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## Intergenerational Integration in Living Space Design: A Solution for Improving the Quality of Life of the Elderly and Orphaned Children

Nadereh Mousa Pasandi<sup>1</sup> , Seyede Fatemeh Motahari<sup>2\*</sup> 

<sup>1</sup> Department of Architecture, Kish University Campus, Kish, Iran; naderehmpdi@gmail.com; fatemehmotahari@gmail.com.

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### Abstract

In this century, profound social and economic changes have significantly impacted the lives of individuals, requiring special attention to vulnerable groups such as the elderly and orphaned children. Older people serve as a valuable source of knowledge and experience for society, while orphaned children face multiple challenges due to the lack of emotional and social support. In this context, intergenerational integration between these two groups can act as an effective strategy to improve their emotional and social well-being. This model not only enhances the quality of life for older people but also meets the emotional needs of children, enriching the experience of shared living. Intergenerational integration is the interaction and cooperation between different generations within a social space. Given the increasing elderly population, the necessity of designing environments that align with the needs of this group becomes more apparent. Older people typically face challenges such as mobility limitations, loneliness, and the need for social support. Therefore, the design of living spaces must ensure safety and comfort while fostering social interactions and psychological support. Architects and urban designers should consider older people's anthropological and psychological needs and modernize the design requirements of residential and social centers. This research aims to identify the design needs for elderly spaces, analyze ergonomic design principles and their impact on quality of life, assess the effect of the environment on the well-being of older people, and provide recommendations for enhancing space design with a focus on the participation of elderly individuals. These activities can improve the quality of life for older people and create a supportive environment for orphaned children, thereby strengthening social cohesion.

**Keywords:** Intergenerational integration, Elderly, Orphaned children, Environmental design, Quality of life, Ergonomic and accessible living spaces, Spatial communication in elderly design.

## 1 | Introduction

As societies undergo profound demographic shifts, the need for innovative solutions to improve the quality of life for vulnerable groups becomes increasingly urgent. Among these groups, the elderly and orphaned children face unique challenges that impact their well-being, social integration, and overall life satisfaction.

 Corresponding Author: fatemehmotahari@gmail.com



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The elderly often struggle with loneliness, reduced mobility, and a lack of social engagement, while orphaned children face emotional distress due to the absence of parental support and stability. Intergenerational integration in living space design offers a promising solution to address these challenges. By fostering meaningful interactions between different generations, these spaces can create a mutually supportive environment that enhances emotional well-being, encourages knowledge transfer, and strengthens social cohesion. The integration of the elderly and orphaned children in shared living spaces has the potential to cultivate a sense of belonging, reduce social isolation, and promote positive psychological and emotional development for both groups.

This paper explores the critical aspects of designing intergenerational living spaces that cater to the needs of elderly individuals and orphaned children. It examines the principles of ergonomic and accessible design, the role of social interaction in fostering well-being, and the impact of spatial communication on enhancing quality of life. By analyzing existing models and successful global examples, this study aims to provide practical recommendations for designing inclusive, age-friendly environments that support intergenerational integration and promote sustainable social relationships.

## **2 | Definition of Aging**

As a stage of human life, aging possesses specific characteristics that include physical, cognitive, social, and psychological changes. This stage typically begins at age 65, but the understanding of aging is not limited to old age; it depends on various factors such as health and social and cultural environment [1].

### **2.1 | Challenges Faced by the Elderly in Daily Life**

Elderly individuals face numerous challenges in their daily lives due to the physical and psychological changes they experience. These challenges can significantly affect their health and quality of life. Below are some of these challenges:

#### **Mobility disabilities**

Many elderly individuals encounter mobility disabilities, which can result from factors such as arthritis, muscle weakness, and balance issues. These disabilities may negatively impact daily activities such as walking, sitting, and performing household chores. Therefore, designing spaces that provide easy access and safety is crucial.

#### **Psychological issues**

Increased loneliness and isolation are common challenges among older people. Many elderly individuals gradually distance themselves from social networks due to losing spouses or friends. This social isolation can lead to psychological issues such as depression and anxiety. Thus, creating environments that provide interaction and social connection opportunities is very important.

#### **Limited Access to Services**

Limited access to healthcare and other social services can pose a significant challenge for older people. Difficulties in transportation and access to service locations such as pharmacies, medical centers, and recreational facilities can adversely affect their quality of life.

Challenge	reason	Consequences	solution
Movement disabilities	arthrosis	Difficulty performing daily activities	Designing accessible spaces (without stairs, ramps)
	muscle weakness	Decreased independence	Installation of handles and safety fences
	Balance problems	Greater vulnerability	Creating safe pathways with non-slip flooring
Psychological problems	Loneliness	Feeling depressed	Designing social and common spaces (sitting stages)
	Losing friends	Anxiety	Creating spaces with the possibility of social interaction
Limited access to services	Transportation problems	Inability to access medical services	Designing residential complexes connected to service centers
	away from service places	Negative impact on quality of life	Creating safe and comfortable walking paths to service locations
			Using smart technologies for reminders, such as automatic lighting

Fig. 1. The conceptual model of the research.

## 2.2| The Necessity of Intergenerational Integration

Both older people and children require strong, supportive relationships. Older people, with their experience and knowledge, can help transmit culture and art to the younger generation. At the same time, with their energy and creativity, children can bring vitality and joy to the lives of older people. Integrating these two groups can reduce loneliness among seniors and provide a sense of security and support for orphaned children.

## 2.3| Theoretical Perspectives on Intergenerational Integration

Intergenerational integration is a social concept and a topic examined in psychology and social sciences. Various theories analyze this subject:

- I. Social belonging theory: this theory emphasizes that belonging to a social group and forming positive relationships can improve mental health and reduce anxiety and depression in both groups. By strengthening this sense of belonging, both generations can achieve greater feelings of support and mutual understanding.
- II. Social learning theory: according to this theory, individuals learn through observation and interaction. Older people can serve as positive role models for children, and conversely, children can introduce new and positive behaviors to older people.
- III. Erik erikson's psychosocial development theory: this theory examines the various stages of human growth. According to this theory, the elderly need to reflect on their lives and pass on their experiences, while children require new learning and experiences. These interactions can assist both groups in achieving their psychological and social goals.

## 2.4| Definition of Intergenerational Integration

Intergenerational integration refers to positive relationships and interactions among different age groups. This concept aims to create a space where each generation can benefit from the experiences, knowledge, and skills of the other. In the context of the elderly and orphaned children, this integration can manifest in various

forms, including joint activities, educational programs, and artistic workshops. This integration's primary goal is to enrich both groups' lives, reduce feelings of loneliness, and enhance social interactions.

## **2.5 | Main Objectives of Intergenerational Integration**

As a novel approach, intergenerational integration seeks to improve the quality of life for the elderly and orphaned children by creating appropriate opportunities for interaction and effective communication. The main objective of this project is to enhance the quality of life for these two groups by creating spaces for close emotional support and connection. In this way, older people will feel more valued by offering their affection and knowledge, while children will benefit from this support, experiencing a sense of security and love.

The two overarching goals of this research include meeting emotional needs and increasing empathy and social solidarity. By creating an environment that facilitates interaction between the elderly and children, the emotional needs of both groups can be addressed. Additionally, these interactions will promote empathy and compassion within the community, strengthening the foundation of families and social groups<sup>1</sup>.

## **2.6 | Social Isolation Among the Elderly**

Social isolation is a serious challenge faced by many elderly individuals. This isolation can stem from various factors such as the loss of spouses and friends, health problems, or transitions to nursing homes. Research indicates that social isolation can lead to more serious issues such as depression, anxiety, and even dementia. Additionally, it can result in decreased sleep quality and an increased risk of heart disease. Therefore, creating spaces for social interactions among older people is paramount.

## **2.7 | The Role of Emotional Support in Improving Quality of Life**

Emotional support entails the provision of compassion, empathy, and understanding from others, profoundly impacting the mental well-being of older people. Studies show that older adults who receive adequate emotional support enjoy better mental and physical health than those who do not. Emotional support can enhance positive feelings such as joy and satisfaction while reducing negative emotions like loneliness and depression. This support can be provided through family interactions, friendships, and even engagements with volunteers and staff in nursing homes.

Overall, older people's emotional and social needs are of special importance, and addressing these needs can directly affect their quality of life. Consequently, intergenerational programs that strengthen the relationships between the elderly, orphaned children, and other community members can be considered an effective strategy for improving the quality of life for seniors and children.

## **2.8 | The Impact of Parental Absence on Children**

Orphaned children, due to the absence of one or both parents, lack essential emotional and social support, which can profoundly affect their emotional, social, and psychological development. The loss of parents, especially in the early years, can lead to feelings of insecurity, low self-esteem, and emotional and behavioral issues. Without parental presence, these children experience a deep need for love and attention, strengthening their sense of security and belonging.

In the absence of emotional support, orphaned children may exhibit aggressive behaviors, anxiety, and depression, impairing their ability to establish positive relationships. Positive love and care from adults can significantly impact their development and help enhance their social skills.

Creating supportive environments in children's homes reinforces feelings of self-worth and security in these children. Positive interactions with adults as effective role models can foster their communication skills,

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<sup>1</sup> Generations Together: A Guide for Multi-Generational Collaboration

empathy, and compassion. Play, educational activities, and simple conversations can be among these interactions.

## 2.9 | Impact of Positive Interactions with Older Adults on Children

Research shows that children who maintain positive relationships with older adults are less likely to face psychological and emotional issues. These interactions contribute to increased self-esteem, enhanced social skills, and improved self-help feelings. In this way, older adults can provide the necessary emotional support and assist orphaned children in facing life's challenges.

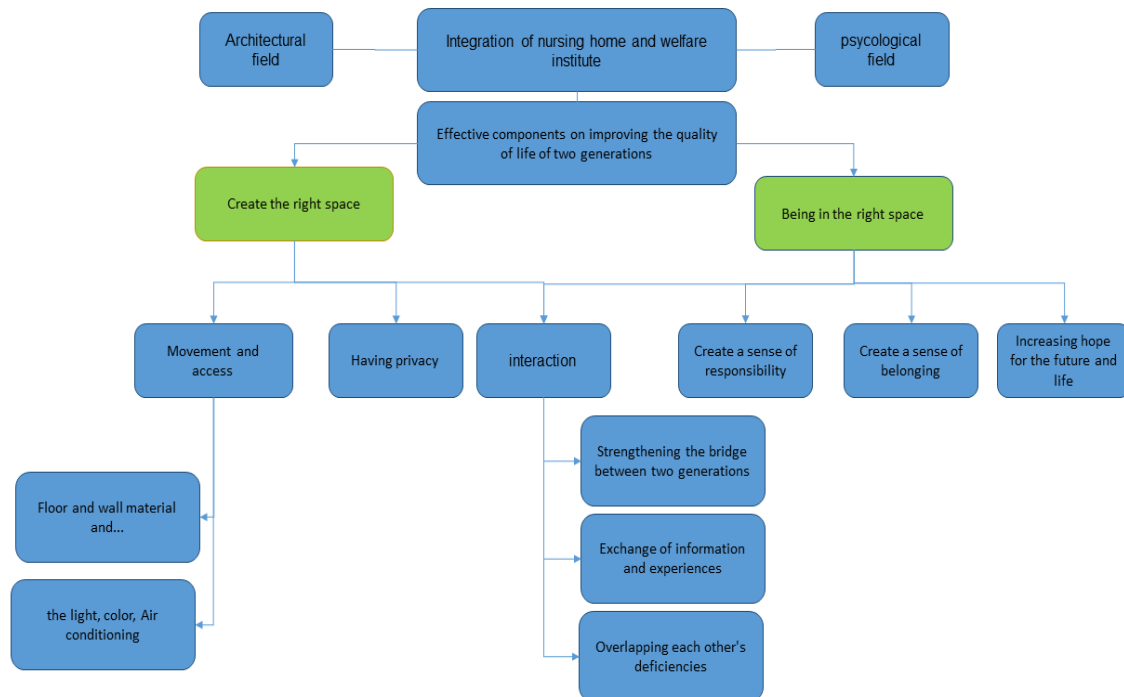


Fig. 2. The conceptual model of the research.

## 2.10 | Successful Global and Internal Experiences

Many countries have successfully implemented intergenerational programs with positive outcomes. In Scandinavian nations, health and educational centers offer gardening, music, and sports that strengthen connections and foster belonging among seniors and children, encouraging active community participation. In the United States, programs such as the "Intergenerational Children and Seniors Program" facilitate art and science workshops, benefiting the mental health of both groups. These initiatives enhance children's social skills while providing seniors with a sense of continued community contribution.

In Iran, the emotional and social needs of the elderly and children are increasingly recognized. Although intergenerational programs are still developing, some institutions and charities are initiating joint cultural, sports, and educational activities. An example is the "Imam Reza (PBUH) Paradise" institution, where children assist seniors in daily tasks and gain valuable insights from their life experiences. These programs enhance intergenerational relationships and boost children's and older people's self-esteem.

## 2.11 | Benefits of Interaction Between the Elderly and Children

### A Sense of Utility and Satisfaction for the Elderly

Interactions between elderly individuals and children significantly enhance seniors' quality of life by fostering a sense of utility and satisfaction. Sharing activities with orphaned children allows seniors to share their life

experiences, reinforcing their sense of belonging and impact on others. Studies show that participation in intergenerational programs increases seniors' feelings of usefulness and community value. These interactions also help reduce depression and anxiety, enabling seniors to live more meaningful and joyful lives.

### 2.11.1 | Learning and Social Growth of Children

Conversely, interactions with older people offer children valuable opportunities for emotional and social learning. Children enhance their social skills by engaging with seniors and developing concepts like empathy and kindness. Research demonstrates that children in intergenerational environments perform better in peer interactions and establish positive relationships. These connections help reduce negative behaviors, such as aggression, while enhancing social competencies. Furthermore, healthy interactions with seniors increase children's awareness of life's challenges, equipping them to face adversity and build positive relationships [2].

standard	Positive aspect	Negative aspect	Impacts on space design.
psychology	Reduction of feelings of loneliness and depression in the elderly.	Age differences may lead to misunderstandings.	Creating shared spaces for social interaction (parks, playrooms)
	Providing emotional needs and increasing the sense of security for children	Being in a space- may lead to unwanted tensions	Designing appropriate spaces - quiet corners for conversation and interaction
	Strengthening the sense of identity and value of the elderly by helping children		Using colors and lighting to create a positive and peaceful feeling
architecture	Creating idea spaces for multi-generational interactions	The need for more expenses to design suitable spaces	Designing multi-purpose spaces that can be used by different generations
	Using an ergonomic design that helps both age groups	Challenges related to accessibility for people with mobility limitations	Consider areas - easy access and safety factors for seniors
	Encouraging shared use of public spaces		Creating suitable viewing points and darkness for a sense of security and comfort
social	Strengthening social connection between generation	The possibility of fading interactions between	Combination of public and private spaces for convenience in interactions
	Reducing the generation gap and promoting mutual understanding		Creating green and recreational spaces that can attract both groups

Fig. 3. The conceptual model of the research.

## 3 | Foundations for Designing Elderly Spaces

### 3.1 | Age-Friendly Design Concept

Age-friendly design aims to create spaces that cater to the needs and preferences of older people, focusing on physical, social, and psychological aspects. This approach addresses seniors' challenges, enhancing their quality of life in independent homes or care facilities. Implementing green spaces, comfortable seating, and social amenities fosters a sense of belonging and encourages participation [3].

Universal design further promotes accessibility for all individuals, regardless of age or ability. It features wide entrances, large-print signage, and mobility aids like ramps and elevators. Research demonstrates that universal design significantly improves comfort and accessibility for seniors in various environments [4].

Emphasizing flexible residential spaces is crucial as well. Multipurpose areas accommodating educational classes, social gatherings, and recreational activities enhance social engagement among older people. Additionally, ensuring safety is imperative to minimize risks of falls and injuries. This involves wide corridors, slip-resistant surfaces, strategically placed railings, grab bars, and easy access to essential services like pharmacies and healthcare centers, enabling seniors to reach the resources they need.



### 3.2 | The Impact of Green Spaces on Seniors' Well-Being

Research indicates that access to green and natural spaces near elderly residences significantly benefits their psychological and physical health, enhancing mood and reducing stress. Designing environments like flower gardens and cozy cafes fosters social interactions and evokes positive memories, contributing to feelings of belonging.

Projects such as the Alzheimer Village demonstrate how vibrant green spaces can improve the quality of life for seniors. Additionally, social centers designed for elderly engagement facilitate cultural activities and workshops, promoting new experiences. These flexible spaces support outdoor events, enhancing social connections. Organized creative activities help seniors acquire new skills and boost their confidence and overall sense of self-worth, improving their quality of life.

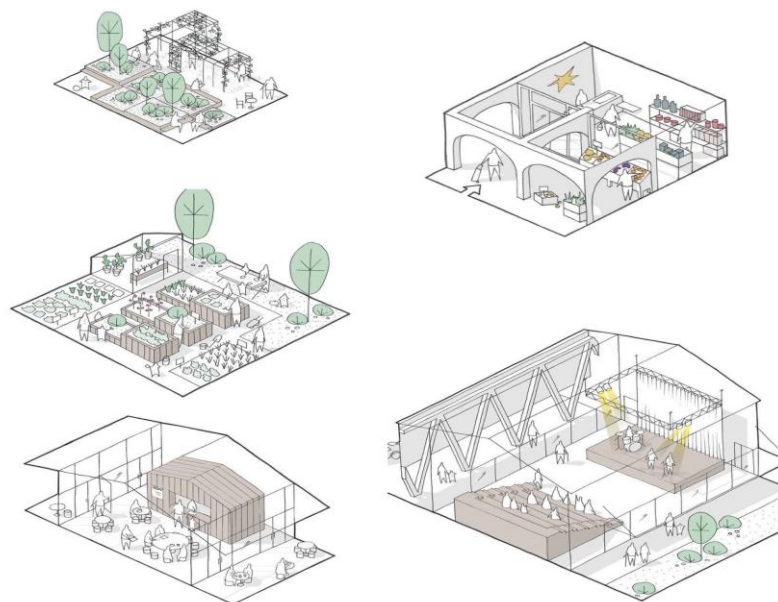


Fig. 4. Alzheimer's village/NORD architects.

### 3.3 | The Environmental Impact on Seniors' Well-Being

Designing spaces that foster social interactions and group activities is crucial for enhancing seniors' sense of belonging and mitigating loneliness. Shared areas like lounges, gardens, and natural landscapes serve as community hubs, promoting connections among seniors and contributing to a stronger social identity. Research shows that these strong social ties are linked to lower levels of loneliness and depression.

Moreover, natural light and strategic color choices in these environments significantly influence emotions and psychological well-being. Natural light regulates biological clocks, elevates mood, and boosts energy while calming colors such as blue and green can reduce anxiety. Conversely, warm colors like yellow and orange enhance feelings of joy.

Additionally, involving seniors in decision-making and allowing them to personalize their spaces fosters a sense of control and autonomy. This empowerment alleviates stress and enhances self-confidence, as choices regarding furniture and room layouts instill a sense of ownership over their environment. Overall, thoughtful design can significantly improve the quality of life for seniors by promoting social engagement and emotional well-being.



**Fig. 5.** An example of the impact of natural lighting and calming colors on the psychological well-being of the elderly.

### 3.4 | Successful Examples of Elderly Care Homes

#### St. Mary's Nursing Home

St. Mary's Nursing Home is a prime example in the field of elderly space design. It focuses on creating a warm and inviting environment that employs senior-friendly design approaches. The layout of this home is intentionally designed to facilitate social interaction. Features such as large common rooms with abundant windows for natural light, green spaces outside the building, and personalized private rooms stand out in this facility.

#### Highlight Features:

- I. Social spaces: large lounges with expansive windows let in natural light, creating a bright and pleasant atmosphere for social interactions.
- II. Safety-centric Design: using non-slip materials and eliminating physical barriers helps seniors confidently move around the space.
- III. Green environment: the presence of gardens and green spaces allows residents to spend time outdoors and enjoy nature.

#### Challenges and Solutions:

To improve residents' quality of life, more space for physical activities was needed. Therefore, a multifunctional interior courtyard was designed, adding sports and recreational facilities to the environment and providing residents with more room for movement and activity.

#### Golha Residential Complex

The "Golha" residential complex, designed for seniors, specializes in creating green spaces and access to nature, alongside providing modern amenities. The design allows residents to utilize easily accessible outdoor pathways and parks, helping them engage in daily physical activities and connect with nature.

#### Key Features

- I. Access to nature: the complex is designed so residents can easily reach parks and walking paths, encouraging regular physical activity.
- II. Social spaces: shared rooms and communal squares in the complex promote interaction among seniors and facilitate social events.



- III. Environmental sustainability: this complex is an example of sustainable design in elderly care spaces, utilizing renewable energy resources and environmentally friendly materials.

### 3.5 | Psychological Analysis

The presence of nature and green spaces not only meets physical needs but also provides a sense of tranquility and reduces stress. Research has shown that connecting with nature can significantly improve seniors' mental health and quality of life.

## 4 | Challenges and Opportunities in Designing Elderly Spaces

Despite advancements and innovative ideas in the design of elderly spaces, various challenges and barriers can negatively affect seniors' lives. Traditional design approaches remain prevalent in many elderly spaces and often overlook the specific needs of seniors. These spaces typically address only basic needs, which can exacerbate feelings of loneliness and depression. Additionally, a lack of standardization and attention to safety in the designed environment, such as insufficient grab bars and non-slip surfaces, increases the risk of accidents for this age group.

However, there are significant opportunities in this field. Modern technologies, from smart home systems to e-health solutions, can enhance seniors' comfort and safety. Moreover, nature-friendly design, incorporating natural elements and green spaces, promotes environments that allow seniors to connect with nature, reducing stress and fostering positive psychology. Creating multifunctional spaces for various purposes allows seniors to participate in educational workshops and social activities. Additionally, involving seniors in the design process through workshops and advisory sessions can lead to spaces that align with their real needs and desires [5].

### 4.1 | Principles of Designing Elderly Spaces

#### **Spatial communication**

Designing suitable spaces for seniors not only meets their physical needs but also profoundly impacts their social relationships and their feeling of belonging to the community. Spatial communication, in this context, refers to the way in which different spaces are designed and organized to facilitate social exchange and shared activities. This section examines key concepts and principles related to spatial communication.

#### **Design of social spaces and interaction facilitation**

Social spaces, such as living rooms, cafes, and outdoor areas, should be designed to encourage individuals to connect and interact. These spaces must also allow people to engage comfortably and express their feelings. According to research published in international journals, open social spaces that include comfortable seating and conversation areas enhance seniors' quality of life and sense of happiness.

#### **Creating logical movement paths**

Movement paths in the design of elderly spaces should guide seniors to various areas while preventing feelings of confusion. Clear and directional pathways, along with appropriate signage, can help seniors navigate spaces with greater confidence. Studies show that logical and comprehensible design in public areas can reduce feelings of anxiety and improve seniors' mobility skills.

#### **Creating gathering points**

Gathering points, or "meeting spaces" are essential in the design of elderly spaces. These areas can include gardens, cafes, or community rooms where seniors can meet and engage in social activities. Research has demonstrated that attractive and inviting gathering points increase social interactions and strengthen the sense of belonging to the community.



Fig. 6. A sample of communal spaces designed to enhance social interactions among the elderly.

## 4.2 | Attention to Sensory Dimensions of the Environment

The relationship between space and human senses is crucial in designing environments for seniors. Creating spaces with natural light, pleasant sounds (such as birdsong or water), and appealing textures and colors can positively influence seniors' emotional and mental well-being. Research indicates that pleasant and sensory-stimulating environments help reduce feelings of depression and anxiety in older adults.

## 4.3 | Optimizing Private Spaces

Maintaining privacy should be an integral part of the design for seniors. Creating areas where seniors can spend time alone or with loved ones is essential. These private spaces can promote relaxation and security while easily accessible to social areas.

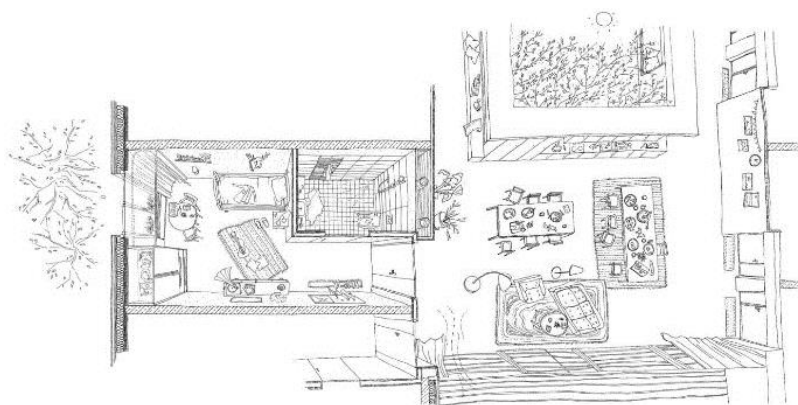


Fig. 7. Sensory design elements aimed at improving the experience of elderly residents in living environments.

Architectural approaches must respond to the specific needs of elderly people while considering aesthetics, functionality, and safety when designing elderly spaces.

### Ergonomic design of spaces

Utilizing ergonomic principles in the design of elderly spaces facilitates ease of use and accessibility. This includes the design of furniture, equipment, and spatial arrangements that support daily movements and activities. For instance, estimating appropriate heights for kitchen appliances, bathrooms, and beds should be based on seniors' physical capabilities and safety considerations. Furniture and equipment should be designed to prioritize seniors' physical health and eliminate strain or difficulty in movement.

### Designing multifunctional spaces

Creating multifunctional areas that can be used for social, recreational, and care activities adds a new dimension to architectural design for seniors. For example, indoor environments can include multifunctional rooms that can be easily repurposed—moving from a party hall to a classroom or therapy room. This design allows seniors to make the most of the space, reducing feelings of loneliness and isolation.

### Emphasizing natural and artificial lighting

Lighting is a crucial element in designing senior spaces. It affects both the physical and mental conditions of the user. Using natural light not only lowers energy costs but also improves mood and decreases depression in seniors. Windows and transparent doors should be designed to allow natural light while providing suitable visibility and minimizing glare during peak sun hours. Additionally, the design of artificial lighting systems should create soft, gentle light in the evening, minimizing the need for bright lighting while preventing harmful shadows.



Fig. 8. Significant impact of light.

### 4.4 | Facilitating Movement and Accessibility

Movement paths should be designed to promote the health and safety of seniors during their daily activities. Using non-slip surfaces, rest stations along pathways, and implementing gentle slopes instead of stairs (or using suitable lifts) can help reduce the risk of mobility-related injuries. This respects seniors' mobility limitations and provides a safer environment for them. Additionally, straightforward and marked pathways can facilitate movement and prevent confusion.

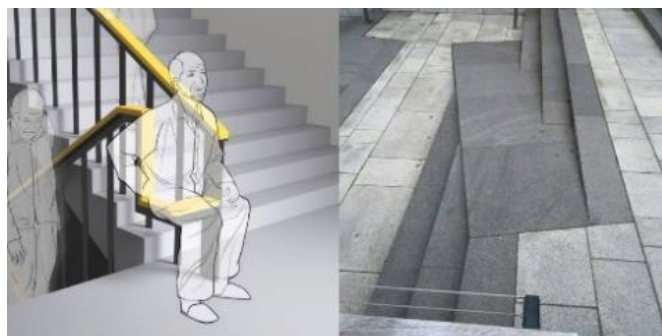


Fig. 9. Facilities movement for elderly.

### 4.5 | Designing Social Spaces and Interactions

Creating spaces for social interactions and connections among residents is essential to designing senior spaces. These areas include large living rooms and outdoor spaces, allowing seniors to participate in social activities

and feel a sense of belonging. The design of cafes, game areas, and recreational spaces should consider seniors' needs and interests. This enhances their mood, fosters positive social relationships, and reduces feelings of loneliness.

## 4.6 | Incorporating Nature and Landscaping Elements

Integrating natural elements into the design can profoundly impact seniors' quality of life. Designing green spaces, therapeutic gardens, and tranquil areas can enhance their physical and mental health. These areas should be easily accessible and maintainable, providing a peaceful and pleasant environment for relaxation and social interactions. Studies have shown that exposure to green spaces helps reduce stress, improve mood, and increase vitality among seniors.

## 4.7 | Design Standards for Senior Living Spaces

Designing living spaces for seniors is a key challenge in contemporary architecture, requiring adherence to principles and standards that enhance their well-being, safety, and quality of life. Addressing their specific needs becomes even more critical with the increasing aging population. According to existing standards, the design of senior living spaces considers the following:

### Accessibility and mobility

Designed spaces must allow easy movement for individuals with mobility limitations, including wide pathways (at least 90 cm), short distances, and barrier-free areas. The use of ramps instead of stairs and the installation of grab bars in key locations are essential needs in designing these spaces [6].

### Appropriate dimensions and sizes

Living spaces should be designed to facilitate easy movement, wheelchair access, and necessary maneuvers. For example:

- I. Bedrooms: each bedroom should have a minimum area of 15 square meters and a maximum of 20 square meters, providing adequate space for a bed, wardrobe, and movement. This space should also benefit from natural light and proper ventilation.
- II. Living and Social Activity Areas: these areas should range from 20 to 30 square meters to accommodate social activities and gatherings, enabling individuals to communicate easily and feel a sense of belonging.
- III. Bathroom and sanitary facilities: the dimensions of bathrooms should ensure comfort and easy access. Showers and toilets should have a minimum width of 90 cm and a depth of 150 cm to facilitate use without difficulties.

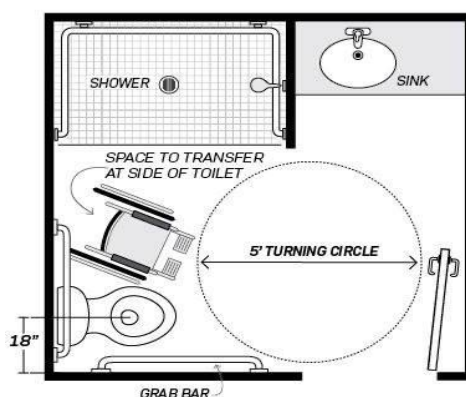


Fig. 10. Design standards for elderly living spaces, including appropriate dimensions for shared and private areas.

## 4.8 | Air Quality and Temperature Control

Improving air quality and regulating temperature in living spaces is crucial. Air conditioning systems with personal controls and large windows for natural light and ventilation are essential for creating a healthy

environment. Maintaining a temperature range of 22 to 24 degrees Celsius enhances comfort for seniors. Additionally, incorporating natural plants helps improve indoor air quality.

#### 4.10 | Interior Finishes and Materials

Interior spaces should be covered with non-toxic and comfortable materials. Choosing soft and soothing colors and using soft carpets can help reduce anxiety and enhance feelings of tranquility among seniors. It's also vital to consider slip resistance and safety when selecting finishes and carpets.

#### 4.11 | Shared Spaces and Courtyards

Common areas, such as kitchens and courtyards, should be of suitable sizes to promote social interaction. The courtyard should have a minimum area of 100 square meters and a maximum of 200 square meters, allowing seniors to spend time in an open and natural environment and engage in recreational activities.

#### 4.12 | Lighting

Proper lighting is another key consideration in designing living spaces for seniors. Using natural light during the day and soft lighting at night enhances feelings of comfort and security. Installing motion-sensor lights and using warm-colored bulbs can help reduce the risk of falls and create a comforting atmosphere.

### 5 | Material

#### 5.1 | Interior Materials

The selection of interior materials in designing living spaces for seniors is crucial, profoundly impacting safety, comfort, and overall well-being. Engineering considerations regarding materials can enhance daily living experiences and create environments that foster emotional stability and security. This section delves into various types of interior materials, their properties, and their implications for senior care design.

##### 5.1.1 | Flooring

The choice of flooring is crucial in interior design for seniors. Slip-resistant flooring options, such as textured vinyl or low-pile carpets, should be prioritized to minimize the risk of falls. Research shows that falls are a leading cause of injury among seniors, with approximately 30% of older adults experiencing falls yearly. Flooring materials should also be easy to clean, hygienic, and durable. The recommended height for carpet piles is 0.5 inches or lower to aid mobility. Additionally, using soothing colors and textures can create a calming atmosphere.



**Fig. 11. The importance of selecting anti-slip flooring in elderly environments to prevent falls.**

##### 5.1.2 | Wall finishes

Wall finishes should possess washability and durability to endure wear and tear in communal areas. Non-toxic paints and materials that resist mold and mildew are essential for maintaining a healthy indoor environment.



Soft, muted colors can positively affect the mental health of residents, helping to reduce anxiety and agitation. Soundproofing materials should also be considered to minimize noise pollution; studies indicate that lowering noise levels can improve seniors' sleep quality and overall health [7].

### 5.1.3 | Furniture

Furniture must be designed with seniors' physical and mobility needs in mind. Selecting pieces with rounded edges, appropriate heights (generally between 18 to 24 inches for seat height), and supportive backs can enhance comfort and safety. Materials should be durable, easy to clean, and non-toxic to avoid health risks. Social engagement is vital for seniors, and the inclusion of communal seating areas encourages interaction. The incorporation of armrests and sturdy legs in furniture design can also facilitate easier movement for those with mobility challenges.



**Fig. 12.** An example of elderly-friendly furniture with rounded edges and standard heights for improved comfort.

### 5.1.4 | Lighting

Interior lighting design should prioritize safety and comfort. Natural light is beneficial during the day, while soft, warm artificial lighting should be used at night to create a welcoming atmosphere. The recommended illumination level for common areas is about 300 to 500 lux, while bedrooms should have softer lighting at around 150 to 300 lux. Motion sensor lights can enhance safety, particularly in hallways and bathrooms, where falls commonly occur. Warm-colored LED bulbs can provide a comfortable visual experience while reducing eye strain for older adults [8].

### 5.1.5 | Indoor plants

Incorporating indoor plants can improve air quality and create a tranquil environment. Studies show that contact with nature and incorporating greenery can reduce stress and anxiety levels in seniors. Choosing low-maintenance plants such as snake plants or peace lilies, which thrive in indoor conditions, can be beneficial. Furthermore, the optimal height for indoor plants should allow for visibility from seated positions, enhancing the sensory experience without causing obstruction.



**Fig. 13. The impact of indoor plants in reducing stress and enhancing mental well-being among the elderly.**

## 5.2 | Façade Materials

The façade of a building is its first point of interaction, serving both aesthetic and functional roles in the overall design. For senior living spaces, façade materials must be carefully selected to enhance safety, durability, and energy efficiency while creating an inviting atmosphere. This section discusses various façade materials, their structural considerations, and their suitability for environments catering to older people.

### 5.2.1 | Weather-resistant materials

Given the exposure to varying weather conditions, using weather-resistant materials is crucial. Options like brick, stone, and fiber-cement siding offer durability and low maintenance requirements. Brick and stone can withstand harsh weather, and their thermal mass properties can aid in regulating interior temperatures, which is vital for comfort. For instance, fiber-cement panels resist rotting, warping, and insect infestation while providing an aesthetically pleasing finish.

### 5.2.2 | Energy-efficient glazing

Incorporating large windows with energy-efficient glazing can significantly impact both aesthetics and functionality. Double or triple-glazed windows enhance thermal insulation, helping to maintain indoor comfort while reducing energy costs. Research indicates that well-placed windows can enhance natural light in interior spaces, benefiting seniors' mental health by reducing feelings of isolation (Higgins et al., 2020). The insulating value of windows is measured by their U-value, with lower values indicating better insulation; a target U-value of less than  $0.3 \text{ W/m}^2\text{K}$  is recommended for energy-efficient design.

### 5.2.3 | Accessibility and entry points

Façade design must consider accessibility aspects, ensuring that seniors with mobility challenges easily navigate entry points. Ramps with a gentle slope (1:12 ratio) should be integrated alongside stairs, providing multiple means of access. The doorway width is also crucial; a minimum width of 32 inches is recommended to accommodate wheelchairs and walkers effectively. Overhangs or structural canopies can provide shelter and security while encouraging outdoor activities [9].

### 5.2.4 | Aesthetic considerations

The aesthetic appeal of façade materials can significantly influence residents' emotional responses. A combination of colors and textures that evoke a sense of warmth and community can enhance the living experience for seniors. Utilizing materials that harmonize with the surrounding environment improves curb appeal and fosters a sense of belonging. Studies suggest buildings that blend with their context can positively affect residents' moods and well-being [10].

### 5.2.5 | Sustainability and eco-friendly materials

Sustainability is an essential factor in modern façade design. Materials sourced from renewable resources or recycled content contribute to reduced environmental impact. For example, reclaimed wood or recycled metal can minimize extraction processes and promote green building practices. Additionally, green wall systems and living façades can improve air quality and biodiversity while creating visually appealing designs. These systems also provide thermal insulation and reduce the urban heat island effect, benefiting both the environment and the inhabitants.



**Fig. 14. A sustainable and eco-friendly building façade designed for elderly living spaces.**

By thoughtfully selecting façade materials that combine durability, energy efficiency, accessibility, and aesthetics, designers can create inviting senior living environments that prioritize functional and emotional needs. The relevance of these considerations becomes increasingly significant as the demand for aging-friendly spaces continues to rise.

## 5.3 | Site Design Materials

The choice of materials in site design is essential for creating safe, accessible, and welcoming environments for seniors. Proper material selection can enhance outdoor spaces, encourage social interaction, and improve the overall quality of life. This section focuses on key materials used in landscape and site design, their engineering considerations, and their benefits for elderly residents.

### 5.3.1 | Pathway and Paving Materials

Pathways are critical for safe navigation within senior living facilities. The materials used should provide a non-slip surface to minimize the risk of falls. Options like textured concrete, permeable pavers, or compacted gravel can be effective. The recommended width for pathways should be at least 48 inches to accommodate wheelchairs and walkers, allowing for two-way traffic. Additionally, using contrasting colors for pathway edges helps visually impaired residents navigate more easily, enhancing overall safety.

### 5.3.2 | Seating areas

Outdoor seating areas should be designed with both comfort and accessibility in mind. Materials for benches and tables should be weather-resistant and durable, such as metal or treated wood. Seating heights should be approximately 18 inches, making it easy for seniors to sit down and get up. The seating arrangement should promote social interaction and consider providing shade with canopies or pergolas to protect residents from excessive sun exposure, thereby encouraging more time spent outdoors.

### 5.3.3 | Landscaping materials

Landscaping plays a significant role in creating an inviting atmosphere. When selecting plants and materials, it is vital to consider low-maintenance and native species, which can thrive in local conditions with minimal

care. Incorporating raised garden beds using rot-resistant wood or composite materials allows seniors to engage in gardening without bending down, promoting physical activity and interaction with nature.

#### **5.3.4 | Safety Features**

Safety features are imperative in site design, including railings, tactile surfaces, and proper lighting. Railings should be constructed from durable materials like stainless steel or powder-coated aluminum that can withstand outdoor conditions and provide stability along pathways and stairs. Installing tactile warning strips on the edges of steps or ramps alerts visually impaired residents [11]. Adequate outdoor lighting, with an illumination level of around 100-200 lux, enhances safety during evening hours, reducing the risk of accidents.

#### **5.3.5 | Water Features**

Integrating water features, such as fountains or small ponds, can provide therapeutic benefits and enhance the aesthetic quality of the landscape. However, safety must be prioritized to prevent hazards. Materials such as anti-slip surfaces around water elements and secure barriers can help prevent accidents. Additionally, the sound of flowing water has been shown to have calming effects, reducing stress and promoting relaxation among seniors [57].

### **5.4 | Sustainable and Eco-Friendly Materials**

As the demand for environmentally responsible design increases, sustainable and eco-friendly materials are essential in creating spaces for seniors. Using these materials reduces the environmental impact and contributes to residents' health and well-being. This section explores various sustainable materials, properties, and implications for senior living spaces.

#### **5.4.1 | Recycled and upcycled materials**

Recycled and upcycled materials offer a sustainable option for building and furnishing senior living environments. Materials such as recycled metal, reclaimed wood, and repurposed textiles can significantly reduce waste and lower a facility's carbon footprint. For example, using reclaimed wood for flooring or furniture provides a unique aesthetic and utilizes resources that would otherwise be discarded. Incorporating these materials can contribute to LEED certification, a widely recognized measure of sustainability in building design.

#### **5.4.2 | Low-volatile organic compound products**

Choosing materials that emit low levels of Volatile Organic Compounds (VOCs) is crucial for maintaining healthy Indoor Air Quality (IAQ). Low-VOC paints, adhesives, and finishes help mitigate health risks associated with indoor pollution, particularly for seniors who may have pre-existing respiratory conditions. The U.S. Green Building Council recommends using materials with VOC levels below 0.5 g/L to promote IAQ. Incorporating properly ventilated spaces enhances the effectiveness of low-VOC materials and promotes a healthier living environment.

#### **5.4.3 | Sustainable insulation**

Insulation is key in energy-efficient building design, reducing heating and cooling demands. Sustainable options such as cellulose insulation made from recycled paper or sheep's wool provide excellent thermal resistance while being environmentally friendly. These materials contribute to maintaining comfortable indoor temperatures and can improve the overall energy efficiency of a senior living facility. The recommended R-value for insulation in residential buildings is between R-30 and R-60, depending on the climate zone.

#### **5.4.4 | Green roofs and living walls**

Green roofs and living walls are innovative ways to incorporate nature into urban spaces. These systems provide thermal insulation, reduce stormwater runoff, and improve biodiversity in built environments. Access to green roofs can improve mental well-being and encourage outdoor activity for seniors while living walls

can enhance indoor air quality. Proper structural support, drainage systems, and a selection of suitable plant species are essential for successfully implementing these systems [12].



**Fig. 15.** The implementation of green roofs and living walls in sustainable design to improve the quality of life for the elderly.

#### 5.4.5 | Sustainable landscaping materials

Choosing sustainable landscaping materials can enhance outdoor environments while supporting local ecosystems. Native plants require less water and maintenance, making them ideal for senior living facilities. Additionally, using permeable paving materials for walkways and driveways allows rainwater to infiltrate the ground, reducing runoff and promoting groundwater recharge. Implementing rain gardens can not only manage stormwater but also create educational opportunities for residents to engage with environmental stewardship [13].

## 6 | Conclusion

In conclusion, designing living spaces for seniors is crucial in enhancing their quality of life and addressing their unique needs as the elderly population grows. Key considerations include ensuring accessibility and mobility within these spaces, with specific dimensions for bathrooms and common areas that facilitate ease of movement and comfort. Moreover, maintaining optimal air quality and temperature is vital for seniors' well-being, which can be achieved through effective ventilation systems and incorporating natural elements. The choice of non-toxic interior materials and calming colors contributes to a tranquil environment, further promoting mental well-being.

Shared spaces and courtyards play a significant role in fostering social interactions, reducing feelings of isolation, and improving overall emotional health. Adequate lighting design, incorporating natural light and warm illumination, is essential to ensure safety and create a welcoming atmosphere.

Adhering to these design principles and standards can create safer, more inviting, and supportive environments that significantly enhance the daily lives of seniors. This focus on older people's needs is increasingly important and should be prioritized in future architectural and design endeavors.

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## Data Availability

All the data are available in this paper.

## Conflicts of Interest

The authors affirm that there are no conflicts of interest to disclose.



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