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Space Syntax Analysis of the Konya Meram AKD Kids Preschool Education Building

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Abstract

Examining the relationship between the spatial uses anticipated during the design phase of preschool education facilities and the patterns that emerge during actual use is important for evaluating design decisions. This study examines the overlaps and differences between design intentions, spatial configuration, and post-occupancy findings at the Konya Meram AKD Kids facility, which was designed specifically for early childhood education and serves children aged 2–5. This exploratory case study, conducted within the framework of a post-occupancy evaluation approach, combines on-site architectural surveys, behavior-mapping-based observations, interviews with educators, and spatial layout analysis. The basement, ground floor, and first floor were modeled separately to calculate isovist area, isovist perimeter, circularity, connectivity, average depth, and integration values. According to the usage findings reported by the principal, the use of niches in classrooms for play and conversation aligns with the goal of creating sub-spaces tailored to children's scale. It was noted that the inner courtyard, originally designed for natural lighting, has acquired additional functions over time, such as play, storytelling, and exhibitions. Although the inner courtyard stands out in the reported usage distribution, the fact that it is not the activity space with the highest integration value on the basement level points to the limitations of explaining usage solely through the integration ranking. However, the distributions reported in the interview are approximate estimates and do not measure children's independent spatial preferences. The study presents an approach that evaluates design intentions and usage through site-specific comparisons; it emphasizes that spatial measurements must be interpreted in conjunction with activities and usage conditions. The findings are limited to the sample examined and should be tested comparatively across different preschool building typologies.

Keywords: space syntax; spatial analysis; preschool education building; preschool education environments; integration; post-occupancy evaluation

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1. Introduction

In preschool education facilities in Türkiye that have been converted from existing buildings, the spatial conditions resulting from their previous uses may limit the arrangements required for educational purposes. For this reason, the compatibility of the spatial layout with the educational approach and the extent to which it meets user needs are among the key issues that must be assessed during the conversion process (Kanbur, 2012) [1]. According to Matthews and Lippman (2020) [2], in the design of preschool learning environments, it is important to consider the characteristics of the physical environment

alongside children's developmental needs. In this context, buildings designed specifically for preschool education provide a suitable research framework for examining how these needs are reflected in spatial decisions from the outset of the design process and to what extent they are met during use.

The decisive role of the physical environment in children's development during the preschool years constitutes a shared intersection between educational sciences and architectural research (Berris and Miller, 2011; Matthews and Lippman, 2020) [2,3]. Within this intersection, space is treated not as a passive backdrop against which activities take place, but as an active element that organises the ways children come together, their movement routes and the spatial distribution of adult supervision (Hillier and Hanson, 1984; Sailer, 2018) [4,5]. In the space syntax literature, however, studies of school buildings have concentrated mainly on primary, secondary and higher education buildings, while preschool education buildings have received comparatively limited attention (Sailer, 2018; Wan Zin, Samsudin and Din, 2025) [5,6].

The research problem addressed in this study is the extent to which the spatial uses anticipated during the design phase of preschool education facilities align with the usage patterns observed after the facility opens and reported by educators. The spatial constraints of converted buildings provide a context that highlights the importance of incorporating user needs into design decisions. In this context, the Meram AKD Kids facility was selected because it was designed specifically for early childhood education, taking into account spatial dimensions, interrelationships between functions, user needs, and client requirements. This characteristic of the facility allows for an examination of how the design intentions for the 2–5 age group are realized during the usage process.

The purpose of this study is to evaluate the overlaps and differences between the design intentions and post-occupancy findings in the Meram AKD Kids preschool education facility through the lens of its spaces. To this end, the spatial characteristics identified through on-site architectural examinations and spatial layout analyses are considered in conjunction with observational findings based on behavioral mapping and educators' accounts of the facility's use. The comparison is conducted within the framework of a post-occupancy evaluation approach that facilitates the correlation between design goals and patterns emerging during the usage process (Preiser, Rabinowitz, & White, 1988; Groat & Wang, 2013) [7,8]. The study's original contribution lies in its comparative analysis of design intentions, spatial configuration, observed uses, and educator feedback within the same spaces. Thus, the potential and limitations of spatial configuration criteria in explaining usage patterns are discussed in conjunction with the usage conditions of the examined case.

This study seeks to answer three research questions. First, how are the spatial relationships envisaged in the design described in terms of the chosen spatial arrangement and visibility criteria? Second, in what ways do the spatial characteristics revealed by these criteria align with or differ from the usage findings obtained from observations and interviews with educators? Third, what design implications specific to the case study do these alignments and differences offer?

The remainder of the paper is organised as follows. Section 2 establishes the conceptual framework for preschool education environments, elaborates the concept of space and space syntax theory, and defines the method adopted. Section 3 presents the design approach of the building, the observation and interview findings, and the results of the syntactic analysis within the case study. Section 4 discusses the findings against the design objectives and the comparative studies in the literature, and Section 5 sets out the conclusions and suggestions for future work.

2. Conceptual Framework

This section first discusses the importance of preschool education environments. The concept of space is then addressed, and perspectives on space are examined across different disciplines. Finally, the meaning of space and the space syntax analysis used to examine it are introduced, and the method followed in the study is defined.

2.1. The Significance of Preschool Education Environments

The preschool period is a crucial stage of development during which children acquire habits and skills in various areas (Arslan-Karaküçük, 2008) [9]. During this period, high-quality preschool education supports children's individual and social development (Bekman and Gürlesel, 2005) [10]. Studies that examine the relationship between spatial configurations in elementary school buildings and children's leisure activities provide a research example of how the use of spaces outside the classroom can be incorporated into the evaluation of the educational environment (Taguchi and Kishimoto, 2012) [11]. Accordingly, this study examines the spatial organisation of preschool education environments in terms of children's opportunities to move around, choose activity areas and interact with their peers. In addition to classrooms, circulation areas and communal spaces are also assessed in terms of their relationship with daily activities.

The spatial organization of educational facilities is evaluated within the context of the relationships among users, learning processes, and the physical environment (Fouad and Sailer, 2019) [12]. Layouts that treat the classroom as the basic spatial unit and are associated with teacher-centered learning represent one of the architectural manifestations of this relationship (Heitor and Marques-Pinto, 2012) [13]. Research on early childhood education settings, meanwhile, highlights the relationship between the physical environment and children's development and daily activities. While Berris and Miller (2011) [3] emphasize the importance of the physical environment in educator and parent evaluations, Matthews and Lippman (2020) [2] examine spatial organization in conjunction with time allocated to activities and group formations. Ata, Deniz, and Akman (2012) [14] discuss the relationship between spatial characteristics and children's behaviors within the framework of environmental psychology; Shaari and Ahmad (2016) [15], on the other hand, examine the relationship between the quality of the physical learning environment and school readiness. From the perspective of this study, these discussions provide a foundation for evaluating spatial organization in conjunction with children's opportunities to move, participate in activities, and form groups of varying sizes.

Within this framework, preschool education environments should not be seen as consisting solely of enclosed classroom volumes; shared areas such as corridors, courtyards, workshops and interior gardens must also be counted among the constituent components of the learning environment. Bollig and Millei (2018) [16], reviewing the spatial turn that has become pronounced in early childhood education research since the 2000s, argue that childhood experience is produced within and through spatial practices and that early childhood institutions should therefore be read as socio-spatial arrangements. This observation makes it necessary to consider the design of preschool education buildings together with pedagogical preferences.

The relationship between pedagogical approach and spatial configuration carries additional weight here because the building examined in the case study adopts the Montessori system. İslamoğlu (2018) [17] shows that the Montessori approach requires a close relationship between interior and exterior space, flexible and multi-purpose use of circulation areas and classrooms, design at the scale of the child, and natural light, and that the concept of the prepared environment has a direct architectural counterpart. Similarly, Al, Sarı and Kahya (2012) [18] note that in the Montessori method free activity takes place within a

prepared environment, so that classrooms are designed as articulated and multi-functional spaces rather than uniform, enclosed units. Macià-Gual and Domingo-Peñafiel (2021) [19] argue that the prepared environment must offer stimuli suited to the child's developmental stages and that a high-quality early childhood setting can only be achieved by addressing teacher competence and spatial quality together.

In this study, the Montessori approach provides a pedagogical framework for interpreting the spatial opportunities envisaged during the design stage in relation to findings on spatial use. Montessori's concept of the prepared environment is associated with child-sized furnishings, accessible materials, and spatial arrangements that support independent movement and choice (Gündüz, Erbaş Özil and Aykal, 2024) [20]. Recent research on Montessori learning environments highlights how interconnected activity areas, flexible partitions, and child-sized furniture can accommodate both individual and collaborative work (Xiang, Ismail and Mohd Ariff, 2024) [21]. Subspaces that accommodate different needs for concentration and proximity to others are also relevant to understanding the spatial organisation of Montessori classrooms (Orihuela, 2025) [22].

In this study, the Montessori approach contributes to the interpretation of spatial arrangements designed for activity area selection, free movement, and individual or collaborative work. The connections between areas and the positions of spaces within the analyzed system are examined using criteria of connectivity, integration, and average depth; while the size and geometry of the visible area are addressed using isovist criteria. However, visual connectivity does not necessarily imply direct physical access (Turner, Doxa, O'Sullivan, & Penn, 2001) [23]. Therefore, the spatial possibilities described by these criteria are interpreted by comparing them with usage findings obtained from observations and interviews with educators. Child-scale subspaces and movable furniture are also evaluated within the scope of the architectural analysis in terms of the opportunities they offer for individual and group activities. This approach does not directly measure the level of implementation of Montessori principles or children's independence; rather, it establishes an interpretive relationship among pedagogical expectations, spatial characteristics, and usage findings.

2.2. The Concept of Space

Space is a complex concept that different disciplines interpret and define in various ways. Spatial designers express the definition in more concrete terms, whereas disciplines within the humanities approach the concept of space from a more social standpoint (Büyükşahin-Sıramkaya, 2015) [24].

Architectural space is conceived not merely as a physical shell surrounding the individual, but as a multi-layered structure that shapes life and enables the individual to realise their full potential (Sanlı, Sağlamer and Dursun, 2010) [25]. In this study, this quality of space is examined through the relationship between the physical order envisaged at the design stage and the everyday practices that take place during its use. Tuan's (1977) approach to the transformation of space into place through experience [26] provides a conceptual framework for explaining how the physical environment acquires meaning for its users. Lefebvre's (1991) approach, which posits that space is produced within social relations and practices [27], indicates that spatial order cannot be considered independently of the activities taking place within it and the relationships of use. These two approaches enable the joint evaluation of the functions defined in the design and the practices that emerge during use.

In this study, these approaches contribute to the interpretation of the relationship between the functions defined in the design and the activities that emerge during the usage process. In particular, the fact that the inner courtyard hosts different activities over time serves as an example for discussing the functions and meanings the space acquires through

its use. However, the observed activities and educators' accounts are not considered a direct measure of the children's subjective experiences or the meanings they ascribe to the space. Spatial configuration analysis complements this conceptual assessment by describing the measurable characteristics of the relationships between spaces. Thus, the analysis of the physical layout and the usage findings derived from observations and interviews are treated as complementary sources that provide different types of information.

2.3. Space Syntax

According to Hillier (1996) [28], space, which has a complex structure, has two fundamental properties. The first is that space is a void, and the second is that movement between spaces must be provided so that they can be experienced as a whole. The most important point in the coming together of spaces to form meaningful wholes is their relational structure, and understanding these structures requires the analysis of form and of the structures of formation (Gündoğdu, 2014) [29]. Steadman (1983) [30], concerned with the composition and form of architectural elements, stresses that the process by which spaces come together can only be determined through studies aimed at understanding spatial relations and analysing the structures of formation. From this it follows that, just as words come together to form sentences, the meaningful and coherent combination of spaces and of the elements that constitute them is a means of expression in architecture.

Space syntax focuses on people's spatial experience when defining space (Seamon, 2007) [31]. The sequence of spaces that emerges from a particular configurational order possesses a rule-governed system within its own integrity, and reading and evaluating space deepens the experience by giving it meaning. Hillier and Hanson (1984) [4] show that space syntax can account for user movement together with the relations between spaces as they come together, and emphasise that space has a language.

Pasalar (2004) [32] compared four middle schools in the United States using space syntax analysis and concluded that students' social interactions reached higher rates in spatial layouts offering shorter and more legible routes. Studies of this kind serve as examples of the joint evaluation of observed usage patterns and measurements of spatial relationships. However, rather than directly applying findings from middle school students to the preschool age group, opportunities for movement and interaction must be examined within the context of the specific age group and the conditions of the educational environment.

The theoretical foundation of space syntax rests on Hillier and Hanson's attempt to read buildings as the spatial counterpart of social relations [4]. The authors argue that every building spatially reproduces the categories of inhabitant and visitor and establishes the balance of access and control between these two groups through an interface. In this framework a building structurally imposes which spaces its users may reach, to what extent, and where they will come together; social knowledge is thus embedded in space itself. Hillier, Hanson and Peponis (1984) [33] showed that building function can be defined through the network of relations between spaces, independently of functional labels. This approach is critically important in that it demonstrates that the quality of a building as a school is established not merely by the presence of classrooms but by the way spaces are connected to one another.

Space syntax analyses rely on different representational tools and corresponding measures depending on how space is abstracted. Axial maps take movement potential as their basis, convex space maps take space–space relations, while visibility-based approaches foreground the perceptual dimension of space. The conceptual definitions of the measures used in this study can be summarised as follows. Connectivity refers to the number of other nodes directly connected to a given node in the analyzed graph. Average depth describes the average number of steps required along the shortest graph paths to reach

other accessible nodes in the system from a given node. Integration, on the other hand, is intended to assess a node's relative position in terms of the relationships it establishes with the system as a whole. The spatial meaning of these metrics depends on what the graph connections represent; in a visibility graph, connections express mutual visibility between locations (Turner, Doxa, O'Sullivan, and Penn, 2001) [23]. The visibility-based measures originate in Benedikt's (1979) [34] concept of the isovist. Benedikt defined the isovist as the set of all points visible from a given location, and the area, perimeter and shape properties of the isovist made it possible to quantify the visual character of a space. Turner, Doxa, O'Sullivan and Penn (2001) [23] developed visibility graph analysis by converting isovists into a graph of mutual visibility, thereby integrating visual integration and visual connectivity measures into spatial analysis. Circularity is addressed in this study to evaluate the formal characteristics of the isovist field. This indicator is not interpreted as a direct measure of children's perceptual balance or their ability to orient themselves.

The literature offers a comparative body of work on the use of these measures in education buildings. Pasalar (2007) [35] shows that the level of accessibility of corridors in school buildings is related to students' tendency to form friendships that cross the boundaries of classes and year groups, demonstrating that the spatial configuration of a school directly affects the breadth of the social network. Kishimoto and Taguchi (2014) [36] analysed the plan schemes of 76 elementary schools in Japan using space syntax and report that open and flexible plan types permit more fluid educational practices, and that teacher assessments largely coincide with the syntactic values. Heitor and Marques-Pinto (2012) [13] employed space syntax as an instrument of design guidance in the rehabilitation of school buildings and discuss how formal and informal learning spaces are reflected in the spatial structure. Fouad and Sailer (2019) [12] evaluate the opportunities that spaces outside the boundaries of formal classrooms offer for self-directed learning in terms of spatial configuration.

Recent studies examine the connections between spatial configuration, use, and visual relationships in educational buildings across various contexts. Tunçok Sarıberberoğlu and Ünlü (2024) [37] demonstrate that spatial order in education buildings determines student behaviour depending on whether it is strongly or weakly programmed, and that weakly programmed, flexible configurations diversify recess behaviour while strongly programmed configurations flatten social behaviour. Psathiti and Charalambous (2025) [38] examine the relationship between spatial layout and teachers' sense of control over the school using space syntax alongside morphological analysis, showing that the level of spatial transparency and visual control is related to forms of pedagogical collaboration. Othman and Mohd Yusoff (2019) [39] use isovist and visibility graph analysis to evaluate safe movement patterns, while Ergün (2026) [40] compares primary school building typologies through integration, connectivity and isovist measures and finds that areas with limited visibility attract lower levels of use.

At the preschool scale, the literature is not yet mature. Çanakçıoğlu (2022) [41] compared the spatial configuration of kindergartens adopting the Waldorf, Montessori and Reggio Emilia approaches on semantic and syntactic planes, showing that each pedagogical approach produces its own socio-spatial order and that free movement within the classroom and the prepared environment are decisive in the Montessori approach. Geramifard, Yeganeh and Tabaeian (2025) [42] report that the connectivity, depth and accessibility values of kindergarten spaces affect the self-efficacy and motivation of children aged 3–6. Wan Zin, Samsudin and Din (2025) [6], in a systematic literature review covering 2015–2025, find that applications of space syntax in school design concentrate mainly on the themes of movement, wayfinding and pedagogical flexibility, while educational typologies remain limited in diversity and clear gaps persist in the integration of qualitative and quantitative

data and in longitudinal studies. These findings highlight the importance of interpreting spatial measurements in preschool settings in conjunction with findings on space utilization. In this study, this relationship is examined by comparing the spatial uses envisaged in the design with findings derived from observations and interviews with educators.

The six measures used in this study were selected to examine complementary aspects of spatial configuration and visibility. Connectivity is used to assess the direct relationships of the unit under analysis, whilst mean depth and integration are used to evaluate its position within the system through its relationships with other units. The interpretation of these values depends on the relationships represented by the graph used in the analysis. As the links defined in a visibility graph represent visual relationships, they are not directly equated with opportunities for physical access (Turner, Doxa, O'Sullivan and Penn, 2001) [23]. Isovist area is included in the analysis to assess the size of the visible area, whilst isovist perimeter and circularity are used to evaluate its geometric characteristics.

The combined use of these criteria allows for a comparison of usage findings—derived from observations and interviews with educators—with the local connections, positions within the system, and visibility characteristics of the relevant spaces. In this comparison, a distinction is made between the spatial possibilities offered by the design and the extent to which these possibilities are realized in actual use. The criteria are treated not as variables that directly determine children's movements or spatial preferences, but as spatial indicators that contribute to the interpretation of usage findings. Adult supervision, the daily activity schedule, and conditions of access to spaces are also considered as contextual factors that may influence usage patterns; however, it is not claimed that the individual effects of these factors have been measured.

2.4. Methodological Framework

The research has a descriptive and exploratory character based on a single case study design. The case study design was preferred because it allows the relationship between spatial configuration and usage practice to be examined within the building's own context and through multiple data sources [8]. Since the study combines qualitative data collection techniques with quantitative spatial measurement on the same plane of analysis, it can be described as a multi-method approach.

The data collection process was carried out in three stages. In the first stage the architectural project, floor plans and site plan of the building were obtained, and the functional labels of spaces, connecting doors and circulation axes were marked on the plans.

In the second stage a number of assumptions were made in order to determine the time period during which the non-participant observation would take place. The observation period was set to exclude times—such as extended official holidays in the academic calendar—that would negatively affect student attendance and disrupt the educational routine. To obtain the data necessary for the study, simultaneous observations were planned to be conducted at a fixed time interval within the building over 10 consecutive business days. The observation period was set between 10:00 a.m. and 1:00 p.m., a time frame that encompasses both class periods and breaks between classes. During the 3-h observation period, students were observed in three intervals: 10:00–11:00, 11:00–12:00, and 12:00–13:00 and the spaces in which children spent time outside the classroom, for how long and in the course of which activities were recorded.

The scope of the observation consisted of a total of eight classes, with two classes for each of the 2-, 3-, 4-, and 5-year-old age groups. There were 14 enrolled children in each class, bringing the facility's total number of enrolled children to 112. The observations included the children present in these classes on the observation days. Specific children were not selected for individual tracking; instead, the classes were examined separately to analyze general

mobility and spatial use. The number of enrolled children does not directly reflect the number of children actually present on the observation days. The observational approach was based on behavior mapping, which focuses on analyzing the spatial distribution of behaviors (Zeisel, 1981) [43].

In the third stage, an interview lasting approximately 20 min was conducted in the principal's office on 27 March 2022. A classroom teacher and a teacher who communicates in English in the classroom also participated in the interview. The principal explained how the children generally used the facility, while the teachers provided information on the variety of activities carried out in the spaces. Notes were taken during the interview, and the participants' statements were presented in the findings using indirect quotation.

Rather than following a pre-prepared, fixed set of questions, the interview proceeded in a natural flow of conversation through open-ended questions focused on the building's use and the arrangements observed on-site. The main topics included the use of niches and their relationship to classroom activities, the current functions of the inner courtyard, the frequency of use of the spaces in the basement, spatial features that did not meet expectations or proved inadequate, and changes made during use. The deviation of the inner courtyard from its intended function in the design was directly addressed. Information was also provided during the interview regarding the use of the green terrace and the painting activities held there.

The percentages presented in Table 1 were derived from the school principal's estimates of the approximate distribution of children, as reported during the interview based on his own observations. These values, recorded in the interview notes, were not calculated from behavior mapping records or usage time measurements. Therefore, the percentages are treated as a separate data source from the systematic observation findings.

Table 1. According to the school principal's estimates, the approximate distribution of children among various locations during their free time activities (%).

Classrooms	Corridor	Sports Area	Art Workshops	Interior Garden	Dining Hall
10%	15%	25%	15%	30%	5%

Note: The percentages are approximate estimates provided by the principal during the meeting; they were not calculated based on systematic behavioral observations.

In the spatial layout analysis, the building's basement, ground floor, and first-floor plans were treated as separate models in the Syntax2D program. Within the scope of this modeling, the spatial relationships within each floor were examined; the vertical connections between floors were not analyzed as part of a single integrated system. For each floor, the isovist area, isovist perimeter, circularity, connectivity, average depth, and integration values were calculated, and averages were obtained at the floor level. Since floor averages do not, by themselves, reveal spatial differences within a floor, the scope of the model used to interpret these values and the representational limits of the averages must be taken into account.

The comparative evaluation of the study is based on a joint analysis of the spatial uses envisaged in the design, observational findings, educator reports, and spatial layout measurements, all conducted within the same spaces. While preserving the distinct characteristics of these data sources, the study examines the overlaps and differences between design intentions and actual use. Spatial measurements are evaluated as indicators that describe the physical layout in which use occurs; approximate distributions conveyed through interviews are not considered equivalent to measurements obtained from systematic observation. The results of this approach, which is based on a single building and a limited study period, are interpreted within the context of the conditions of the case under study.

3. Case Study

This section first describes the Meram AKD Kids preschool education building briefly along its general design lines through its façade and plan characteristics. Following the account based on the plan plane, data collection was carried out first through observation and interviews, and then through space syntax analyses.

3.1. Examination of the Konya Meram AKD Kids Preschool Education Building

The Konya Meram AKD Kids preschool building, situated in the Melikşah neighbourhood of Konya's Meram district, was designed in 2014 by Architects C. Azer Erdağı and Göktürk Peker and opened in 2015. The building, arranged around a courtyard, comprises a basement, ground floor and first floor, as well as a terrace level used as a garden (Figures 1–7). According to information provided by the school management, during the inspection period in 2022, the institution's capacity was stated as 128children, whilst the number of registered children was 112.

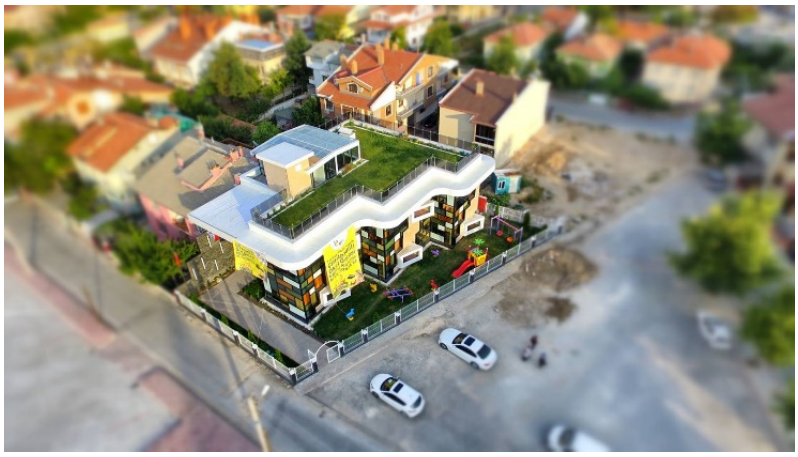


Figure 1. The surroundings of the Meram AKD Kids building.



Figure 2. The park façade of the Meram AKD Kids building.

The building, which has a plan scheme arranged around a courtyard, contains a sports area, music and visual arts workshops, a staff room, sanitary facilities, a dining hall with kitchen, and technical volumes on the basement floor. The ground floor accommodates the entrance, classrooms and sanitary facilities, while the first floor contains the principal's office, classrooms and sanitary facilities.

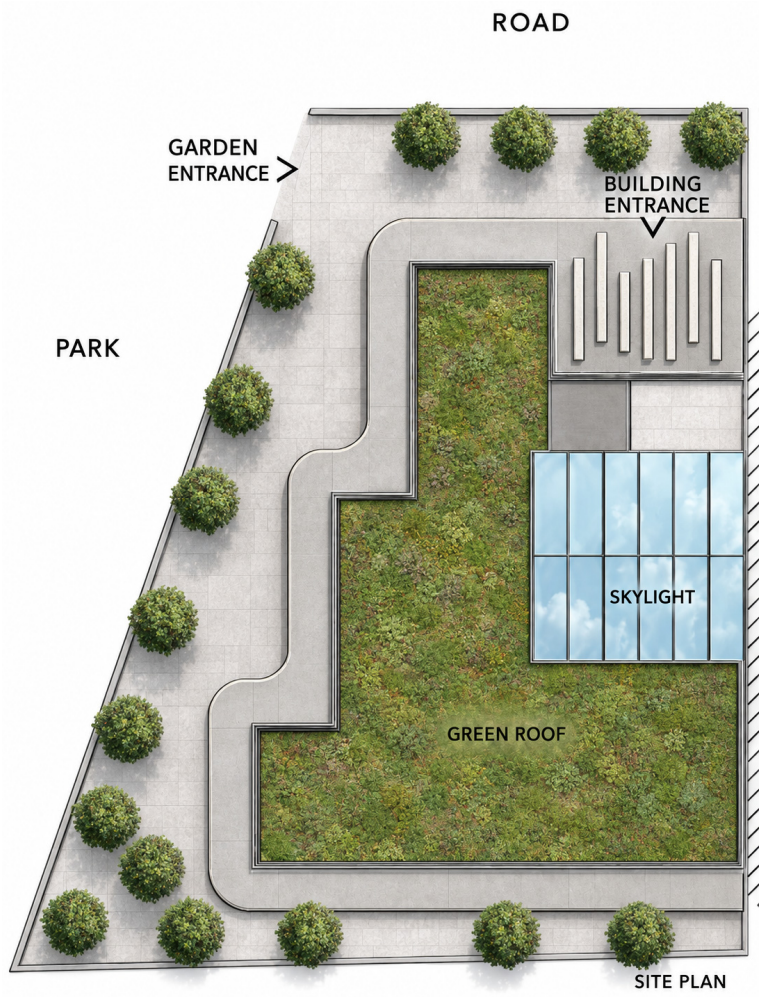


Figure 3. Site plan of the Meram AKD Kids building.



Figure 4. Green roof of the Meram AKD Kids building.

The interiors of the classrooms are designed to be vibrant and colorful, in harmony with the building's facade. Following the adoption of the Montessori approach during the design process, the classroom interiors were revised to create a simpler and calmer environment (Figure 8). Solid wood was selected for the furniture, and movable furniture

was designed to allow different activity areas and arrangements for individual and group work within the classrooms (Figure 9).



Figure 5. Basement floor plan.

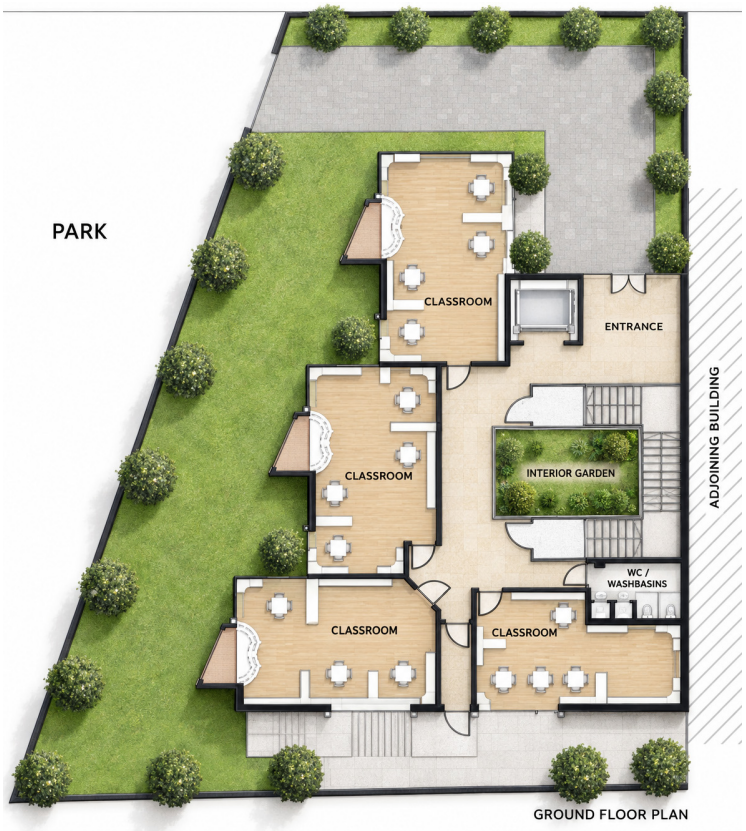


Figure 6. Ground floor plan.

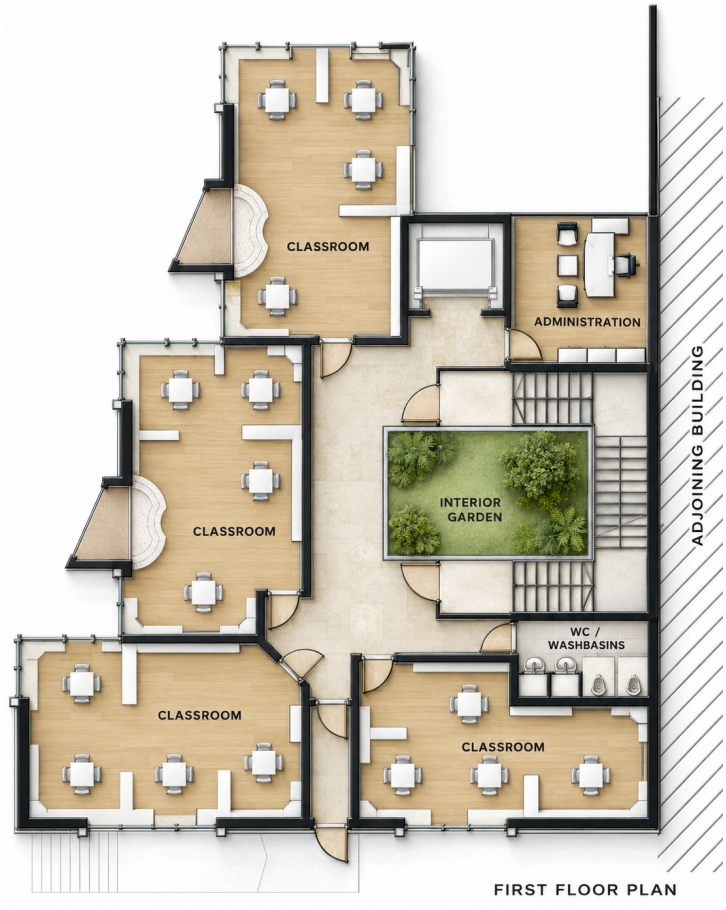


Figure 7. First floor plan.



Figure 8. Classroom interior with low open shelving and child-scale, movable furniture.

This arrangement of the classroom interior corresponds to the principle of the prepared environment in the Montessori approach. The literature stresses that the prepared environment is not a fixed and uniform classroom order but a flexible spatial arrangement supporting the child's free movement, choice of their own working area and coming together with peers [17,18]. The movable furniture and multi-functional surfaces used in the building are considered to correspond to this principle.



Figure 9. Classroom interior with tables grouped in the centre of the room and cubby shelving along the walls.

Creating different areas of use within a space, and thus changing the conventional spatial order and its operation, gains importance in children's acquisition of new fields of movement and experience.

3.2. Design Approach to the Konya Meram AKD Kids Building

The design intentions described in this section are based on the author's retrospective explanations of the design process; the author is one of the building's designers. In this structure, designed for children aged 2–5, a niche has been incorporated into each classroom to create sub-spaces tailored to children's scale (Figure 10). By elevating these spaces above floor level, enclosing them with glass, and projecting them outward from the facade, the goal was to create a "space within a space" effect within the classroom (Figure 11). The niches are intended to allow children to partially separate themselves from the general classroom environment while observing the outside surroundings and to develop different uses for the spaces in accordance with their imaginations.



Figure 10. View of the niche from inside the classroom.



Figure 11. View of the niche from the building façade.

Subspaces within the classroom that vary in scale and have clearly defined boundaries are associated with the spatial opportunities provided for children to create their own space and step away from the general activity environment [2]. Studies examining the relationship between the layout of school spaces and social behavior also provide a basis for analyzing such arrangements in the context of their actual use [5]. In this study, niches are considered as a design decision aimed at providing these opportunities; how they are utilized in practice is evaluated in the following section.

In addition to this classroom-scale layout, one of the design's primary objectives is to bring natural light into the circulation areas and the interior spaces on the basement level. To this end, a light well extending from the center of the building down to the interior courtyard on the basement level has been incorporated (Figure 12). The openings and windows at the roof level are intended to facilitate natural ventilation, while the transparent partitions in the basement are designed to transmit daylight into the surrounding spaces (Figure 13).

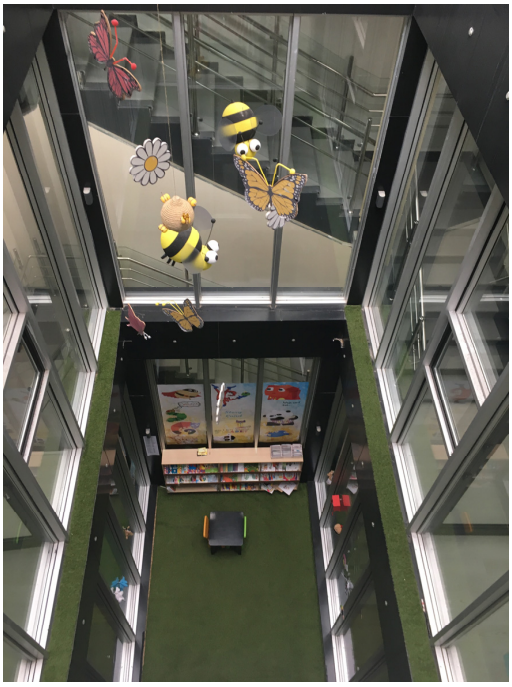


Figure 12. The lightwell: view from the roof towards the interior garden.



Figure 13. View from the interior garden towards the lightwell and the roof.

The vertical void at the center of the structure also allows for the establishment of a visual connection between floors. However, two-dimensional analyses in which the floors are modeled separately do not directly assess the effect of this vertical connection. Therefore, the potential effects of vertical visual connections on user perception or wayfinding are not treated as findings corroborated by the study's numerical results.

To compensate for the limited ground-level garden space, the roof was designed as a green terrace to provide children with additional open space (Figure 4). This arrangement is intended to increase the school's opportunities for using open spaces.

The goal was to create spaces throughout the building that are interconnected yet offer distinct spatial possibilities, thereby providing an environment conducive to children's participation in a variety of activities throughout the day. The extent to which these design intentions were realized during actual use is discussed in the following section based on findings derived from observations and interviews with educators.

3.3. Findings Based on Observation and Interviews

The findings from the interview regarding usage consist of the school principal's account and the statements of the two teachers who participated in the interview. The principal explained how the children generally used the structure and described the use of the niches; the teachers, meanwhile, provided insights into the variety of activities carried out in the spaces and the ways in which usage evolved in line with the children's interests.

The school principal noted that the alcoves in the classrooms on the ground floor and first floor were areas that children specifically preferred for playing, chatting, and spending time (Figure 14). During the visits, instances were also observed of children lying down in the alcoves and chatting with their friends. These observational notes from the visits, which are kept separate from the systematic behavior mapping records, serve as examples of activities taking place in the alcoves; they are not considered measurements indicating frequency of use or distribution of preferences.

The school principal noted that the inner courtyard and sports area in the basement are among the spaces used for children's activities (Figures 15 and 16). According to the principal, the inner courtyard has been adapted for various activities in line with the school's changing needs and the children's desire to spend time there. It was explained that, in

addition to games and storytelling, the space has been used at various times as a library, an area to display the children's drawings, models, and sculptures, and for small-scale theater productions.



Figure 14. Children gathered around the niche.



Figure 15. Interior garden.

During the visits, it was observed that children were using the climbing wall in the sports area and playing in groups in the inner courtyard. Since the number of participants and the duration of use were not recorded in the visit observations regarding these activities, these examples were not evaluated for the purpose of measuring the intensity of use of the spaces.

During the interview, the discussion also addressed which spaces the children used during their free-time activities. According to the principal, during this time, the children are asked what activities they would like to do; once activities such as art, sports, or dance

are identified, suitable spaces where these can be carried out are selected. Therefore, the reported distribution of use reflects a combined assessment of the children's activity choices and the appropriate spaces; it does not merely indicate independent space preferences.

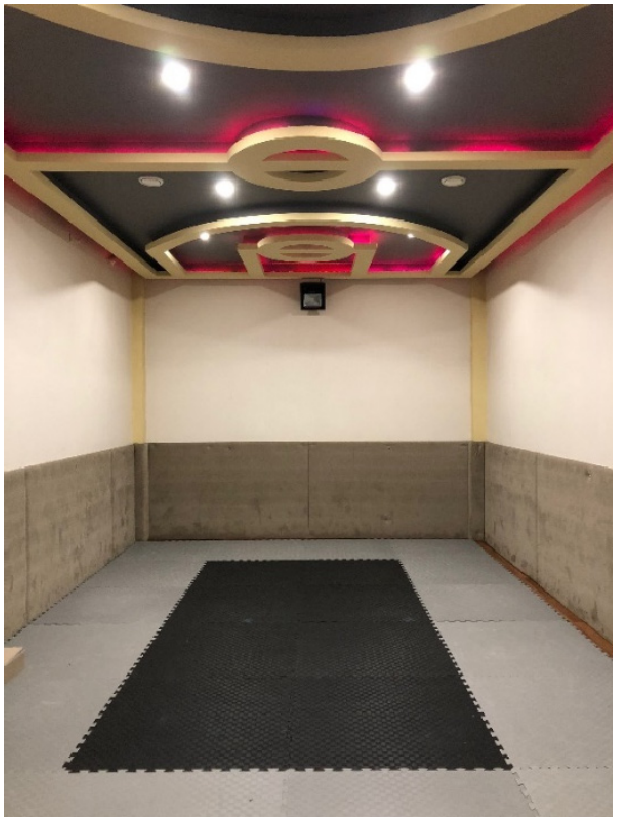


Figure 16. Sports area.

The percentages in Table 1 are estimates of the approximate distribution of children across spaces during their free-time activities, as verbally conveyed by the principal based on his own observations. These values, recorded in the researcher's interview notes, were not calculated from a systematic count of children or measurements of usage time. Therefore, the percentages are treated not as measured behavioral frequencies but as information that approximately describes the reported distribution of use.

In the principal's approximate distribution estimates, the inner courtyard and sports area are represented by higher percentages among the spaces listed in the table. However, since these percentages do not reflect measurements of frequency or duration of use, the differences between the spaces should not be interpreted as definitive differences in usage intensity. The fact that the inner courtyard is described as being used for various activities during different periods indicates that the space can be adapted to changing needs. However, these descriptions do not demonstrate that visual continuity is the reason children use this space.

3.4. Findings Based on Space Syntax Analysis

The basement, ground and first floor plans of the Meram AKD Kids education building were analysed with the Syntax2D program. For each floor, isovist area, isovist perimeter, circularity, connectivity, mean depth and integration (integration-n) values were determined and their average values taken. The abbreviations and notations of the measures used in the analysis have been retained in accordance with the output terminology of the Syntax2D program. Area and perimeter values represent the visibility characteristics of spatial units,

while connectivity and integration values represent the access structure between spaces. The display of the integration value as integration-n indicates that the value is normalised with respect to system size [4].

Because the building has a courtyard plan scheme and the corridors are resolved around the courtyard, integration values are quite high in the spaces on the ground and first floors (the areas shown in red tones). The fact that the building does not have a complex plan configuration and is not large in scale also reinforces this situation. On the ground and first floors, which repeat each other in terms of plan characteristics, the corridors and the classrooms to the south are the most integrated spaces, while the spaces with the lowest integration values were observed to be the entrance on the ground floor and the principal's office on the first floor (the areas shown in blue-green tones). On the basement floor, apart from the corridors and the toilet, the most integrated space suitable for different actions is the sports hall. The sports hall is followed in order by the dining hall, the interior garden, the art workshops and the play area (Figure 17).



(**a**) (**b**) (**c**)

Figure 17. Integration (integration-n) graphs of the floor plans: (**a**) basement floor; (**b**) ground floor; (**c**) first floor.

When the average syntactic values between the floors of the Meram AKD Kids education building are examined, the basement floor is seen to be the floor with the highest integration value (Table 2). The basement floor plan, whose mean depth value is also high because of the size of the plan, displays diversity particularly in integration values owing to the facilities and design elements it possesses.

Table 2. Average syntactic values of the Meram AKD Kids building.

Floor	Isovist Area	Isovist Perimeter	Circularity	Connectivity	Mean Depth	Integration
Basement floor	3.44	4.18	53	559	2.53	5.73
Ground floor	3.82	4.48	56	608	2.27	4.80
First floor	3.81	4.48	56	614	2.27	4.88

In Table 2, the average values for the isovist area, isovist perimeter, circularity, and connectivity of the ground floor and first floor are close to one another. However, floor averages alone do not reveal the differences that may exist among spaces on the same floor. Since the floors were modeled separately, the average depth value for the basement floor is

not interpreted as a measure of that floor's vertical accessibility within the entire building. The relationships between the spatial analysis results and the usage findings derived from observations and interviews are discussed in the following discussion section, taking these limitations into account.

4. Discussion

Findings regarding the Meram AKD Kids facility indicate that the spatial possibilities envisaged in the design do not align in the same way with the activities that emerged during the usage process in every space. When evaluating this relationship, the scope of information provided by design descriptions, spatial layout results, and usage findings must be distinguished from one another. In particular, the approximate distributions in Table 1 are based on the principal's accounts and should not be interpreted as measured usage frequency or independent space preference.

With regard to the first research question, the selected criteria contribute to the description of the spatial relationships envisaged in the design through local connections, position within the system, and visibility characteristics. The integration distributions within each floor illustrate the relational positions of circulation and activity areas within the analyzed system. However, design features such as the child scale intended for niches and partial separation cannot be explained solely by these criteria; they are evaluated in conjunction with architectural analyses. Due to the separate modeling of the floors, the vertical visual relationships established by the skylight also fall outside the scope of the numerical evaluation.

With regard to the second research question, the discrepancy between the ranking in the spatial analysis and the distribution of use reported in the interview becomes particularly evident in the inner courtyard. While the inner courtyard is not identified as the space with the highest integration value among the activity spaces on the basement level, it is represented by the highest share in the director's approximate distribution estimate presented in Table 1. This comparison suggests that explaining reported usage solely through the integration ranking may be limited. However, this discrepancy between interview estimates and quantitative spatial measurements is not interpreted as a statistically tested relationship or causal effect.

Studies discussing the relationship between spatial program and behavioral diversity [37] provide a framework for interpreting the inner courtyard's adaptability to different activities. However, the multifunctional use of the space does not demonstrate that flexibility alone determines the distribution of use. Isovist and visibility analyses also provide tools for examining the characteristics of the visual field [23,34,39]; the use of these tools does not constitute direct evidence that visual continuity increased children's use in this case.

The functions the courtyard has acquired over time illustrate the divergence between the original design intent and its actual use. According to the director, this space—which, as described in the design statement, was intended to provide natural light to circulation areas and basement spaces—has, over time, been used for games, storytelling, as a library, for exhibitions, and for small-scale theater productions, demonstrating the additional functional uses that have been added to its original purpose. Rather than being interpreted as a failure of the design or as a complete failure to anticipate user behavior, this change is viewed as the space adapting to evolving needs.

The changing use of the inner courtyard can be linked to discussions that view common areas in school buildings as environments for learning and social interaction outside of classrooms [5,35]. Tuan's approach to the transformation of space into place through experience [26] and Lefebvre's explanation that space is produced within social relations and practices [27] provide a conceptual foundation for interpreting this functional transforma-

tion. However, since the meanings children ascribe to space were not directly investigated in this study, these approaches are used not to validate children's subjective experiences but to interpret the reported changes in usage.

The principal's account of the use of niches in classrooms, however, indicates a partial alignment with the design intentions. The observation that niches are used for playing, chatting, and spending time is consistent with the goal of creating a child-scale sub-space within the classroom. This relationship can be discussed within the literature that considers spatial arrangements in conjunction with activities and social interactions [2,5]. However, the reported uses do not constitute a direct measurement of children's sense of privacy or the meanings they ascribe to the niches. Although Montessori's "prepared environment" approach, which allows for freedom of movement and activity selection [17,18], contributes to the interpretation of niches and variable furniture arrangements, the presence of these features does not imply that children's independence has been measured.

The relationship between activity selection and space selection is also important in interpreting usage. According to the director's explanation, during free-time activities, the activities the children wish to engage in are first determined, and then appropriate spaces are selected for them. Therefore, the reported distribution cannot be interpreted solely as a result of spatial configuration or children's independent spatial preferences. Adult supervision, the daily schedule, and access conditions are factors that may influence usage and complicate the interpretation of the relationship between spatial characteristics and usage. Since the individual contributions of these factors were not determined in this study, differences in usage are not attributed solely to integration, depth, or visibility values. This finding aligns with the literature emphasizing the importance of evaluating spatial measurements and usage data together [6].

Within the scope of the third research question, the study offers insights into the evaluation of the examined sample design intentions by considering spatial dimensions, adaptability to activities, and the pedagogical and administrative conditions of use in a comprehensive manner. The uses reported in the niches make it meaningful to evaluate sub-spaces that differ on a child scale; the changing functions of the inner courtyard, in turn, make it meaningful to examine the adaptability of common areas to different activities. However, these findings do not lead to the conclusion that visual continuity compensates for spatial depth or that a specific spatial arrangement directly determines children's behavior. The conclusions presented are limited to the Meram AKD Kids example and should be tested comparatively in different buildings to inform broader design recommendations.

5. Conclusions

This study examines the relationship between the spatial uses envisaged in the design of the Meram AKD Kids preschool facility and the findings from its actual use. The evaluation suggests that considering spatial characteristics alongside usage findings can help interpret how design intentions are realized—or deviate from them—in practice.

A comparison between the design intentions and the usage findings reported by the director indicates a degree of overlap that varies depending on the space. The observation that the niches are used for playing, chatting, and spending time aligns with the goal of creating sub-spaces that vary on a child scale. In contrast, the use of the interior courtyard—designed for natural lighting—for play, storytelling, and other activities demonstrates functions that have been added to the original purpose. Therefore, the extent to which design intentions are realized in actual use should be evaluated not through a single, building-wide success metric, but rather through the overlaps and differences specific to each space. These findings do not confirm that designers anticipated children's subjective experiences or the meanings they ascribe to the spaces.

This study presents an exploratory analytical approach that considers design intentions, spatial measurements, and usage findings collectively. Its theoretical contribution lies in discussing the relationship between spatial configuration and usage—in conjunction with pedagogical and administrative conditions—while taking into account the socio-spatial nature of early childhood education settings [16]. Its methodological contribution lies in its approach to comparing different types of information—derived from architectural analysis, observation, educator accounts, and spatial layout analysis—across the same spaces. The practical implications, however, are limited to the conditions of the structure under study. The applicability of this approach to different structures and the transferability of the findings should be tested through comparative studies.

The fact that the study is based on a single building limits the direct generalizability of the findings to different early childhood education settings. Because the observations were limited to a specific study period, changes in usage across seasons and school terms were not assessed. Furthermore, the separate modeling of floors limits the examination of vertical relationships between floors at the building-wide scale.

The percentages in Table 1 are approximate estimates of child distribution provided by the director during the interview. These values, which were not calculated from systematic behavior mapping records, should not be interpreted as measured usage frequency or duration. Observations of activities made during visits that were not included in the systematic records are also not considered quantitative evidence determining the intensity of space usage.

The separate contributions of adult supervision, the daily activity schedule, and conditions of access to spaces to usage patterns have not been determined. Therefore, observed or educator-reported uses cannot be explained solely as a result of spatial configuration or children's independent spatial preferences.

In addition to these limitations, the fact that one of the authors, Göktürk Peker, is one of the architects who designed the building under study may contribute to the transmission of information regarding the design process but could also influence retrospective interpretations. Information gathered after the building's use may shape how the initial design objectives are recalled and explained. For this reason, the architect-author's explanations regarding design intentions and the usage findings reported by the school principal have been treated as distinct sources of information. The researcher's position in this regard should also be taken into account when evaluating the findings.

Future research should include comparative studies covering structures designed specifically for preschool education, as well as structures converted from other uses, and different floor plan typologies. In these studies, age groups, pedagogical approaches, adult supervision, daily schedules, and access conditions should be recorded together to evaluate the relationships between spatial characteristics and usage. Repeated observations across different seasons and school terms can contribute to examining changes in usage over time. Models incorporating inter-floor relationships and movement simulations compared with field data can also expand the scope of the current analysis. Children's spatial experiences, meanwhile, should be investigated separately using age-appropriate methods. Broader design recommendations should be based on comparative evidence derived from testing these relationships across different case studies.

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Institutional Review Board Statement: Institutional ethics committee approval was not obtained prior to conducting this study. The research combined architectural space syntax analysis with feedback obtained through discussions with the school owner. This participant was informed of the research purpose and asked to sign a consent form to the use of his feedback in the publication.

Informed Consent Statement: Consent form was obtained from the school owner who participated in the discussions. He was informed of the purpose of the research and agreed to the use of his feedback in this publication. Interpretations of children's use of the spaces were based on his feedback. Photographs depicting children were obtained from the school's publicly accessible webpage (facebook). No separate parental or legal guardian consent was obtained for the use of these photographs in this study. The children's faces were blurred in the images prepared for publication to reduce identifiability.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The architectural drawings and observation records are not publicly available because they contain information belonging to the institution concerned.

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Abbreviations

The following abbreviations are used in this manuscript:

Term	Definition
VGA	Visibility graph analysis
POE	Post-occupancy evaluation
Integration-n	Integration value normalised with respect to system size

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