Post-Occupancy Evaluation and Children's Satisfaction with physical configuration and indoor environmental quality in Egyptian Orphanages

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Abstract. This research focuses on children's satisfaction in Egyptian orphanages. It aims to evaluate the existing physical configuration and indoor environmental quality within a particular orphanage in Egypt to ascertain children's satisfaction with their built environment. A mixed methods approach was used .Quantitative method for conducting post-occupancy evaluation survey with children 12/18 years old as pilot study. While Qualitative method was employed through semi-structured interviews with two groups of children 6-11 years old and 15-16 years old. The results showed that children have a positive perception of their environment, high appreciation with available services and assessed their environment as a home where their basic needs were met. They also indicated dissatisfaction with the available physical disabled access. However, some of the children felt that their environment could be enhanced with some recreational needs, such as the existence of a gym and swimming pool. It was found that their requirements and desires for space were different. It is recommended that the design of future orphanages should consider the perceptions of children to provide them with effective facilities.

1. Introduction

Although Egypt has 1.7 million orphaned children [1], the number of children between the ages of 0 and 17 who are currently registered in orphanages is 12,015 [2]. According to Freundlich [3], orphanage is defined as a residential childcare facility that is intended to care for children from the time of their admission until their maturity or emancipation, and which holds itself out as an acceptable or superior substitute for the children's families.

A child is never expected to start or continue his/her life journey without parents' embrace. Unfortunately, there are unlucky ones who are forced to go through the journey of life without the affection of their parents. These children were reallocated to orphanages and raised by the government or private funds with basic facilities. An Orphan is "a child under 18 whose mother, father, both parents, and a primary caregiver has died, and who needs care or protection." All over the world, orphans in the past and present have lived in homes called orphanages or children homes. Orphanages should serve as an ideal built environment that will enhance the growth and development of its inhabitants. Orphanages in Egypt are typically operated by the government or non-governmental organizations (NGOs) and provide housing, food, and education for children who are without parents or whose parents are unable

to care for them. Most orphanages have been neglected by the government, architects, designers, and general public [4]. Especially in Egypt orphanages are religion-based [5]. Many individuals open orphanages for the religious benefits of sheltering an orphan, without taking into consideration the other very essential psychological and social aspects of raising a child [6].The majority of constructed orphanages are not designed for the orphanage [7]. In most cases, the basic needs are fulfilled, but the designed space cannot be classified as a child-friendly environment to develop them and gain satisfaction [8]. Unfortunately, most of these orphanages lack a conducive environment that will aid interaction among these children, thereby raising concerns about their social wellbeing.

This paper is part of an ongoing research which focusses on understanding children's satisfaction and needs regarding the existing physical configuration and indoor environmental quality of Egyptian orphanages and to propose recommendations for the design of future orphanages in Egypt.

2. Literature Review

When studying young children's satisfaction there is a problem to find suitable methodologies with which to understand their voices and perspectives. There's been a growing interest in devising novel methodological approaches to conduct research involving children, focusing on research with and for children rather than research solely about them[9].

Post-Occupancy Evaluation (POE) methods involve collecting data from building occupants and users, analyzing the data, identifying areas for improvement, and implementing changes based on the findings. The goal of POE is to improve the quality of the building or space and enhance the well-being and satisfaction of the occupants. For example, a previous study [10] reviewed the recent literature on the application of the POE methodology to assess IEQ in different types of buildings. This study provides both qualitative and quantitative assessments of the main factors that comprise IEQ, such as thermal comfort, air quality, lighting quality, and acoustic quality. The article also suggests some common approaches and methods for conducting POE studies, and identifies the factors that most influence IEQ satisfaction.

Another study[11] analyzed the association between building characteristics and IEQ in different rooms (classrooms and offices) and occupants (students and lecturers) using POE surveys in 26 higher educational buildings in Spain. This study identified the building characteristics that influence IEQ perceptions of different rooms and occupants, such as lighting control, shadow control, and HVAC control. The article also provides recommendations for facility managers to improve IEQ based on user satisfaction.

Similarly, Park et al. presented a case study of the POE for a school building in Slovenia using both subjective surveys and objective measurements of IEQ parameters [12]. This study compares the results of surveys and measurements to evaluate the performance of buildings in terms of thermal comfort, air quality, lighting quality, acoustic quality, spatial quality, aesthetic quality, health quality, safety quality, and maintenance quality.

This article also discusses some limitations and challenges of POE methodology. And by using this method with children, for example [13], an assessment of 49 accredited orphanages in Liberia was conducted. The assessment of orphanages aims to improve the care and protection of children in orphanages in Liberia. The assessment of orphanages aims to improve the care and protection of children in orphanages in Liberia. It also gathers information on the quality of care services being provided to determine the capacity of orphanages to provide care to children. The main method employed during the assessment was direct interviews with children living in orphanages, orphanage proprietors, and/or caregivers and community members living near the orphanages. Both qualitative and quantitative information was gathered, and photographs of interesting scenes were taken. The main Findings of the assessment of 2,224 (1,184 male, 1040 female) children were recorded in the 49 orphanages. 33 of the 49 orphanages assessed, 33 were found to operate within the minimum standards required by the 1999 guidelines[14]; all 49 orphanages assessed had poor managerial childcare practices (such as protection, security, hygiene/sanitation, etc.), and there were no medical facilities in all orphanages assessed. Only five of the 49 orphanages assessed have very good sleeping quarters (Phebe Gray, SOS, Bishop Judith

Craig, Hebron Homes and Liberia Missions). In contrast, the remaining 44 had deplorable and congested sleeping quarters, which contributed to poor health and hygiene.

Over a 10-year period, the Centre for the Built Environment (CBE) at the University of California Berkeley conducted approximately 600 post-occupancy evaluation surveys collecting information about the satisfaction of building occupants in relation to several indoor environmental quality parameters and buildings[15] . List of parameters is presented in Table 1.

Table 1. A list of parameters related to physical configuration and indoor environmental quality to be assessed by the CBE occupant satisfaction survey

Category	Questionnaire item
Layout	Amount of space available for individual work and storage
	Level of visual privacy
	Ease of interaction with co-workers
Furnishing	Comfort of furnishings
	Ability to adjust furniture to meet your needs
	Colours and textures of flooring, furniture, and surface finishes
Thermal comfort	Temperature in your space
Air quality	Air quality in your space (i.e., stuffy/stale air, air cleanliness, odours)
Lighting	Amount of light in your space
	Visual comfort of the lighting (e.g., glare, reflections, contrast)
Acoustic quality	Noise level in your space
	Sound privacy in your pace (ability to have conversations without neighbours overhearing and vice versa)
Cleanliness and maintenance	General cleanliness of the overall building
	Cleaning service provided to your space
	General maintenance of the building
General comments	Your personal workspace
	Building overall

Overall, POE methods can be a useful tool for assessing the physical configuration and indoor environmental quality of orphanages, and identifying areas for improvement. Using POE methods and implementing changes based on the findings, orphanages can create an environment that is both functional and supportive of the needs of their residents.

3. Methodology

This section explains the adopted research methodology and case study selection criteria. A mixed-methods research approach was used that combines both quantitative and qualitative research approaches. First, the author started with a questionnaire as a pilot study and the author has conducted semi-structured interviews with children of two groups.This approach can provide more comprehensive and nuanced insights into complex phenomena, such as building occupant satisfaction with the physically built environment.

### 3.1 Dar Al Medina Al Munawarah Orphanage as a case-study

Dar Al Medina Al Munawarah Orphans Care is a private organization and a charity that aims to provide care, education, and development for orphans. The orphanage is not a governmental organization but is supervised and regulated by the Ministry of Social Solidarity. Dar Al Medina Orphanage is a branch of the Medina Orphan Care Foundation, which was founded in 1992. The site is shown in Figure 1 the Layout of Al Madinah Al Munawarah Orphanage on the Tenth of Ramadan City, East of Cairo, Egypt. The site is different from other orphanages because it is located between an industrial and a residential education area in Figure 1. It was originally designed by the architect as an orphanage.

The land area is about 4,200 m^2 and the building is 400 m^2. The building consists of five floors and a basement. The basement consists of storage room, a laundry, a main kitchen, and rooms for service workers. The ground floor contains the main entrance, the main administration of the orphanages, the

dining hall, and the prayer spaces, and a table-tennis. The first floor is an administrative floor, the second, third, and fourth floors are for the orphans, as shown in Figure 2. They consist of bedrooms, a living room, a study space, bathrooms, and the supervisor's room. The number of children in this orphanage was 24 children and 3 children with mental disabilities age 15 years old. This orphanage for one gender all of them are male. The children live on the same floor, divided into three children of the same age who live in the same room. The children were divided into two groups. Four children age of 6 to 11 years, and seventeen children age of 12 to 18 years.
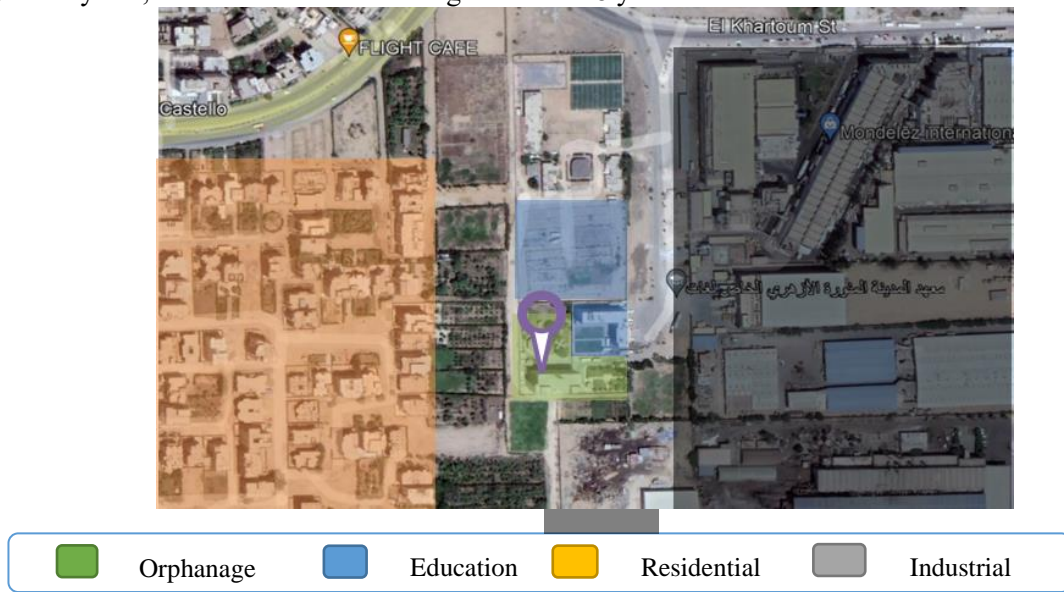
Figure 1. Layout of Al Madinah Al Munawarah Orphanage on the Tenth of Ramadan city (Google Earth, 2024)
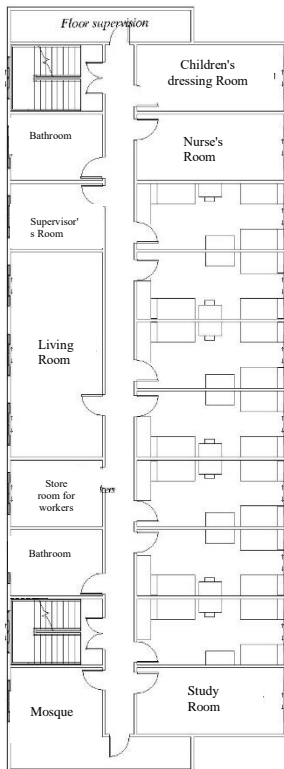
Figure 2. Typical floor plan for orphans' rooms (Author, 2023).

Figure 3. The main building for Al Madinah Al Munawwarah Orphanage (Author, 2024).

3.2   Questionnaire design

First, the author started with a questionnaire as a pilot study. The questionnaire included children 12 to 18 years old. Children under 11 years of age and the three children with mental disabilities were intentionally excluded from the questionnaire because based on the literature they don't usually provide real and meaningful response[16]. It must be noted that the environmental aspects stated in the results were thoroughly explained to the children before their data were classified. The questionnaire design followed the structure of the CBE core satisfaction survey but with minor amendments. Based on a literature review, the questionnaire was administered on paper in Arabic and was estimated to take 15–30 minutes. The quality vote below (figure 4 to figure 7) depicts this information graphically. Evaluations were collected on a seven-point scale ranging from very satisfied (+3) to very dissatisfied (–3), with a neutral midpoint (0) indicating great quality, absolute comfort, or satisfaction. The questionnaire had four sections for children according to the parameters assessed by the CBE: basic information, functional requirements, indoor environmental quality, and building operation. The functional requirements section is classified into size, number, access, and relationships/zoning. The indoor environmental quality section covered thermal comfort, air quality, lighting, and noise. The building operation section includes safety and security, cleaning, and routine maintenance. The last question asked for additional comments. The results were analyzed in the form of graphs, tables, and charts.

3.3   Semi-structured interviews

Based on the questionnaire findings, the author has conducted semi-structured interviews with children of two groups; a group from 6 to 11 years old and another group from 15 to 16 years old. The group discussions lasted for approximately 45–60 minutes. Thus, when analyzing data from semi-structured interviews, the most common one is thematic analysis. Thematic analysis is the process of identifying, organizing, and interpreting patterns or themes in the data relevant to the research question [17]. These qualitative methods can provide more in-depth insights into the factors that influence children's satisfaction with the physical built environment and can help contextualize quantitative data.

Overall, using a mixed methods research design can help to provide a more comprehensive and in-depth analysis of children' satisfaction with the physical built environment and can provide valuable insights for building owners and managers to improve the quality of their buildings and spaces.

4.   Results & findings

The gathered data from a pilot study the questionnaire were processed with Microsoft Excel. The outcome of the survey based on the subjective opinion of the children was tabulated and graphed (using mean and percentage values) in IBM SPSS Statistics 20.

4.1   Analysis of the questionnaire response

The POE questionnaire was conducted in March 2023 as a pilot study at the Al Madinah Al Munawarah Orphanage. 17 children participated in this questionnaire. The main spaces for the children are found to be the living spaces and the study rooms (Figure 2) where they spend most of their time, they use their bedrooms just for sleeping and for changing clothes. The children provide input on the functional requirements regarding size and number of spaces. Figure 4 demonstrates that children express high satisfaction levels with the size and quantity of living and dining spaces, at 94.1% and 88.2% respectively. Figure 5 illustrates the occupants' evaluation of the building's access, indicating their appraisal of functional requirements at this aspect. Children indicated their dissatisfaction with the accessibility configurations for children with physical disabilities (88.1%). They are very satisfied and could find easily vertical & horizontal circulation 76.5% & 82.4%, respectively.

Children's satisfaction with their indoor environmental quality. Mean votes (M) for satisfaction questions were calculated and plotted. Highest mean votes for satisfaction with IEQ parameters are achieved with the Quality/level of artificial lighting and Quality/level of daylight (M=+2.8), personal control over light quality (M=+2.6), air humidity (M=+1.64), air quality (M=+2.17) among air quality environmental aspects and personal control. Ventilation (M=+2.7), only one of the 16 IEQ-tested

parameters received negative mean satisfaction votes. The children's lowest mean ratings, indicating dissatisfaction with Indoor Environmental Quality (IEQ) parameters, were observed for the internal air temperature in the summer for main spaces, specifically the "living room" (M=-1.5) within the Thermal Comfort environmental aspect. Conversely, the internal air temperature in winter received a positive rating (M=+1.00). Personal control and temperature affect productivity (M=+2.4 & +2.17). All children's results were satisfactory with the sound quality but some sources of noise were declared; main sources are generated either from nearby rooms or nearby factory. Overall, they were satisfied with the noise level and sound privacy mean votes (M=+0.7 & =1.00).
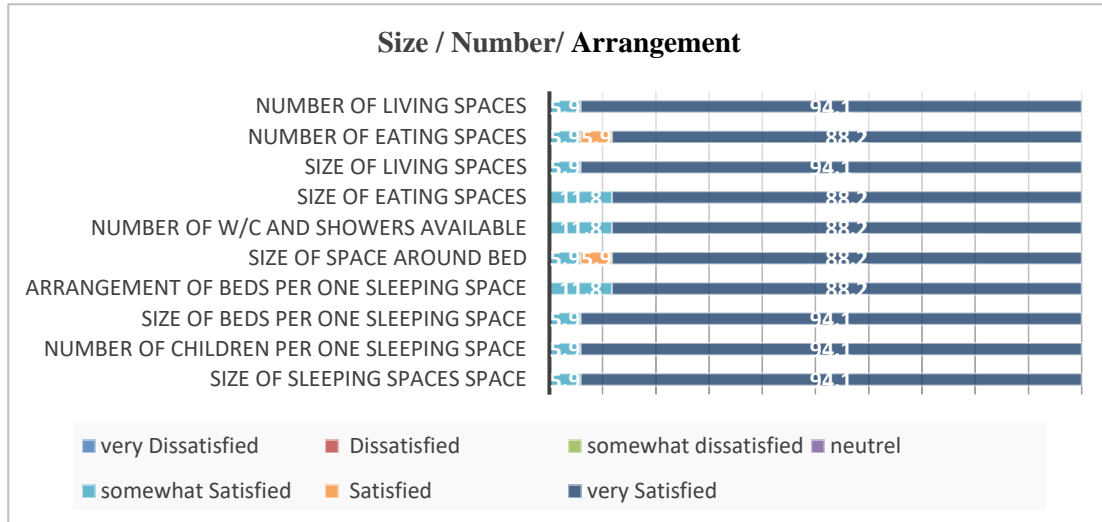

Figure 4. The children's vote on the functional requirements about size & number & Arrangement
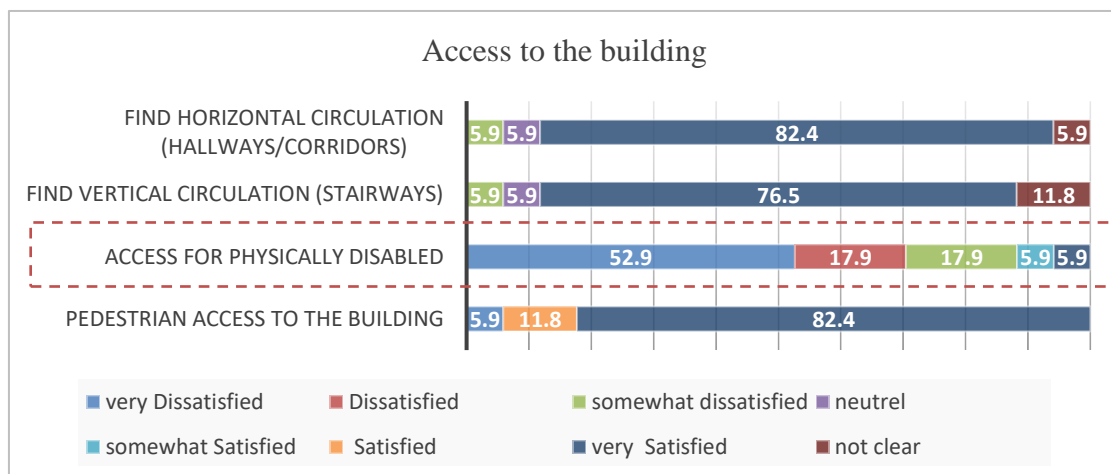

Figure 5. Vote on the functional requirements regarding access to the building

The general vote on the physical environment and its performance for safety and security are represented in Figure 6. They indicated that security inside and outside the building was 94%, but security at night decreased to 65%. This indicates that users feel extremely safe in the buildings and 82% are extremely satisfied on the site. The things that contribute to this safety include the gated property, security guards the gate, lighting quality inside the building, and a familiar community of people on site. The children also mentioned that there were cameras in the place to increase the feeling of safety. Figure 7, the mean vote of the survey on the performance of residential dining and study spaces, showed that 97.3% of the children found their performance to be satisfactory.
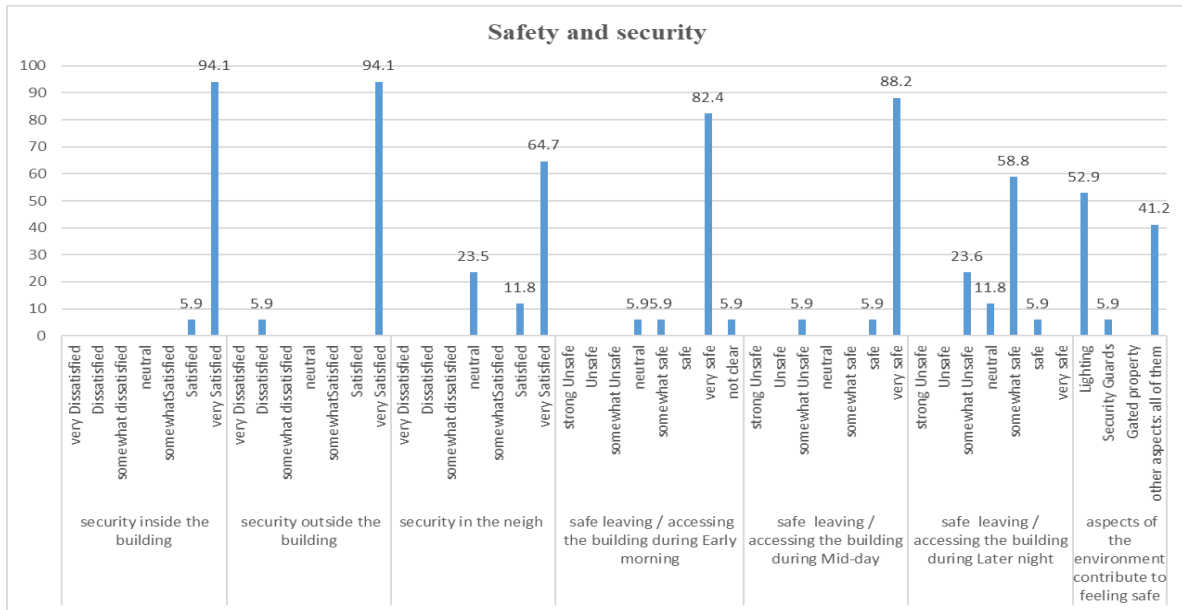
Figure 6. Overall evaluation and rating of the building's safety and security performance.
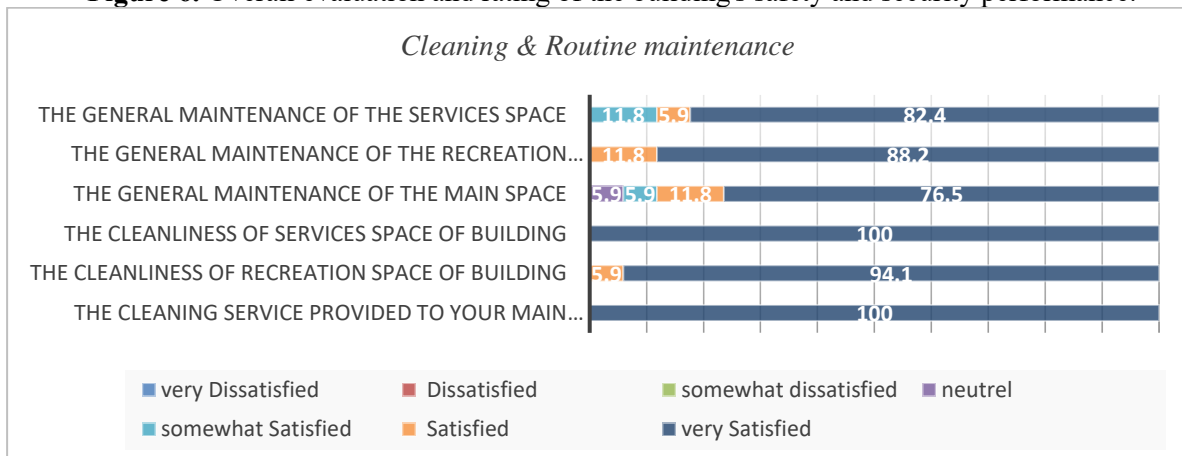

Figure 7. Vote on building operation and its performance for Cleaning & Routine maintenance

4.2   Analysis of the Interviews' Response

Data collection was conducted via on-site visits and semi-structured interviews during February 2024.Interviews were conducted to discuss the results of the questionnaire with two groups of children; one group from 6 to 11 years old children in the meeting room and another group of 15 to 16 years old children in the guest room. The groups' discussions lasted for approximately 30–45 minutes. The author discussed the questions of the questionnaire in the form of an open conversation (
Table *2.* Semi-structured interviews.).

Table 2. Semi-structured interviews.

Questions	Group from 6/11 years old	Group from 15/16 years old	Findings
Main spaces	They agreed that the living spaces and the praying space are the main spaces; the living space is for watching TV and the prayer space is for studying. Study rooms are mainly for preparatory school to study.	Study room & living spaces where they spend most of the time. They do not spend time in the bedrooms except when sleeping and changing clothes only.	The main spaces for children are Study rooms and living spaces.

Size and number for the spaces	Yu: satisfied with the number, size, and relation rooms but they are not satisfied with the study space. It is one room You :I am studying in the prayer area while another brother is studying in the designated study room. There are insufficient study rooms available."	All of them say satisfied with Size and number for the spaces. Ra: satisfied with the number, size, and relation of rooms but they are not satisfied with the study space" I take my books and study in the bedroom".	Children were satisfied with the number, size, of bedroom and living spaces. The number of study rooms is not enough for children.
Access	You: On Friday, we walk to the nearby mosque to pray with the supervisors. If someone needs to buy something sweet, the mosque is a little far away. Hos: I am not satisfied with the access for the physically disabled. He has nowhere to move. Yon: If someone is in a wheelchair, we carry him from the stairs, and if he does not go up, he stays in the supervisor's room. Yas : It is easy to find vertical circulation. The staircase is directly in front of the door.	Ra: Pedestrian access to the building must enter by car or walk from the beginning of the street. Ka: There is no transportation beyond here, all the way to the beginning of the street, but it is easy. No: If someone is in a wheelchair, we carry him from the stairs and he does not go up, he stays in the supervisor's room. Mo: Following the injury to my leg, I was escorted to an upstairs room where I ate and studied. However, I am unable to descend the stairs. It would be greatly appreciated if an elevator could be installed in the orphanage, if feasible.	Children indicate being unsatisfied with the Access for physically disabled. They are satisfied with the easy accessibility to the vertical & horizontal circulation.
Relationships zoning	Yon :" I want a place to eat next to the bedrooms" hos :A space where we all eat together when we are moving, no one signs the "eating service"	Ka: It is better to eat underneath. This is better so that the rooms are not dirty. Mo: the dining hall located on the ground floor so The best thing is to eat below so that the supervisor does not get tired and watches all of us.	The dining space is far from the bedrooms and the living room The opinion of young children in contrast to the older ones.
Thermal Comfort	Hos: about the internal air temperature When the weather is too hot, I turn on the fan. And it is fine. You: We have to open the windows every day in the morning so that sun penetrates the rooms and to ventilate the room. Yon " I want a house with air conditioning like the supervisor's office	No: In summer, the weather is very nice in the bedrooms, but the problem with mosquitoes at night is that we close the window and do not allow air to enter, and we turn on the fans. Ka: The weather is hot in the living room. If it is possible to get just one air conditioner to save electricity.	Rooms seem to be hot in summer and need artificial ventilation. Living rooms or prayer rooms are places where they spend most of their time, and these places face south orientation.
Air quality	They didn't say anything about this.	Ra: I am not satisfied with the air quality because the unpleasant odour persists for hours due to the nearby chocolate factories addressing their violations with cleaning procedures twice a week. Ka: I want to leave the house because of the smell Mo: Can I install an air extractor hood at the door of the orphanage?	Indoor air quality is highly dissatisfactory contrary to the questionnaire results
Lighting	Hos: In the morning the room is well lit, but at night we turn on the lamp Yas: Light all over the place	All of them say satisfied with quality / level of artificial lighting & daylight.	high satisfaction regarding the amount of lighting and level of control
Noise	You, Hos & Yas says that "The factory outside does not disturb Yon : We are the ones making the noise	Ka: the noise is mainly from 7 to 8 in the morning from the educational institute next to us, but it does not affect us very much, as we are having breakfast at that time and are not concentrating. Ra: I take my books and study in the bedroom because the noise is disturbing.	Sources of noise are from children in the nearby room, from the nearby factory or educational institute.
Safety and security	Hos: We require four or five security personnel to prevent any potential robberies at the orphanage. Yas: We have enough cameras Yon: I am not afraid of anything	Mo: There are cameras everywhere in the orphanage, which gives me a sense of security, but I feel like I am being watched all the time I can't feel privacy except in the bathroom. Ra: I am satisfied with security because of Security men and cameras everywhere.	The sense of security and safety is greatly satisfied due to cameras and the presence of guards. Still, at some times, the cameras in the bedrooms pose a threat to privacy.
Cleaning	You: We clean our rooms and the supervisor sweeps the floor Hos : The supervisor assists me with cleaning	They were satisfied with the cleaning service provided to them. Children clean on official holidays.	They are satisfied with the cleanliness of the place and the assistance provided to them

	Not aware of the maintenance work in the building.	Ka: Maintenance is available every day regularly Ra: We have a plumber, electrician, and carpenter here at the orphanage every day from 8 a.m. to 3 p.m.	They are satisfied with general maintenance
Routine maintenance			

If you have any additional comments? Ra: He wanted a balcony in the bedrooms, like the infant building next to us Ka : I want to do some exercises or have a gym, even if it is simple equipment Mo: Every Friday, we go to play football in the field, but the field needs maintenance because it is not the best No: Can I install an air extractor on the door of the house because of the chocolate factory that causes the bad smell? Kr: It is a luxury, I know, but if it is possible, a swimming pool, and if it is not possible we are satisfied and appreciating the place

5. Discussion

The built environment should be developed to accommodate children within the indoor and outdoor spaces where a supervisor can maintain close supervision and help the children explore and develop an autonomous nature. The environmental parameters are related to the operation of installed building systems [18] to achieve a good indoor climate, which is essential for people who spend about 80% of their time in homes or offices. However, We observed that some aspects of the built environment rated positive (good) by the children could not be justified; for example, some routine maintenance was observed to have less satisfaction, as shown in Figure 8, while the chair was broken. Figure 9 shows that the painting of a wall was not in good condition, but all the children said they were satisfied with it in the questionnaire.

Figure 8. Maintenance in Dining Spaces (Author, 2023).

6. Conclusion

Through case study, children's assessments of the quality of the built environment in an orphanage were studied. Conclusions were drawn that influenced the design proposal of a children's orphanage in Al Medina Al Munawarah, 10th of Ramadan City, Egypt. The results from the pilot study questionnaire showed a positive perception of their environment as well as high satisfaction with the available services. The children assessed their environment as a home where their basic needs were met. However, some of the children felt that their environment could be enhanced by adding more of their recreational needs, such as the existence of a gym and swimming pool.

Figure 9. The painting of a wall inside the orphanage (Author, 2023).

However, the children's high satisfaction with most of the questions directed the authors to use a qualitative approach. Semi-structured interviews discussed the questions of the questionnaire in the form of an open conversation with groups of children. Additional findings emerged that were not uncovered by the questionnaire. The author observed variations in their spatial requirements and preferences for space. Space requirements for a 6-year-old child are dissimilar from adolescence. The way of sharing and spending time actively and passively differs with age. The built form should meet the needs of 6-year-olds as well as 18-year-old children. According to these findings, the spaces for children are proposed to be divided into two parts, one for children aged 6–11 and another for children aged 12–18.

All Children commented that access to the physically disabled should be available and in good condition. There should be ramps which should be wheelchair accessible as well as doors and beds. Also, the orientation of the main spaces "living room" for children should take a good orientation like sleeping spaces they spend most of their time in. The number of study rooms must be increased. The results that were not revealed through the questionnaire are that the indoor air quality is highly dissatisfactory because of the neighboring factories, which greatly affects their satisfaction. Another point is privacy. The presence of cameras everywhere makes them feel safe, but they have a feeling of being monitored throughout the day, even in the bedrooms.

The survey aspects, nonetheless, aligned with the children's interviews, either being rated as good overall or satisfying. From the author's perspective, the level of satisfaction of orphaned children is different from the satisfaction of children who have families, while the responses were unexpected. And they must research more about the life requirements of orphans compared to normal children, which affects their level of satisfaction. It is recommended that the design of future orphanages consider the needs of occupants, especially the children, to provide facilities that will be useful and promote the healthy growth of the children.

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