



ARCHITECTURAL ROLE TO ACHIEVE INCLUSION FOR CHILDREN WITH DISABILITIES IN NURSERIES

Heba Mohamed Ahmed Abdou ¹, Rania Abdul lateef Ahmed Ghanam ²

¹ *Dept. of Architectural Eng., Faculty of Engineering, Mansoura University*

² *Dept. of Architectural Eng., Faculty of Engineering, Kafr Alsheikh University*
arch_heba84@yahoo.com

Received 11 December 2019; Accepted 22 January 2020

ABSTRACT

An essential part of society are children including children with disabilities, advocating their rights is essential; therefore, providing a comfortable environment that meets the needs of children with disability and encourage them to engage easily in the society is crucial. Subsequently, applying these fundamentals while designing nurseries in Egypt to voice children with disabilities as these facilities are not up to standards and restricts their contribution to society. The research aims to achieve suitable nurseries for all children through architectural solutions. Internal and exterior spaces satisfying the needs of children with disabilities in learning and enjoying while being independent in the use of spaces easily and safely. The theoretical part of the research highlights the concept of disabled children, the criteria for designing comfortable spaces for them and studies the interior and exterior treatments for disabled children in nurseries. As well as, the analytical part studies the Center for Childhood Care and Development, Mansoura University as a sample for the study. The study recommends applying the architectural standards and treatments in nurseries in Egypt to be qualified for disabled children, applying those points on the existing design, as well as, develop the current regulations to ensure their proper application.

Keywords: Architecture– Inclusion - Children with disabilities – Requirements- Nurseries

1. Introduction

Childhood is the most mesmerizing period of one's life, so it is necessary to pay attention to educational spaces, whether internal or external spaces to contribute and support the spirit of pure childhood and encourage their abilities. Therefore, designers should build a framework to create spaces that motivate talents and ideas for better future, and provide a higher quality learning environment for children with disabilities, as well as offering Opportunities to play and discover [17]. All children have the right to learn, play and discover regardless of their physical and mental differences, so integrating them in the social and educational environment in nurseries must be achieved. As this can help them to socialize and learn many different social skills, and develop successful personal relationships through their practice and inclusion in all educational activities, play and discovery with ordinary children [19]. It highlights the role of the architect in facilitating the movement of children with disabilities and achieving the optimal design of internal and

external spaces for them, in addition to the work of a special code for the requirements of children with disabilities due to lack of attention to the Egyptian code.

2. The concept of children with disabilities

They are children with congenital or non-congenital deficits that are constant in one of their senses and they have special needs that make them unable to live their lives normally without caregivers. The disability can be divided into motor, mental, behavioral, emotional, and learning disabilities, and sensory, including verbal, auditory and visual disabilities [12].

According to the Law for the Support of Childcare Facilities no child may be refused admittance to a childcare facility due to the type or severity of a disability or because of special needs, 'Tasks and Objectives of Support' it is stated that the communal life of children, lived side-by-side with and without disabilities, should be promoted as part of the fundamental right to equal inclusion [16].

This research discusses architectural solutions that help in children with different physical abilities inclusion.

3. Flexibility

Nurseries should be flexible for everyday use and adaptable over time to meet the current and future needs of children with disabilities. It should be committed to ensure that all children are able to access the variety activities services, and feel welcomed, according to the following:

- Being able to adjust the environment locally for a variety of learning needs, rationalizing spaces so their functions can change over time, as shown in Figure1.
- Having access to different sizes of space (possibly by moveable partitions) to suit different needs, minimizing fixed furniture, fittings, and equipment to allow re-arrangement for different activities and changing needs [22].
- Providing the class with ICT equipment, network computer workstations, and interaction whiteboard and/or plasma screens will allow students with visual impaired to benefit from the learning process [21].



Fig. 1. Rationalizing spaces so their functions can change over time. [22]

4. Architectural criteria and requirements for children with disabilities in nurseries buildings

The architect should consider disabled children as a main priority when designing nursery buildings to be perfectly suitable for them, as well as consider the appropriate dimensions for the design elements such as doors and distances between furniture, equipment, and the entrance and corridors width.

4.1. Entrances and corridors

The entrance to the building must be clear for all users from a sufficient distance, it should be wide enough for easy entry and exit of wheelchair users, the doors should be operated as easily as automatic sliding doors, If the entrance is in a different level, a ramp

should be made next to the stairs. The arrival court should be safe for children and accessible, and there must be a good visual connection between the inside and outside through the supervision of the entrances to be more secure [22].

The **ramp** is a sloping surface to facilitate the movement of the chair towards the main entrance and any other entrances, The degree of inclination is between 1:16 and 1:20 (This tendency is best suited for wheel-chair users of children where the ability and physical strength of children differ from adults), There should be a break in the slope if the horizontal dimension of the slope exceeds 6 meters to take into account the child's ability to move, at the entrance to the building and corridors and different levels that change their levels as shown in Figure 2. [20]

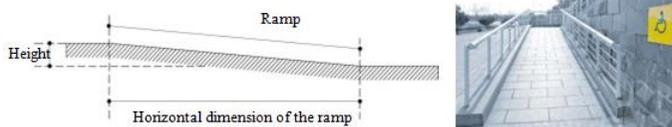


Fig. 2. Explain the criteria for the ramp needed for wheelchair users. [20], [23]

The **handrail** should be with different heights to serve and support all children of different ages and abilities, the height of the handrail is between 50-60 cm as well as, the handrails should not exceed 22.86 cm to protect children from the risk of falling.

The **corridors** width should appropriate and it is recommended that the minimum width of the corridor be 180 cm, it is better to have a width of 2 m net, in areas of circulation preferably the width of the corridor at the turn of 2.7-3 m. [22] Provided support handles for movement, exclude using columns, thresholds, water coolers and flower beds in the corridors. [8]



Fig. 3. Shows the handrail mounting distances to the walls. [5]

4.2. Spaces design criteria

4.2.1. Classroom design criteria

When designing the classroom, the following criteria should be considered:

- Preferably not less than 65m² separation area is enough for 6-8 children. It's a Must provide a quiet corner or space where child can have privacy, rest and calm, as well as, provide a corner for the computer. [22] Design square or near square rooms, which are more flexible and functional than rectangular rooms and which reduce distances between users, this configuration enables to set up many distinct activity areas while leaving enough room around these areas for circulation. [6]
- Classes should be on the ground floor to provide easy access for children with disabilities; it should be close to the entrance to reduce the distance on children. Classes should be designed with the non-existence of any columns in the classroom, which ease the movement in the space. Exclude using levels in the class space.
- Sufficient width between rows to provide safety for wheelchair user's and ease their movement, preferably 90 cm wide, There must be enough floor space for their movement equivalent to a circular area of 140 cm to be able to rotate and fully move. [20]

Measurements for wheelchair users are essential data to design the furniture in order to enable safe motor performance and to use the building easily on their own.

The work tables: It should be designed with a appropriate height and size to fit all the space users. It is useful to provide work tables with adjustable height but may be more expensive, as shown in Figure 4, Avoid drawers, storage shelves, or other obstructions under the table. Offer tables with tilting tops to facilitate the reading and writing needs of some children, select tables at least 900 mm wide and 500 mm deep. [2]

The height of the top table serving wheelchair users as shown in Table 1 showing the height difference between wheelchair and ordinary children.



Fig. 4. Adjustable tables allow for children's different needs. [22]

Table 1.

Elevation difference between wheelchair and ordinary children. [3]

	4 years		8 years	
	Wheelchair users /cm	Ordinary children / cm	Wheelchair users /cm	Ordinary children / cm
Head height	101	87.5 - 98.5	113	99 - 110
Level of sight	90	68 - 77.5	102	88.5 - 100
Board height	46	30 - 32	46	42
Table height	67	50 - 52	70	66

Playing tables: knee clearance 61 cm high, 43 cm deep, and 76 cm wide minimum shall be provided. The tops of rims shall be 78.5 cm high maximum [5]. Table 2 provides guidance on reach ranges for children seated in wheelchairs:

Table 2.

guidance on reach ranges for children seated in wheelchairs. [25]

Children's Reach Ranges		
Forward or Side Reach	Ages 3 and 4	Ages 5 through 8
High (maximum)	91.5 cm	101.5 cm
Low (minimum)	51.0 cm	45.5 cm

The seats: Provides a horizontal space of 48.5 cm to enter the wheelchair under the table or counters installed, width required for wheelchair space 76.6 cm as shown in Figure 5. [20]

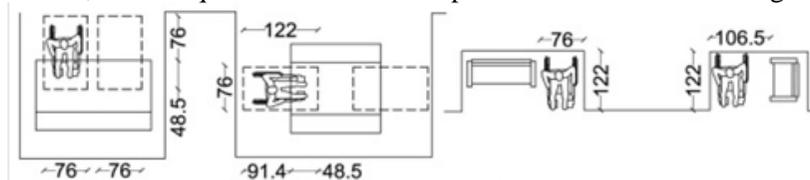


Fig. 5. Sitting dimensions for children. [20]

4.2.2. *The openings*

All openings must be wide enough to give easy access for all users, have the appropriate strength, impact resistance and durability, robustness and integrity, be smooth and easily cleaned and maintained, All external doors should be easy to operate or automatic (preferably sliding), need to ensure that all users, including those with visual or hearing impairments and wheelchair users, could operate it. [22]

The doors open in the classroom towards the inside of the classroom and not towards the corridors, in a simple retreat with enough space to serve the movement of children using wheelchairs, to avoid the problems of congestion in the corridors. [20] The opening of doors in bathrooms and small rooms should be to the outwards to avoid falling of disabled children behind the door and it's more difficult to reach and save them [23], The minimum opening for any door is 82 cm. [18] In the interior doors should be provided lower bumpers of a height of not less than 40 cm used as bumpers for wheelchairs and be of aluminum or galvanized sheets or any material resistant to friction and shocks. [7] Door handles are placed at appropriate height at the fingertips of Children with Disabilities. Door fittings of handles and locks are placed between 76.2-86.36 cm above the floor to suit wheelchair users.

Avoid fully glazed doors which are hazardous, especially for children with visual impaired and blindness. [2]

Windows is essential to provide natural lighting, it provide visual contact with the outside world, It is important to design windows at heights that fit the level of vision for both ordinary and physically disabled children. The height of the window sessions ranges between 76.2 - 86.36 cm with the addition of partitions for protection without obscuring lighting and transparency at the same time. [20]

4.2.3. *Bathrooms*

The design and fixtures should reflect the age of the children and help them develop personal care skills, so consider the following when designing toilets:

- Sewage and water pipes should be covered so as not to impede movement; expulsion fund should be his handle in a location easily accessible. [4]
- Fittings should be sturdy and at an appropriate height accessible, washbasins may be of adjustable height or fixed height suitable for wheelchair users.
- Attention should be paid to the special equipment of disabled children, for example, the use of long arm handles with taps or infrared equipment to overcome the difficulties faced by such children, and should choose where to put the soap dispenser and towels in places suitable for them to use, as shown in Figure 6. [22]



Fig. 6. Adjustable height wash hand basins and lever taps may be needed; hand-wash stations are installed at two height levels. [22]

- Provide a sufficient space under the wash-basin so that the child using the wheelchair can approach and use a chair, as shown in Figure 6. [11], the height of the sinks ranges between 50.8- 60.96 cm. adequate floor space of 76.2cm wide and 121.9cm long in front of the washbasin provides an easy and safe movement for wheelchair users.
- It is recommended to place the water faucet at a maximum depth of 35.56 cm from the front edge of the sink to suit children. A circular area of 140 cm should be available within each bathroom for wheelchair children users. [20]
- The dimension between the middle of the toilet chair and the adjacent wall should be 30.48- 45.5 cm in general for children aged 3-12 years. [14] Hand-wash stations are installed at two height levels considering the use of wheelchairs and the difference in physical size.
- Urinals: Provide a floor area of 91.44 cm wide and 111.76 cm length in front of the urinal. The height of the urinal rim is 35.56 cm at most. [20]

Accessories in the toilet:

Cushions are placed in the bathrooms near the toilet chair to help the child wheelchair in motion and be installed on the adjacent wall and back of the toilet chair, the lengths of the cushions are similar to the lengths used for cushions in adult toilets where the length of the side cushions is 106.5 cm and the length of the backrest is 91.4 cm, the height of the cushions for wheelchair users of children ranges from 45.72 to 63.5 cm depending on the age as shown in Figure 7, 8. Water flow control valve is placed in toilet seat at ranging from 91.44 to 101.6 cm. Toilet paper tray placed at heights between 35.56 - 43.18 cm, The following table 3 shows the dimensions of toilet facilities for children by age. [14]

Table 3.

Dimensions of toilet facilities for children by age. [14]

	3-4 years	5-8 years
After the middle of the toilet chair for the adjacent wall / cm	30.48	38.1
Toilet chair height / cm	30.48	30.48 – 38.1
Height of side and rear cushions for toilet seat / cm	45.72 – 50.8	50.8 – 63.5
Height of water flow control valve in toilet chair / cm	91.44	101.6
Paper tray height in toilet / cm	35.56	35.56 – 43.18

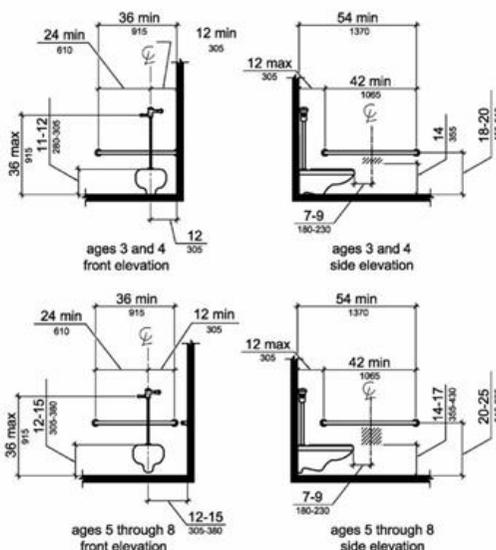


Fig. 7. Dimensions of children's toilet facilities by age. [14]



Fig. 8. A restroom for those with impaired mobility; a crib for changing diapers. Takachiho Kindergarten-Suginami Ward, Metropolitan Tokyo. [24]

5. External spaces and coordinated to achieve inclusion

Play is a vital role to help children to take their first step into the wider world especially for those with disabilities; where they can discover and learn things by experience and playing with objects and materials. Therefore, involving creative learning methods help them to solve practical problems and bring emotional balance [13]. Subsequently, designing these spaces should be accomplished with consideration of the following:

- Design barrier-free corridors such as plants, shrubs, and signboards, they should be positioned outside the path of the trail as much as possible to avoid impeded the movement for all children with disabilities. Minimum width of corridors 90 cm or 150 cm is used for the passage of two adjacent chairs preferably 180 cm width. Do not exceed the allowed slope of the corridor 1:20. Plants whose seeds or fruits fall on the path and cause disability and slippage should be avoided. Care must be taken in the selection of plant species and it is necessary not to use poisonous or forklift plants. [20]
- The rest seats are placed outside the main corridor and added to the lounge seats additional space adjacent minimum 120 cm to place the wheelchair. [20]
- The floor of the corridor must be rough in texture and has no curvy surface that impedes the movement of the children with disabilities. In the case of large areas of sand or grass must be made corridors intersecting to provide access to disabled people to all services by wheelchairs. [7]
- Adjustable outdoor furniture of different heights that allow a wheelchair front-on access for all activities including water play, interactive panels, raised gardens, troughs, and sand. Variable turning circles of wheelchairs vary depending on the size and type of chair, as shown in Figure 9. [9]



Fig. 9. Elevated sandboxes allow easy wheelchair access to one of the most desirable play areas in the playground, and design play to suit children with disabilities. [10]

6. Safety and security

There are some considerations to can enhance safety in the space:

- Accessibility-the mounting height and shape should allow all users to control the handle. Electronic door entry system–need to ensure that all users could operate it. Low-level windows with safety glazing to be accessed to young children.
- Adequate space should be provided for children (ordinary children and with special needs) to gather at the beginning and end of the day inside the building and avoid overcrowding to ensure the safety of children. [22]
- Furniture, toys and equipment are carefully designed to create excitements, in maintainable, non-toxic and conform to recognised safety standards. They should be free from rough edges, sharp corners, splinters, exposed bolts or nails. Furnishings: Rounded/chamfered corners and edges (radius of 10 mm). [16]
- Install covers over drains that cross external paths and they should be at the same level of the pathway to avoid tripping. [2]

- Lighting must take into account the different needs of children with disabilities. Children with visual impaired, need lighting levels that enhance their sight. Those with hearing impairment need clear visibility for lip-reading and signing, for using signage and way finding. Designs should avoid glare, silhouetting, reflections, shadows and any other interference that causes visual confusion.[22]

6.1. Finishing materials

The paving should be completely consistent and avoid gaps in-between, in order to don't disrupt or put wheelchair users endanger. It's important also to Use a different flooring material, texture or color for example, using a different material in the entrances and in the different levels, where Changes in texture, shape and colour can all help children with disabilities to orientate themselves [7]. Semi-light-colored tiles should be used to mitigate the effects of wheelchairs on the floor, to facilitate the monitoring of changes in floor surfaces and to avoid obstacles. [23] Floors should be slip-resistant in both dry and wet situations, the slip coefficients of adjacent floor finishes need to be similar. [2] Carpet is not recommended as it is not hygienic and makes traffic. It may not be suitable for children who might be affected by dust that can accumulate in a carpet.[22]

Tactile floor indicators for the Blind and visual impaired, grey rubber with patterned indented surfaces that children can feel under their feet is attached on both sides of the corridor floor. Braille blocks are installed under the entrance of each room and the room name is displayed in Braille on the handrail [11]. Typical floor indicators use material combinations such as concrete pavers, small paving stones etc. to create conspicuous visual and tactile contrasts. These contrasts are useful for children who are blind, who sense them using a white cane, as well as for visually impaired children through foot contact [16], as shown in Figure 10.



Fig. 10. Tactile floor indicators for the Blind and visual impaired. [16]

The walls should be constructed of materials that allow the installation of Grab bars that help disabled children easily move [23], as shown in Figure 11. All corners in the walls should be non-sharp and with some rotation, avoid any projections in the walls that may affect the safety of disabled children [7], the walls should be covered with soft but rigid, shock-resistant and non-scratch-resistant materials to reduce the risk of child self-harm. [22]



Fig. 11. handrails are installed on the walls, for all children of different ages and abilities. [11]

6.2. Finishing materials for outdoor playgrounds and games

Playgrounds should have combinations of natural and artificial flooring as each has certain qualities and supports certain activities. Consistent finishes of flooring in playground to ease the movement of users. Avoid materials that preclude their movement, such as keeping away from gravel, sand, and wood in the floors [15].

Rubber is the most recommended material to be used in playground areas where there is a need for impact absorption and slips resistance. As well as, ease the movement of Children with Disabilities, as shown in Figure 12. [10]

Outdoor play elements should be firm and smooth to avoid injury. In order to, motivate all users to participate and integrate disabled users in play space as shown in Figure 13. [15]

The most common materials in playground equipment:

Avoid sharp elements, edges should be round, Safety distance between the elements should be taken into consideration:

Timber is a natural material, it is cost-effective, can be painted if necessary, it needs to be protected with a protective coating, hard timber should be selected.

Stainless steel is the most durable material, easy to maintain, it can be thinner in comparison to wood elements, it is more resistant to vandalism than timber, dark colors should be avoided as they absorb heat.

Plastic is popular in small playgrounds as they are cost-effective, usually in strong, less durable than steel or wood. [10]



Fig. 12. playground with mixed materials, and use rubber in Playground floor [1]



Fig. 13. The playground must become more accessible. [26]

6.3. Furniture

Furniture should be designed in an appropriate way to fit the children scale and size, therefore, it should be stable enough to prevent easy tilting, particularly important for supporting children with poor control of motion, balance or coordination skills, with rounded edges to prevent injuries, it have to be properly maintained and cleaned to function safety, open joints or projections should be avoided which allow dirt and dust to gather. [2] Use an appropriate material such as a fire resistance and compliance with health and safety standard. Provide appropriate type of multi-purpose elements for disabled users, such as plastic-coated foam-filled shapes, foam-cushioned support seats or armchairs, rocking and swinging chairs and feeder seats. [22]

6.4. Guiding signs

Guiding signs must be well designed and placed to offer a visual communication, Colour, texture, acoustics and lighting, as well as landmark features, can all help children orientate themselves inside the nursery.. Therefore, keep the content clear and simple in order to be easily understood for example spotted with target lights, using a color code for each room, providing good color contrast, as shown in Figure 14. Locating signs consistently for all doors around the Nursery. The height of signs should be at the eye level of the average child or between 1.2 m and 1.5 m from floor level, placing signs about 200 mm from the door on either side of the handle. [2] Placed at junctions or in long passageways to indicate the directions and using voice signals which react to movement or other triggers [10] provide embossed tactile lettering, incorporating Braille where required, for instance on classroom doors ,avoid bright or shiny surfaces that can be distracting [22].



Fig. 14. Models of Guiding signs. [8]

7. Analytical study of the center for childhood care and development, Mansoura University

The center was established in 1985 at Mansoura University. The president of Mansoura University adopted the special care unit for the center in 2002. It accepts children with different disabilities (All types of disabilities) from 2-15 years old. [27]

This center was selected as a sample of study, where the Center for Child Care and Development is the only nursery that accepts children with disabilities in Dakahlia (through personal interviews with officials of different nurseries and research).

7.1. The objective of the study

Studying the efficiency of the current appliance of the architectural requirements of disabled children and if they are satisfying for users or not.

7.2. Study the extent to which the center of childhood care fulfills the criteria and requirements for children with disabilities

The Child Care and Development Center is located within the faculty members housing area of Jihan Street in Mansoura.

General description of the building:

The building consists of two floors: the Ground floor with an area of 950 m², the First floor area is about 620 m², and the Playground area is about 532 m².

The First floor consists of class and activities hall for disabled children only, It has all types of children with disabilities.

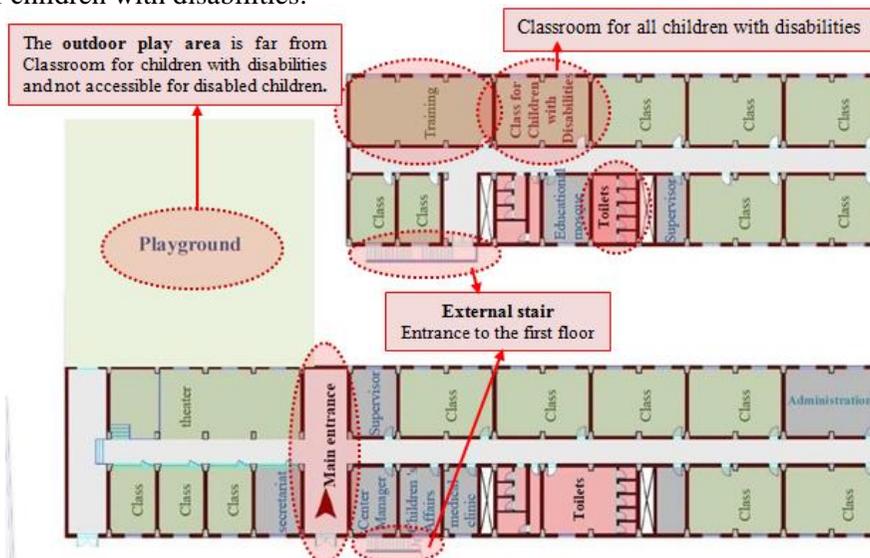


Fig. 15. plan of Ground floor and First floor. [Researchers]

Entrance for disabled children: there is a different level with a staircase and width of 90 cm which impedes the access of the wheelchairs to the space

Table 4.

Study the extent to which the Center of Childhood care fulfills the criteria and requirements for children with disabilities

The criteria and requirements for children with disabilities		fulfill	To some extent	no fulfill	Achievable	Unattainable
FLEXIBILITY	Having access to different sizes of space to suit different needs to allow re-arrangement for different activities		√		√	
	Providing the class with ICT equipment, network computer workstations, and interaction whiteboard and/or plasma screens			√	√	
ENTRANCES	The entrance to the building must be clear for all users from a sufficient distance			√	√	
	The entrance should be wide enough for easy entry and exit of wheelchair users			√	√	
	The doors should be operated as easily as automatic sliding doors			√	√	
	A ramp should be made next to the stairs			√	√	
ENTRANCES	There must be a good visual connection between the inside and outside through the supervision of the entrances to be more secure		√		√	
	The handrail should be with different heights to serve and support all children of different ages and abilities			√	√	
THE CORRIDORS	The corridors width should appropriate and it is recommended that the minimum width of the corridor be 180 cm	√				
	Provided support handles for movement			√	√	
	Exclude using columns, thresholds, water coolers and flower beds in the corridors		√		√	
CLASSROOM	Preferably not less than 65m ² separation area is enough for 6-8 children			√	√	
	Design square or near square rooms			√	√	
	Classes for children with disabilities should be on the ground floor			√	√	
	it should be close to the entrance to reduce the distance on children			√	√	
CLASSROOM	Classes should be designed with the non-existence of any columns in the classroom	√				
	Exclude using levels in the class space	√				
	Sufficient width between rows preferably 90 cm wide, There must be enough floor space for their movement equivalent to a circular area of 140 cm		√		√	
	Work tables should be designed with a appropriate height and size to fit all the space users		√		√	
 <p>Fig. 16: Field photo of the classroom.</p>  <p>Fig. 17: Field photo of Entrance to the first floor through an external staircase.</p>  <p>Fig. 18: Field photo of the corridor. The corridors floors are slippery with wide of 2 m which is satisfying. There is no slope in the whole building and total reliance on stairs to move between levels. There are no railings in the corridors or any technical means that help disabled children to move without obstacles. The corners of the walls are sharp edges. The presence of planting containers in the corridors impedes the movement of disabled children</p>  <p>Fig. 19: Field photo of the classroom for children with disabilities.</p>						
<p>Disabled children have been completely isolated from other children, reducing their participating with ordinary children.</p> <p>The class area is 43 m² and with a rectangular shape 7.8 × 5.5m, and it is located on the first floor, making it difficult for disabled children to access and move.</p> <p>The height of the work table is not suitable for some children.</p>						

Table 4. (Cont.)

The criteria and requirements for children with disabilities		fulfill	To some extent	no fulfill	Achievable	Unattainable
THE OPENINGS	All openings must be wide enough to give easy access for all users	√				
	The doors open in the classroom towards the inside of the classroom	√				
	The opening of doors in bathrooms should be to the outwards			√	√	
	The minimum opening for any door is 82 cm	√				
	In the interior doors should be provided lower bumpers of a height of not less than 40 cm used as bumpers for wheelchairs and be of aluminum or galvanized sheets or any material resistant to friction and shocks.			√	√	
	Door handles are placed at appropriate height at the fingertips of Children with Disabilities between 76.2-86.36 cm			√	√	
	Windows provide natural lighting	√				
	Windows provide visual contact with the outside world	√				
	The height of the window sessions ranges between 76.2 - 86.36 cm			√	√	
	BATHROOMS	Expulsion fund should be his handle in a location easily accessible	√			
A circular area of 140 cm should be available within each bathroom for wheelchair children users.				√	√	
Cushions are placed in the bathrooms near the toilet chair to help the child wheelchair in motion and be installed on the adjacent wall and back of the toilet chair				√	√	



Fig. 20: Field photo of Classroom door.

The doors open towards the classrooms with 90 cm width which is appropriate for children with disabilities, but there are no lacks bumpers that should be placed at the bottom of the door. The existing door openings are normal and not electronic, it made of wood. The door handles are 1.20 m high and are not suitable for disabled children.



Fig. 21: Field photo of Classroom window.



Fig. 22: Field photo of Bathroom.

Table 4. (Cont.)

The criteria and requirements for children with disabilities		fulfill	To some extent	no fulfill	Achievable	Unattainable
BATHROOMS	Fittings should be sturdy and at an appropriate height accessible	√				
	washbasins height suitable for wheelchair users, Provide a sufficient space under the wash-basin so that the child using the wheelchair can approach and use a chair			√	√	
	Attention should be paid to the special equipment of disabled children			√	√	
	Sewage and water pipes should be covered	√				
EXTERNAL SPACES	Design barrier-free corridors			√	√	
	Minimum width of corridors 90 cm	√				
	Plants whose seeds or fruits fall on the path and cause disability and slippage should be avoided	√				
	The floor of the corridor must be rough in texture and has no curvy surface that impedes the movement of the chair			√	√	
	Adjustable outdoor furniture of different heights that allow a wheelchair front-on access for all activities			√	√	
SAFETY AND SECURITY	Install covers over drains that cross external paths and they should be at the same level of the pathway to avoid tripping.	√				
	Furnishings: Rounded/chamfered corners and edges (radius of 10 mm).			√	√	
	The paving should be completely consistent and avoid gaps in-between			√	√	
	Semi-light-colored tiles should be used to mitigate the effects of wheelchairs on the floor		√		√	



Fig. 23: Field photo of washbasins.

Bathrooms have lack in the technical specifications of the requirements of children with disabilities such as the opening direction of doors is towards the bathrooms and the floors are ordinary ceramic which they are slippery.



Fig. 24: Field photo of the Way out to Playground.



Fig. 25: Field photo of the Playground.

Table 4. (Cont.)

The criteria and requirements for children with disabilities		fulfill	To some extent	no fulfill	Achievable	Unattainable
SAFETY AND SECURITY	Adequate space should be provided for children (ordinary children and with special needs) to gather at the beginning and end of the day inside the building and avoid overcrowding to ensure the safety of children.	√				
	Furniture, toys and equipment are carefully designed to create excitements, in maintainable, non-toxic and conform to recognised safety standards. They should be free from rough edges, sharp corners, splinters, exposed bolts or nails.			√	√	
	Playgrounds should have combinations of natural and artificial flooring			√	√	
	Floors should be slip-resistant in both dry and wet situations		√		√	
	It slip coefficients of adjacent floor finishes need to be similar		√		√	
	Carpet is not recommended			√	√	
	keeping away from gravel, sand, and wood in the floors			√	√	
	Tactile floor indicators for the Blind, grey rubber with patterned indented surfaces are attached on both sides of the corridor floor.			√	√	
	Braille blocks are installed under the entrance of each room and the room name is displayed in Braille on the handrail			√	√	
	Handrails are installed on the walls			√	√	
The walls should be constructed of materials that allow the installation of Grab bars that help disabled children easily move	√					

Fig. 26: Field photo of gathering area for children.

There is a sufficient space for children (ordinary children + children with special needs) to gather at the beginning and end of the day inside the building, but it's not facilitated with tools and elements to sit or play.

Fig. 27: Field photo of the Playground.

The Playground flooring made of sand and there are no paved paths for wheelchair users, and the play elements are made of tin iron with defective finishes (sharp edges and corners). The quality of playing elements impeded disabled users to play and participate in the space.

Table 4. (Cont.)

The criteria and requirements for children with disabilities		fulfill	To some extent	no fulfill	Achievable	Unattainable
SAFETY AND SECURITY	The walls should be covered with soft but rigid, shock-resistant and non-scratch-resistant materials to reduce the risk of child self-harm.	✓				
	All corners in the walls should be non-sharp and with some rotation			✓	✓	
	Furniture should be designed in an appropriate way to fit the children scale and size	✓				
	Furniture should be stable enough to prevent easy tilting, with rounded edges to prevent injuries, it have to be properly maintained and cleaned to function safety	✓				
GUIDING SIGNS	Guiding signs must be well designed and placed to offer a visual communication		✓		✓	
	keep the content clear and simple in order to be easily understood			✓	✓	
	Locating signs consistently for all doors around the Nursery	✓				
	The height of signs should be at the eye level of the average child or between 1.2 m and 1.5 m from floor level			✓	✓	
	provide embossed tactile lettering, incorporating Braille where required			✓	✓	
Avoid bright or shiny surfaces that can be distracting	✓					



Fig. 28: Field photo of threshold loves the classroom door for disabled children; this impedes the movement of the child wheelchair users.



Fig. 29: Field photo of furniture in classroom.



Fig. 30: Field photo of Guiding signs.

7.3. Results of the analytical study for the Center of childhood care

As a result of the theoretical study, the criteria and requirements for the analytical study were reached, by analyzing the current status of the Center of Childhood Care as previously, we find that it lacks many of these standards, as shown in Table (5) as follows:

Table 5.

Explains the extent to which the Center of Childhood care fulfills the criteria and requirements for children with disabilities.

Total number of standards 65 standard	Number of criteria fulfilled	21 criterion
	The number of criteria that part of it is partially fulfilled	9 criterion
	The number of criteria not fulfilled	35 criterion

As a result of compiling the number of criteria achieved by the center, we find that they do not exceed 50% of the criteria; therefore, the center needs to develop and strive to achieve the criteria and requirements of children with disabilities in it.

7.4. Suggestions to develop the center of childhood care, Mansoura University for children with disabilities.

The transfer of special classes for children with disabilities in the ground floor to achieve ease of movement and transition for them, moreover design all classes in an appropriate way that integrate children with disabilities with ordinary children according to the previous requirements.

Add elevators to the building or install wheelchair porter on to the staircase handrail in order to ease the accessing to the upper floor. Also accessible ramps near to any changing level and consider the previous requirements. Provide handles in corridors to help disabled children to move easily.

Propose to add another bathroom next to the basic toilets for children with special need according to the previous requirements.

Propose to add door accessories such as an extra pull handle and a rubber slide under the door, as well as, directional signs should be clear.

Adding wide pathways and flat flooring material in the outdoor spaces to ease the movement of disabled children, such as using rubber material. Replace the play elements by another one that provides safety, accessibility and enjoyment for users considering the previous requirements. Modifying furniture in all spaces to fit all users.

8. Conclusions and recommendations

Through the analytical study, field visits and personal interviews as well as, the theoretical study of the children with disabilities special needs, Research Paper emphasizes the following:

- The vital role of the architecture design to facilitate the movement of children with disabilities in educational facilities. The impact of well design spaces is help them to learn by socialize and play, integrate them with ordinary children and Strengthen their self-confidence.
- There is a need to provide awareness about the special needs of the disabled children, keeping architects updated with the newest techniques of accessibility and the importance to useful and utilized design that meet the disables abilities and requirements.

Therefore, research recommends to:

- Raising awareness among architecture students in all faculties about the requirements of the disabled.
- The importance of conducting analytical surveys covering all public and private buildings and knowing how to adapt the design of these spaces and the art of special needs requirements.
- Government should encourage the steps toward improve the children educational facilities environment by don't approve any project unless it addressed the basic abilities and required needs, the design would be useful and utilized to ease the use of the space by all user's abilities.

- Add standards for disabled children to the Egyptian Code of Architectural Requirements for People with Special Needs.

REFERENCES

- [1] Asli SUNGUR, “Designing Playgrounds for All”, Yıldız Technical University Faculty of Architecture, MEGARON, Volume 13, No. 3, Turkey, 2018.
- [2] Australian Government, “Accessibility Design Guide: Universal design principles for Australia’s aid program”, AusAID, Australia, 2014.
- [3] Buckinghamshire and Milton Keynes, “Accessibility by Design: A Standard Guide”, Ten Alps Publishing Ltd, London, September 2007.
- [4] Daoud Mahmoud Al-Ma'aytah, “Building and Open Space Facilities”, Ministry Deputy for Teachers Colleges, Ministry of Education, Riyadh, 2003.
- [5] Department of Justice, “ 2010 ADA Standards for Accessible Design”, New York, (www.ADA.gov), 2010.
- [6] Dogan W. Arthur, Cindy Larson, Amy Gillman and Carl Sussman, “Resource Guide: Designing Early Childhood Facilities”, The Local Initiatives Support Corporation/Community Investment Collaborative for Kids, New York, 2006.
- [7] Housing and Building Research Center, “Egyptian Code for the Design of Exterior Spaces and Buildings for the Use of the Disabled”, Ministry of Housing, Utilities and Urban Communities, Egypt, 2003.
- [8] Ibrahim R. S. Aljowair, “The Fact of The Application of Requirements for People with Disabilities on The Newly Constructed College Buildings at King Saud University”, Journal of Engineering Sciences, Assiut University, Volume 38, No. 6, November 2010.
- [9] Jeavons. M, “Making natural play spaces more accessible to children with Disabilities, Chapter 6 of Outdoor Play space Naturally for children birth to five years”, New South Wales, Pad melon Press, 2008.
- [10] Jure Kotnik, “Architectural Design Guidelines for Early Childhood Education Centers and Playgrounds”, Council of Europe Development Bank, Europe, October 2017.
- [11] Jun Ueno, “A Collection of Exemplary Design of School Facilities for Special Needs Education”, The Ministry of Education, Culture, Sports, Science and Technology, Japan, May 2012.
- [12] Mahmoud Abdel Karim Moftah curio, “Architectural Requirements for People with Special Needs in Multi-storey Residential Buildings in Misrata”, International Journal of Engineering Science and Information Technology, Vol. 4, No. 2, June 2018.
- [13] Malone, K., Dimoulias, K., Truong, S., and Ward, K., “Researching Children’s Designs for a Child-Friendly Play Space at Rouse Hill Town Centre”, Centre for Educational Research, University of Western Sydney, 2014.
- [14] Marcela A. Rhoads, “Designing for The 2010 Americans with Disabilities Act Standards for Accessible Design in Multiple Building Types”, the State of California, April 2013, <http://abadiaccess.com/designing-for-children-in-the-ada/>.
- [15] Margaret Wallace, “Effective Building Practices for Children and Students with Disability project report”, Department for Education and Child Development, Government of South Australia, August 2016.
- [16] Michael Müller, “Berlin-Design for all: Accessible Public Buildings”, 2nd Edition, The Berlin Senate Department for Urban Development and the Environment, Berlin, August 2012.
- [17] Mounir Anwar Azzam, “Children's Architecture”, Architectural Journal 22, No. 56, October 2017, https://issuu.com/twentytwo22magazine/docs/twenty_two_56.
- [18] Namir Qasim Khalaf, “Designing the Interior-Environment for Modern Housing according to the Requirements of Special Needs - Diyala Governorate as a Model”, Proceedings of the Second Design and Environment Conference, Baghdad, 2015.
- [19] Randa Mostafa El-Deeb, “Problems Facing the Integration of Children with Special Needs”, First Scientific Conference, Faculty of Education, Benha University, 2010.

- [20] Rasha Shaker, "Developing of the Existing Architectural Designs for Mobile Disability in Educational Buildings", Master, Faculty of Architecture, Aleppo University, 2013.
- [21] Soheir Mohamed Hegazy, "REMODELING A SCHOOL FOR THE BLIND AND VISUALLY IMPAIRED IN OMAN", Journal of Teaching and Education, ISSN: 2165-6266:: 2(4):143-158, 2013.
- [22] Stationery Office, "Designing for disabled children and children with special educational needs: Guidance for mainstream and special schools (BUILDING BULLETIN 102)", The Stationery Office/Tso, Britain, December 30, 2008.
- [23] Suleiman Jamila, "The role of ergonomics in improving the home space for the physically disabled", 2nd International Forum, Algeria, May 2014.
- [24] The Ministry of Education, Culture, Sports, Science, and Technology, "A Collection of Exemplary Design of Kindergarten Facilities", Revision of Guidelines for Designing Kindergarten Facilities, Japan, June 2010.
- [25] United States Access Board, "Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines", Washington, D.C, 2004.
- [26] <http://www.universaldesignstyle.com/wheelchair-accessible-playground-equipment/> (accessed 17May 2019)
- [27] <http://ccdc.mans.edu.eg/index.php> (accessed 12August 2019)
- [28] Personal interviews: Managers of some nurseries in Mansoura, parents of some children with Disabilities.

دور المعماري لتحقيق الدمج للأطفال ذوي الإعاقة بالحضانات

الملخص

الطفل أساس المجتمع، لذلك لا بد من الاهتمام بالأطفال المعاقين وتشجيعهم علي مشاركة الأطفال العاديين من خلال توفير بيئة تتناسب مع احتياجاتهم. معظم مباني الحضانات في مصر غير مؤهلة لاستخدام الأطفال المعاقين، الأمر الذي يحد ويقلل من نشاط هؤلاء الأطفال ومساهماتهم بنجاح في المجتمع، بالإضافة إلي عدم اهتمام الكود المصري الخاص بذوي الاحتياجات الخاصة بالاشتراطات الخاصة بالأطفال المعاقين. يهدف البحث إلي تحقيق الدمج بين الأطفال المعاقين والأطفال العاديين في دور الحضانة من خلال الحلول المعمارية في الفراغات الداخلية والخارجية لتلبية احتياجات الأطفال المعاقين في التعلم واللعب والاعتماد علي أنفسهم في استخدام الفراغات بسهولة وأمان. تناول البحث دراسة نظرية تناول فيها دراسة مفهوم الطفل المعاق، ومعايير تصميم الفراغات الداخلية ودراسة المعالجات المعمارية في الفراغات الداخلية والخارجية للأطفال المعاقين بدور الحضانة، ودراسة تحليلية لأحدي دور الحضانة كعينة للدراسة. أوصت الدراسة بتفعيل المعايير والمعالجات المعمارية في دور الحضانة لتأهيلها لاستخدام الأطفال المعاقين في مصر لتشمل جميع دور الحضانة وإدخال التعديلات اللازمة علي دور الحضانة القائمة، مع وضع التشريعات المتعلقة بهم لضمان تطبيقها بصورة صحيحة.