 2014). For example, activities like building sand structures exemplify the creative and sensory-rich experiences enabled by natural settings (Sandseter et al., 2022). Ideally, a playground should not only be visually compelling but also offer progressive challenges and a flexible layout. Functional and visual zoning is also essential for guiding children's exploration and interaction (Czalczyńska, 2014).

Despite these benefits, large outdoor playgrounds are often unavailable in densely built urban areas due to limited land. As a result, many kindergartens rely on indoor play spaces, which frequently lack natural features such as grass or vegetation. Research has shown that the spatial characteristics of these indoor environments—including volume, color, and layout—can significantly affect children's behavior (Abbas, 2010). Thoughtful spatial arrangement, such as well-designed classroom furnishings or playroom layouts, has been associated with improved social and cooperative behaviors (Moore et al., 2008).

Colin Ward (1978) famously proposed that the entire city should be considered a potential playground. In this spirit, the design of play spaces—whether outdoor or indoor—has a profound influence on children's capacity for social interaction and self-expression (Ward, 1978; Stankovic & Stojic, 2007). Unlike traditional playgrounds with fixed equipment, adventure playgrounds offer children opportunities to construct their own environments using natural and found materials like water, mud, sticks, or old tires (Stanton-Chapman et al., 2018). These flexible, nature-based environments empower children to shape their own play experiences.

However, few studies have examined the impact of natural elements on children's social behaviors specifically within indoor settings. In high-density urban areas where outdoor space is scarce, many children are deprived of green environments and the developmental benefits they offer. This

lack can hinder social engagement, limit opportunities for group activities, and restrict children's ability to fully explore their potential (Nilsen, 2021). If similar opportunities can be created within buildings—through the inclusion of natural features like sunlight, greenery, water, and rooftop gardens—it may be possible to achieve comparable developmental benefits for children who lack access to outdoor playgrounds. This study investigates the effects of incorporating such natural elements into indoor playgrounds on children's social interactions, offering insight into how indoor environments can be reimagined to support healthy childhood development.

3.method and material

3-1. The context and participant

This quantitative study aimed to investigate the influence of natural elements on children's social interactions within indoor playgrounds, specifically in culturally contextualized settings. The research was grounded in a comprehensive review of authoritative sources, including academic texts, published documents, and credible online references, adopting an argumentative and evidence-based approach. The study was conducted in the Children and Adolescents' Section of the Tehran Book Garden, with the target population comprising parents and educators of children aged 3 to 7—individuals who spend the most time observing and engaging with the children.

A correlational research method was employed, supported by a close-ended questionnaire, as well as comparative and interpretive analyses of key spatial and behavioral components. Regular field observations within the Tehran Book Garden complemented the data collection process. To determine the appropriate sample size, the Morgan sampling table was used, resulting in the distribution and collection of 158 completed questionnaires from parents and teachers.

To ensure the accuracy and reliability of data interpretation, SPSS statistical software was used during the data extraction, cleaning, and analysis phases. To assess the reliability of the questionnaire, a pilot study was conducted with 50 visitors of the Children and Adolescents' Section. The resulting Cronbach's alpha coefficient was 0.87, indicating a high level of internal consistency and validating the reliability of the research instrument.

Table1-frequency and percentage of frequency of subjects according to visiting Tehran Book Garden

Statistical indicators of age	Frequency	Percentage of frequency
Regular visitors	65	40.88%
Periodic visitors	94	59.12%
Total	158	100%

Table2-frequency and percentage of frequency of subjects according to number of visiting Tehran Book Garden in a month

Statistical indicators of marital status	Frequency	Percentage of frequency
Once a month	49	30.82%
Twice or three times a month	36	22.64%
Three to five times a month	59	37.11%
More than five times a month	15	9.43%
Total	158	100%

3-2. Important factors on children's social interactions

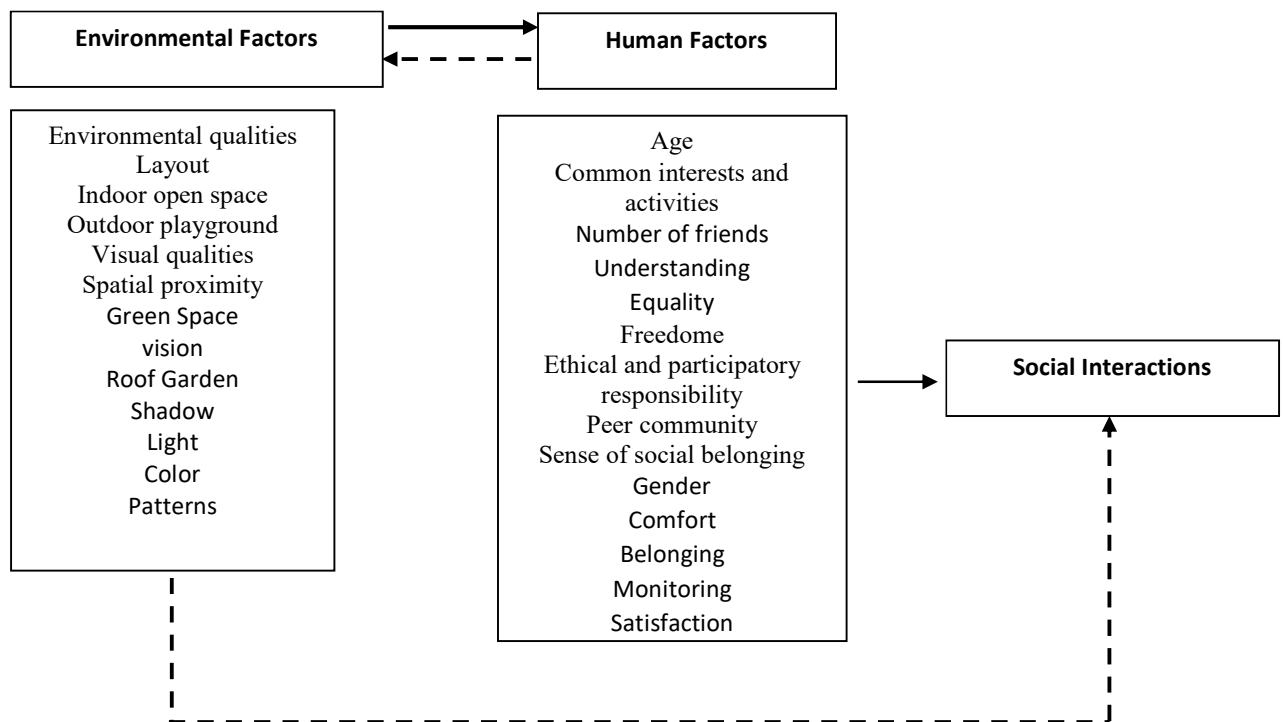
Children between the ages of 3 and 7 develop crucial communication and social skills through group activities and physical play, both of which significantly influence their overall learning process. As such, it is essential to identify and consider the key factors that affect their social interactions within play environments. Table 3 presents the most critical components influencing children's social engagement in playground settings. These factors were identified through an extensive review of authoritative academic sources, direct observation of children's behavior in playgrounds, and interviews conducted with children, their parents, and their educators at the Tehran Book Garden.

Table 3- The most important factors on children's social interaction

factors affecting children's social interactions				References
1	Equality	16	Environmental qualities	Moore (2008)
2	Freedom	17	Indoor open space	Mashburn (2008)
3	Ethical and participatory responsibility	18	Visual qualities	Ittelson (1974)
4	Peer community	19	Roof Garden	Jacobs
5	Age	20	Layout	&Appleyard
6	Sense of social belonging	21	Outdoor playground	(1987)
7	Gender	22	Spatial proximity	Whyte (1980)
8	Norms	23	Green Space	Brown and
9	Comfort	24	Visibility	Burger (1984)
10	Patterns	25	Shadow	Gehl (2004)
11	Sense of belonging	26	Light	
12	Memorable	27	vision	
13	Monitoring	28	color	
14	satisfaction	29	Common interests and activities	
15	Understanding	30	Number of friends	

After identifying and collecting Influential components that affect children's behavior and interactions, we classified these components into 2 main groups as the table 4:

Table4- classifying important factors that influence children's social interactions



As shown in the table above, the key factors influencing children's social interactions were categorized into two main groups: human factors and environmental factors. To specifically assess the role of natural elements in enhancing social interaction from a physical and spatial perspective, the study drew upon existing literature and applied statistical analysis. Within the broad spectrum of qualitative components, visual appeal was identified as a central focus. By selecting visual attractiveness as a key evaluative criterion and isolating its most influential variables, the study examined the extent to which each of these variables impacted the level of social interaction among children in indoor playgrounds.

Table 5- natural elements and their impact on promoting children's social interactions

Dimension	Component	Measures
Physical	Natural elements	The presence of light in indoor playground
		The presence of open space in indoor playground
		The presence of fountain in indoor playground
		The presence of green space in indoor playground
		The presence of accessible roof garden in indoor playground

It appears that natural elements, functioning as independent variables, influence children's social interactions by stimulating emotional responses and enhancing their motivation to engage in play. Based on this hypothesis, the questionnaire was designed to examine and validate this relationship. Table 5 presents the correlation between the identified independent variables (natural elements) and the dependent variable (children's social interactions), illustrating their potential role in fostering social engagement within indoor play environments.

Table6- relationship between independent and dependent variables to promote children's social interactions

Architecture		Psychology		Final aim
Independent Variables	Interfering Factors	Effective Mediator Variable	The Dependent Variable	
1 The presence of light in indoor playground	Stimulate emotions	Increased desire to play	Promoting children's social interactions	
2 The presence of open space in indoor playground				
3 The presence of fountain in indoor playground				
4 The presence of green space in indoor playground				
5 The presence of accessible roof garden in indoor playground				

3-3. findings

After statistical analysis, the results were reported in the following order:

Table 7- Calculate Pearson correlation coefficient

Variable	1	2
Promoting social interactions	1	
Natural elements	0.587**	1

* $P < 0.05$ ** $P < 0.01$ *** $P < 0.001$

According to the results derived from the correlation matrix (Table 7), the correlation coefficient calculated at the significance level of $p < 0.001$ is statistically significant. This finding indicates a meaningful relationship between the presence of natural elements and the enhancement of social interactions in the design of children's indoor playgrounds. The strength of this relationship, represented by a correlation coefficient of 0.587, suggests a moderate to strong positive correlation. As a result, Hypothesis H_1 is supported, and the null hypothesis (H_0) is rejected.

Table 8- Results of analysis of variance

	Total squares	df	Average square	F	sig	R	Justified R^2
Regression	12507.88	5	2501.57 135.67			0.613	0.356

residual	20758.26	153					
Total	33266.15	158		18.43	0.001		

Prediction: (fixed value); Components of natural elements

Criterion: Promotion of social interactions

As shown in Table 8, the value of R was calculated as 0.613, with an adjusted R² of 0.356. The results of the regression analysis, $F(5, 153) = 18.43$, with $p < 0.001$, indicate a statistically significant relationship between natural elements and the promotion of social interactions in children's indoor playgrounds. In other words, 35.6% of the variance in the enhancement of social interactions within the design of children's book gardens can be attributed to changes in the natural element components incorporated into the space.

Table 9- Differential contribution of predictor variables

components	Not standardized coefficients		Standardized coefficients		
	B	standard error	Beta	t	sig
Constant	72.324	7.268	-	9.951	0.001
The presence of light in indoor playgrounds	4.578	1.180	0.260	3.878	0.001
The presence of fountain in indoor playgrounds	0.994	1.059	0.070	0.938	0.350
The presence of green space in indoor playgrounds	1.934	1.244	0.127	1.554	0.122
The presence of accessible roof garden from indoor playgrounds	5.238	1.618	0.277	3.236	0.001
The presence of open space in in indoor playgrounds	4.091	1.442	0.207	2.837	0.005

Based on the findings presented in Table 9, several natural components were identified as having varying degrees of influence on the dependent variable—promoting social interactions in indoor playgrounds. The components with the highest standardized coefficients were: accessible rooftop gardens connected to indoor playgrounds ($\beta = 0.277$), presence of natural light ($\beta = 0.260$), availability of open spaces within the playground ($\beta = 0.207$), presence of green space ($\beta = 0.127$), and presence of a fountain ($\beta = 0.070$). These results indicate that rooftop gardens and natural lighting have the most substantial impact on enhancing social interactions among children.

Based on the regression analysis, the following predictive equation was developed to estimate the level of social interaction promoted in indoor playgrounds:

Promoting Social Interactions in Indoor Playgrounds =

$$72.324 + (4.091 \times \text{Presence of Open Space}) + (5.238 \times \text{Accessible Rooftop Garden}) + (1.934 \times \text{Green Space}) + (0.994 \times \text{Fountain}) + (4.578 \times \text{Natural Light})$$

This equation reflects the relative contribution of each natural element to the overall enhancement of children's social engagement within indoor playground environments.

4.Conclusion:

The way children interact with a space reflects how its physical and functional characteristics influence their behavior and development. By understanding children's qualities and the extent of their engagement with the environment, valuable insights can be gained into how spatial design affects their experiences. Among the various factors influencing environmental appeal, visual attractiveness is one of the most immediate and compelling, particularly for children. In this study, natural elements—recognized as key components of visual appeal—were examined to assess their impact on children's social interactions.

The findings demonstrate a statistically significant correlation between the presence of natural elements and the promotion of social interactions, with a correlation coefficient of 0.587, indicating a direct and meaningful relationship. These results underscore the importance of integrating natural elements into the design of children's environments—especially indoor playgrounds, where children frequently spend their leisure time and engage in peer play.

Among the variables analyzed, accessible rooftop gardens and the presence of natural light emerged as the most influential components. Rooftop gardens not only offer a unique spatial experience by allowing users to access elevated outdoor areas but also provide exposure to greenery and panoramic views of the surroundings—evoking a sense of being in nature. Similarly, the integration of natural light through architectural features such as curtain walls can enhance both visibility and transparency, creating a more inviting and engaging indoor environment for children.

Following these, the presence of open spaces within indoor playgrounds and the inclusion of green areas—such as central courtyards—also showed notable effects. In dense urban contexts where access to outdoor playgrounds is limited, these indoor open spaces offer children a valuable opportunity to experience nature within built environments. Central courtyards designed with vegetation and floral elements can help simulate natural settings and foster a sense of openness and freedom.

Although the presence of water features showed the least direct influence on social interactions, it still contributes positively to the overall environmental quality. Water elements can be

incorporated through proximity to natural bodies such as lakes or lagoons, allowing children to benefit from visual access to calming, nature-based scenery. This indirect exposure enhances the aesthetic and emotional appeal of indoor playgrounds.

In conclusion, the thoughtful integration of natural elements—such as greenery, sunlight, rooftop gardens, and visual access to water—within architectural design can significantly enhance the quality, visual appeal, and social functionality of spaces intended for children. These elements not only improve the spatial experience but also play a critical role in promoting children's social development in indoor play environments.

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