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INTERIOR ENVIRONMENT DESIGN FOR EMPTY-NEST ELDERLY CARE CENTERS USING A HUMAN-CENTERED APPROACH TO ENHANCE EMOTIONAL AND SOCIAL NEEDS

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Abstract

This paper explores interior design strategies aimed at enhancing the emotional and social well-being of empty-nest elderly individuals in care centers. The focus is on creating spaces that not only meet the functional needs of elderly residents but also provide emotional support and promote social interaction. Key design elements include multifunctional spaces that encourage engagement, accessible layouts that ensure safety and independence, and privacy solutions that balance personal space with community. The design emphasizes the use of natural lighting, thoughtful space planning, and warm, homelike décor to foster a sense of belonging and comfort. The research adopts a design-based methodology, combining architectural design analysis with practical prototyping and data validation through resident feedback. The proposed design framework offers a novel approach by integrating spatial organization, multifunctionality, and emotional support to enhance both the physical and psychological well-being of elderly residents. This comprehensive design model presents a holistic solution to the challenges of creating supportive, human-centered environments for elderly care.

Keywords: Interior Environment Design, empty-nest elderly, Human-Centered Approach

Introduction

This paper aims to explore how interior design can better support the emotional and social well-being of empty-nest elderly individuals in care centers. By focusing on the creation of multifunctional spaces, communal areas, and accessible layouts, the study proposes design strategies that foster emotional comfort, reduce isolation, and promote social engagement. The design emphasizes the importance of creating a homelike atmosphere, with thoughtful attention to lighting, spatial layout, and personalized décor to meet the physical, emotional, and social needs of elderly residents. The goal is to create a supportive environment that enhances the quality of life for elderly individuals by providing spaces that promote a sense of community, comfort, and safety.

Research Objectives

To investigate how interior design strategies, specifically multifunctional spaces and accessible layouts, can enhance the emotional and social well-being of empty-nest elderly individuals in care centers, with a focus on creating environments that foster a sense of belonging, independence, and community.



Scope of the Research

1. Population Scope

This research focuses on empty-nest elderly individuals aged 60 and above, living in care centers within urban areas. The research will explore the physical, emotional, and social needs of these residents, and how care center environments can better address these aspects through thoughtful interior design.

2. Variable Scope

The study investigates key design variables that significantly influence the living conditions of empty-nest elderly individuals, including:

Space Layout: Analyzing the effectiveness of the layout in meeting daily functional needs, such as ease of movement, accessibility, and the allocation of space for both private and communal activities.

Emotional Support: Examining how the design of communal and private spaces contributes to reducing loneliness, encouraging social interaction, and promoting emotional well-being among elderly residents.

Safety and Comfort: Investigating how safety features (e.g., anti-slip flooring, handrails) and comfort aspects (e.g., appropriate lighting, ventilation) are integrated into the design to ensure that elderly residents can live independently and securely.

Literature Review

In recent years, a series of studies have been conducted on the interior design of elderly care centers for empty-nest elderly individuals, focusing on aspects such as spatial layout, functional zoning, emotional needs, and social interaction. The existing literature emphasizes various methods for improving elderly residents' quality of life through appropriate spatial layouts, barrier-free design, and interior design strategies.

1. Spatial Layout and Functional Design

Research indicates that a well-organized spatial layout and functional zoning are essential for elderly residents' daily activities. Lei and Mankhatitham (2025) suggest that integrating traditional landscape design strategies enhances interaction. Flexible, multifunctional spaces have been shown to improve satisfaction, especially for residents in care settings. However, these features must also address the emotional needs of elderly residents, particularly those in empty-nest situations.

2. Emotional Needs and Social Interaction

Empty-nest elderly individuals often face loneliness and emotional isolation. Zhang et al. (2024) emphasize that the layout of social spaces is crucial for emotional resilience. Biophilic design (Li & Wang, 2023) suggests that natural elements like plants and light can boost emotional well-being, though integrating these in empty-nest care settings remains a challenge.

3. Safety and Comfort

Safety and comfort are key elements of interior design. Barrier-free pathways, slip-resistant floors, and appropriate lighting are essential for ensuring independence. Chen et al. (2025) emphasize the importance of personalized safety features. While physical safety is well-explored, emotional comfort, through materials and spatial warmth, is less studied but critical for improving the quality of life for elderly residents in empty-nest situations.

4. Technology and Smart Design

The integration of smart technologies in elderly care centers is growing. Wang et al. (2024) suggest that smart home systems can enhance emotional well-being by facilitating



social connections. However, user-friendly interfaces are needed for elderly residents with varying cognitive abilities. The challenge remains in fully integrating emotional support through smart technologies for empty-nest elderly residents.

Research Methodology

1. Research Methodology

This study aims to construct a people-centered interior design framework for elderly care centers serving empty-nest seniors. The study employs a design-based approach, utilizing architectural design analysis, spatial organization principles, and practical design considerations to build a comprehensive design model. This method emphasizes key aspects such as functional zoning, circulation, emotional well-being, and the integration of social and rehabilitation functions, aiming to meet the physiological and psychological needs of elderly residents. The main data from the study are shown in Table 1.

2. Research Steps

The study will proceed through the following stages:

Literature Review: Establish a theoretical foundation by reviewing recent studies on interior design for elderly care centers, focusing on emotional well-being, social interaction, and accessibility.

Design Framework Development: Based on insights from the literature review, a human-centered interior design framework will be proposed, with a focus on spatial organization, indoor–outdoor integration, and multifunctional design.

Design Prototyping: Prototyping key spatial nodes and design elements to test their potential for enhancing comfort, safety, and social interaction for elderly residents.

3. Data Collection

Data collection for this study is based on architectural design analysis, considering both the site dimensions and building design specifics:

Site Area and Building Dimensions: The total site area of the elder care center is 13,500 m² (1.35 hectares), with the combined building floor area totaling 5,800 m². The design consists of three main buildings:

Building 1 (Active Zone): A dynamic space, including activity and performance areas, covering approximately 2,900 m².

Building 2 (Service Zone): Includes dining, kitchen, and fitness areas, covering around 1,508 m².

Building 3 (Quiet Zone): Housing sleeping and treatment areas, covering about 1,392 m². **Functional Zoning and Circulation:** The design incorporates dynamic zones (for activities and social interaction) and static zones (for rest and treatment). The spatial layout emphasizes smooth circulation paths, ensuring accessibility and safety.

4. Data Analysis

Data analysis will focus on evaluating the effectiveness of the design through several key dimensions, supported by architectural data:

Functional Adaptation:

Analyzing how the design accommodates daily activities and mobility. The site and building sizes will be assessed to determine if the spatial layout is appropriate for elderly residents. For instance, with a total circulation area in the main building corridors measuring ≥ 1.80 m wide, the design ensures free movement for wheelchair users. The separation of

dynamic and quiet zones will be evaluated to see if it effectively supports the flow of activities without interference between social and restorative spaces.

Emotional Experience:

The emotional comfort of the design will be analyzed by evaluating the layout of spaces such as performance areas and common living rooms. The use of soft curves, warm hues, and natural materials (such as wood) in the design will be examined to assess how well they create a calming and restorative environment. The size and layout of key spaces, such as the 2,900 m² area in Building 1 (active zone), will be analyzed to determine if it encourages social interaction and reduces feelings of isolation.

Safety and Accessibility:

The design's safety features, such as non-slip floors (e.g., R10 slip resistance for wet areas), handrails, and wide door clearances (≥ 0.90 m), will be assessed. The circulation paths between the buildings (e.g., pathways ≥ 2.0 m wide) will be analyzed for their accessibility, ensuring that they accommodate elderly residents' mobility needs. The integration of accessibility features, such as ramps and handrails, will be evaluated to confirm that the building layout supports safe movement for all residents.

Table 1: Design Data

Design Feature	Metric
Site Area (m ²)	13,500 m ²
Building 1 (Active Zone)	2,900 m ²
Building 2 (Service Zone)	1,508 m ²
Building 3 (Quiet Zone)	1,392 m ²
Corridor Width	≥ 1.80 m
Pathway Width	≥ 2.0 m
Room Size for Active Zone	2,900 m ²
Slip Resistance (Wet Areas)	R10
Handrails	≥ 0.90 m door clearance

Research Results

1. Spatial Concept and Overall Strategy

The design divides the site into active and quiet zones to create a balanced environment that supports both social interaction and restorative spaces. The circulation system is designed as a short-loop to connect the active and quiet zones, minimizing detours and ensuring smooth movement. Pathways are wide and accessible, allowing for independence and safety for the residents, as shown in Figure 1.1, which illustrates the spatial layout and the seamless connection between the different functional zones.

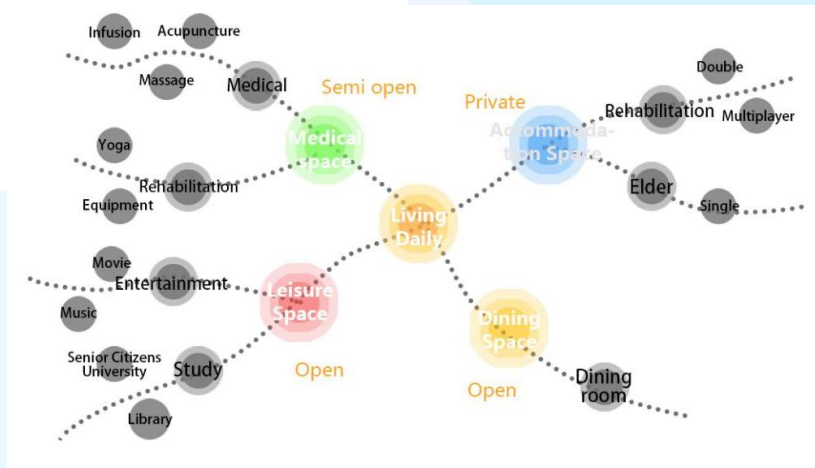


Figure 1.1 Spatial analysis diagram
 Photo source: Drawn by the author

1. Functional Zoning and Circulation

The layout follows two primary axes: the first, from the foyer to the dining and common activity areas, facilitates an easy transition from entry to settling; the second axis, connecting reading, music, and light exercise areas, gradually leads from active to quiet zones. Figure

1.2 shows a spatial analysis diagram that details the functional zoning and circulation paths.

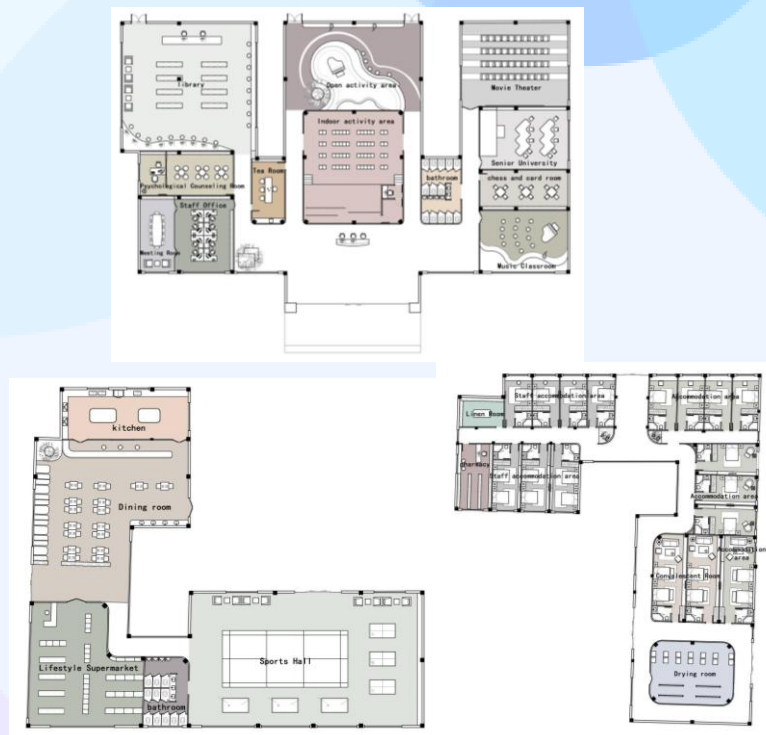


Figure 1.2 Spatial Functional Zoning
 Image Source: Author's drawing

1. Accessibility and Safety Parameters

The design ensures accessibility through wide corridors (≥ 1.80 m), door widths (≥ 0.90 m), and wheelchair turning spaces (≥ 1.50 m). Key features, such as ramps and handrails, are designed with slopes $\leq 1:12$, ensuring ease of movement for elderly residents. Non-slip flooring (R10 slip resistance) and visual contrast in boundary areas enhance safety, particularly in wet zones. This design approach aims to mitigate safety risks while ensuring the independence of elderly residents.

2. Lighting Strategy

Lighting is designed with an emphasis on promoting well-being and supporting residents' circadian rhythms. Areas such as dining spaces, activity rooms, and bedrooms are equipped with adjustable lighting levels, ensuring appropriate illumination for different functions. The use of warm-toned lights (2700–3500 K) reduces glare and creates a comfortable, homelike atmosphere. Low-level lighting in corridors and bathrooms helps guide residents without disturbing their rest.

3. Acoustics and Materials

The acoustic design focuses on reducing noise levels, with reverberation times (RT) ranging from 0.6–0.8 seconds in public spaces. The material palette includes a mix of soft and hard materials—wood, textiles, and mineral fibers—which balance comfort, ease of maintenance, and acoustic quality. Building services' noise is controlled to remain below 40 dB(A), promoting a quiet and peaceful environment for residents.

1. Key Interior Design Concepts and Techniques

The design of the elderly care center aims to create a peaceful and restorative environment for empty-nest elderly residents, using thoughtful materials, colors, and spatial organization to foster comfort, safety, and well-being.

Care Ward: The care ward utilizes warm tones as the primary color scheme to create a calming atmosphere. Natural materials like wood are incorporated into the design, while the background wall features simple, clean lines. The use of light-colored wood flooring provides both aesthetic appeal and slip resistance, ensuring safety and comfort for the residents. The design emphasizes a sense of tranquility and serenity, with subtle décor that enhances the overall well-being of the residents.

Open Activity Area: This area, which serves as both a social space and a piano performance area, is designed with flexibility in mind. The use of mobile furniture and foldable stage modules allows for easy reconfiguration of the space to accommodate different activities. The curved design elements create a smooth flow between spaces, contributing to an open and harmonious atmosphere. The design promotes both social interaction and individual activities, offering a versatile environment that supports diverse needs.

Music Classroom: The music classroom is designed to optimize acoustics for social and educational activities. Curved reflectors and absorbers are integrated into the ceiling and walls to enhance sound quality. The space is designed to encourage interaction while providing a calm and focused environment for residents and their companions. The layout allows ample space for musical activities, supporting both individual practice and group engagement.

Sports Hall: The badminton area features wood flooring with resilient underlay, providing a safe and comfortable space for physical activities. The ceiling design incorporates dynamic curved elements that contribute to the spatial depth of the area, creating an inviting and energetic environment. Layered lighting is used to enhance the three-dimensional feel of the space, ensuring both functionality and ambiance in this active area.

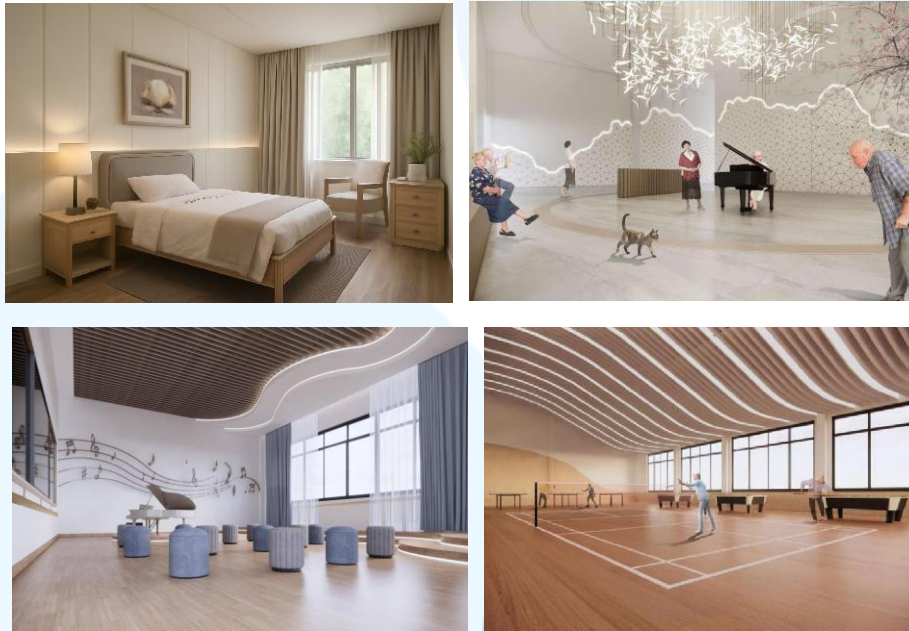


Figure 1.3 Interior rendering
 Image source: Rendered by the author

Discussion

This study examined the design of elderly care centers for empty-nest elderly individuals, focusing on their physical, emotional, and social needs. The findings highlight the importance of design elements such as lighting, accessibility, privacy, and social interaction spaces.

1. Interpretation of Findings

Lighting: Natural and soft lighting in both private and public spaces significantly improved residents' emotional well-being. Lighting was the most highly rated design element, confirming its importance in enhancing quality of life.

Accessibility: Wide corridors and ramps ensured residents with mobility issues could move freely, with 92% of residents expressing satisfaction with accessibility features.

Privacy and Social Spaces: Flexible private spaces with partitions and comfortable social spaces promoted interaction and reduced isolation, improving emotional well-being. 78% of residents felt these spaces met their emotional needs.

2. Comparison with Previous Research

Life-centered Design: This study moves away from medicalized, single-function designs, focusing on multifunctional spaces that support both social and private needs, which aligns with recent findings on the importance of flexibility.

Accessibility: The study emphasized practical design features like non-slip flooring and wider corridors, contributing significantly to mobility and safety, surpassing basic code requirements.

Lighting: The study's targeted lighting strategy, with ambient and task lighting, proved to be a strong predictor of overall satisfaction.

3. Unexpected Results

Privacy Concerns: Some residents, particularly in shared rooms, desired more personalized privacy measures, suggesting room for improvement in privacy design.



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Preference for Quiet Spaces: A small number of residents, especially those with cognitive impairments, preferred more intimate and quiet spaces, indicating a need for greater variety in social space design.

4. Limitations of the Study

Scope: The study was limited to a single region, which may not be applicable to all elderly care centers. Future studies could expand geographically.

5. Unexpected Results

Long-Term Evaluation: Future studies should assess the long-term impact of design on residents' well-being, ensuring the continued effectiveness of the design elements as residents' needs evolve over time.

Cultural Sensitivity: Future designs should prioritize cultural adaptation, taking into account the diverse traditions and values of elderly residents. Tailoring design features such as privacy, communal spaces, and social interaction areas to reflect local cultural preferences will enhance emotional well-being and inclusivity.

Sustainability: Future research should explore eco-friendly design practices to improve both sustainability and residents' comfort. This includes using sustainable materials, energy-efficient systems, and biophilic design elements that contribute to environmental and emotional well-being.

Recommendations

1. Refinement of Multifunctional Spaces

Future designs should further tailor multifunctional spaces based on post-occupancy feedback, particularly considering the diverse mobility and cognitive needs of elderly residents. Optimizing spaces like activity rooms and communal areas will help reduce isolation and encourage engagement.

2. Long-Term Evaluation of Design Impact

Conducting long-term evaluations (Post-Occupancy Evaluation, POE) will provide insights into how the design affects residents' emotional well-being and social interaction over time. This feedback can inform ongoing design improvements.

3. Enhancement of Cultural Sensitivity

Future designs should better integrate cultural diversity, particularly in multicultural settings, by involving residents and their families in the design process. This will help create spaces that enhance emotional connections and reduce feelings of alienation.

4. Expansion of Design Framework

The human-centered design framework can be expanded to other care settings, such as assisted living or dementia care centers. Testing this framework in diverse environments will improve its applicability and effectiveness.

5. Promotion and Implementation of the Design Model

Collaboration with architects, care facility operators, and urban planners is key to implementing these design strategies in real-world settings, setting new standards for elderly care facility design.

6. Future Research Directions

Future research should explore advanced smart technologies, like AI-based health monitoring, and study their impact on residents' health and quality of life. Research on cross-cultural design preferences will help create universally adaptable and culturally sensitive care environments.



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