



Chinese Art and Design of Bathroom Space for the Elderly

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Abstract

Background and Aims: The aging population is becoming an increasingly difficult burden for China. It is projected that China's senior population will reach the noteworthy 500 million mark by 2050, accounting for about one-third of the country's entire population. Thus, this research purpose is to study and design the bathrooms for the elderly people in Shandong and to analyze the needs of the elderly for the bathroom and Shandong art style in the design of the bathroom space for the elderly.

Methodology: The respondents to this study were 80 elderly people residing in Shandong, along with 10 experts possessing expertise in both the design of bathrooms for the elderly and Shandong art. The research employed a mixed-method approach, utilizing various instruments for data collection. These instruments included literature analysis, field study, questionnaire survey, and expert interview. The data collected through these methods were analyzed using descriptive statistics and content analysis techniques.

Results: The research results were as follows; (1) The elderly in Shandong prefer bathrooms with traditional cultural elements, emphasizing the importance of cultural identity and aesthetics. (2) Safety is identified as a crucial factor, with a significant portion of the elderly requiring accessible and safe bathroom environments, emphasizing the need for multifunctional and adaptive designs. (3) For incorporating the bathroom requirements of the elderly and Shandong artistic styles into the design of bathroom spaces. The designers should be concerned with seven aspects, which are Prioritize Safety and Practicality, Functional and Comfortable Design, Aesthetic and Emotional Consideration, Respect for Personal Preferences, Integration of Traditional Art with Modern Design, Human-Centered Design Approach, and Continual Learning and Adaptation.

Conclusion: The study highlights Shandong's older population's preference for bathrooms with cultural influences, highlighting cultural identity and safety. For an inclusive and practical bathroom environment, designers should incorporate these results into multipurpose, adaptable solutions that put safety, comfort, and cultural aesthetics first.

Keywords: Bathroom Space Design; Interior Design; Shandong Art; Elderly

Introduction

China is confronted with the progressively formidable challenge of population aging. By the year 2050, it is anticipated that China's elderly demographic will approach the significant milestone of 500 million individuals, constituting more than one-third of the total population (Hu, 2022). The State Council has outlined several requirements and guiding principles for elderly care facilities in the "14th Five-Year Plan for the Development of the National Elderly Care Industry and the Pension Service System" aimed at building a comprehensive, efficient, and sustainable elderly care service system. These include expanding the coverage and quality of elderly care facilities, establishing more facilities in urban and rural areas, and increasing service levels and bed capacity. Additionally, there is a focus on creating barrier-free environments in public spaces and elderly care facilities to cater to the specific needs of the elderly. Ensuring that elderly care facilities meet national standards for building safety and fire safety is also emphasized to provide a secure living and service environment for the elderly (The State Council of China, 2022). This support has led to the establishment of over 500 bathroom facilities for the elderly across the country, with demand exhibiting a continuous upward trajectory (National Bureau of Statistics & Ministry of Civil Affairs, 2018).

Shandong, as one of the initial provinces within the nation to experience the aging process, has garnered substantial policy backing for its elderly care industry. In light of the intricate and dynamic nature of the aging process, there exists a pronounced emphasis on addressing the emotional and affective requisites of the elderly population. The infusion of Shandong's artistic elements into senior care services





presents an opportunity to engender a sense of nostalgia and intimacy, thereby augmenting the overall well-being experienced by the elderly (Shandong College of arts & design, 2022).

Situated at the confluence of the Yellow River and the eastern foothills of the Taihang Mountains, Shandong boasts a reputation for industriousness and groundedness. Its inhabitants have dedicated their lives not only to making substantial contributions to society but also to selflessly caring for their families. As these dedicated laborers progress through the years, they aspire to lead a life of quality in their advanced age. In pursuit of this objective, Shandong has endeavored to establish various types of elderly care institutions. Nonetheless, deficiencies persist in both design and amenities (Shandong Provincial People's Government Information Office, 2019). These shortcomings are especially pronounced in the design of bathrooms. Firstly, the construction of bathrooms in certain elderly care facilities lacks distinct regional characteristics. While contemporary architectural styles may be attractive, they often fail to evoke a sense of cultural identity among elderly individuals who are well-versed in traditional Shandong culture. Wang et al. (2019) argue that there is a need for bathroom designs that embrace Shandong's local characteristics and harmonize with traditional cultural elements to meet the physical and spiritual needs of the elderly. Secondly, the current facilities in elderly care institutions do not adequately cater to the specific needs of the elderly, including issues related to mobility and visual impairment. Therefore, a more meticulous approach is required in the design of facilities within elderly care institutions to accommodate the physical and psychological needs of the elderly. Of particular concern are inherent safety hazards in bathroom design that can result in risks such as falls during bathing due to improper sizing and material choices. These issues require immediate attention to ensure the safety and well-being of the elderly population in their later years (Zhou et al., 2016). Furthermore, Shandong's elderly population typically exhibits a high degree of cultural sensitivity, seeking not only physical safety in their daily lives and activities but also emotional comfort. While current nursing homes emphasize meeting the spiritual and cultural needs of the elderly during facility construction and providing basic care services, this philosophy is often not reflected in the bathroom design process (Gao, 2020).

In conclusion, significant improvements are needed in the space design of bathrooms in Shandong nursing homes to effectively meet the unique requirements of Shandong's elderly population. This effort is driven not only by gratitude for the contributions of these individuals throughout their lives but also to establish a foundation for safeguarding the rights and well-being of the elderly. This study hopes to provide emotional, physical, and psychological comfort to Shandong's elderly population by incorporating Shandong's artistic styles into the design of nursing home bathrooms, ultimately enhancing the quality of life for the elderly in Shandong.

Objectives

1. To study the needs of the elderly of bathroom space design in Shandong.
2. To develop and design for the elderly of bathroom space with Shandong artistic styles.

Literature Review

Theoretical Background

The conceptual framework of this study draws upon Shandong art theory, Aesthetic theory, the James-Lange theory, and the principles of bathroom design for the elderly. This integrated approach provides a comprehensive foundation for understanding the incorporation of the elderly's bathroom requirements and Shandong's artistic styles into bathroom space design.

Shandong art: Shandong art theory refers to a comprehensive understanding and approach to the unique art forms originating from Shandong Province in China. The characteristics of Shandong art, deeply embedded in its rich historical and cultural heritage, encompass several key aspects. Firstly, it reflects a profound cultural depth and unique regional style, stemming from its status as a cradle of Chinese civilization and Confucian thought. Shandong art is diverse in its forms, including painting, paper-cutting, weaving, embroidery, ceramics, architecture, and sculpture, showcasing the richness and variety of its culture. The art theory of Shandong emphasizes the fusion of traditional elements with modern design, particularly notable in the design of living spaces for the elderly, representing respect for tradition coupled with an understanding of contemporary needs. Finally, the art is characterized by its naturalness, simplicity, and vitality, often depicting vivid human figures and landscapes, reflecting a deep appreciation and portrayal





of the natural environment. These characteristics together define the unique style and charm of Shandong art, securing its significant place in Chinese art (Liu, 2023).

Aesthetic theory: Aesthetic theory is a framework that delves into the connection between art and the experiences of beauty and aesthetic pleasure it elicits. It defines artworks as intentionally crafted objects designed to provoke aesthetic experiences in viewers, focusing on the perceptible qualities within artworks, such as composition unity or color vibrancy. By explaining how these aesthetic effects arise in the perception of a work, aesthetic theory seeks to elucidate its artistic qualities. Moreover, it sets the stage for a biological theory of artistic value by examining the evolutionary and biological significance of art in human culture and cognition (Seeley, 2018).

James-Lange theory (emotion theory): One of the earliest theories of emotion in psychology, the James-Lange theory developed by Dewey (1894) postulates that emotions are a byproduct of physiological arousal. This theory contends that physiological changes like elevated heart rate or crying are the main causes of emotions, as opposed to the previous view that emotions are responses to outside events. Stated differently, certain emotions are experienced as a result of the brain's interpretation of physiological changes in the body through the nervous system (Barrett, 2017; Cannon, 1927). This theory can be related to the content on nostalgia in older people's well-being. When older individuals experience nostalgia, the theory suggests that physiological responses, such as changes in heart rate or tearfulness, may be intertwined with the emotional experience of nostalgia, influencing their overall emotional well-being and sense of belonging. This theory highlights the connection between physiological responses and emotions in the context of nostalgia's impact on older individuals (Sedikides et al., 2004).

The principles of bathroom design for the elderly: the principles of bathroom design for the elderly refer to a set of guidelines and concepts that are aimed at creating functional, safe, comfortable, and aesthetically pleasing bathroom spaces specifically tailored to the needs and preferences of older individuals. These principles take into account factors such as accessibility, safety features, personalization, and the incorporation of artistic elements to enhance the overall quality of life and well-being of the elderly when using their bathrooms (Deardorff & Birdsong, 2005; Katherine, 2019).

Related Research

Internationally, there is a significant focus on designing bathrooms for the elderly that prioritize safety and independence. Abroad, research on bathroom design has focused on creating a space that combines art and comfort. In "Apartment Bathroom Design to Prevent Falls for Independence of the Elderly", Cho and Lee (2017) focused on flat bathroom design to reduce the risk of falls and increase the self-reliance of older people. The study focused on analyzing the main causes of falls in older adults and proposed a series of targeted design strategies. These include but are not limited to, the choice of flooring materials, anti-slip measures, proper layout of grab bars and handrails, and the provision of emergency call facilities. The study also highlights the importance of lighting in bathrooms and how operational complexity can be reduced by simplifying the design. The work of Cho H and Lee H provides practical guidance for improving the safety and independence of bathroom use for older people. Afifi et al. (2015) in 'Geriatric bathroom design to minimize the risk of falling for older adults—a systematic review' conducted a systematic study to explore the reduction of the risk of falls in bathrooms for older adults. They analyzed the main causes of falls in bathrooms for older adults by reviewing a large body of literature and made specific design recommendations based on these findings. The research recommendations included appropriate lighting, accessible entrances, the installation of grab bars and handrails, the use of sliding doors, and the installation of emergency call systems. In addition, they discussed the importance of material choices, such as the use of non-slip floor tiles and easy-to-clean surfaces. This research is valuable in understanding how to integrate functionality and safety in design to meet the needs of older adults.

In China, research on bathroom design for the elderly places a strong emphasis on meeting specific needs of them. Zheng (2015) conducted a thorough investigation into the utilization patterns of public bathroom spaces within elderly facilities. Her study offers insightful recommendations for enhancing the design of these spaces, rooted in observations of user behaviors and requirements. Emphasizing the importance of humanization and personalization, Zheng (2015) advocated for designs that account for the physical and mental attributes, as well as the individual habits, of older individuals. She stressed that effective designs should promote physical health, social interaction, safety, and privacy for the elderly. Similarly, in her doctoral thesis (Zhong, 2013), Zhong Lin delved into the design of public bathing spaces within elderly facilities. Her research aimed to improve the user experience of older individuals in such



environments. Zhong proposed innovative design concepts focusing on spatial adaptability, safety enhancements, and environmental ambiance optimization. She underscored the significance of considering both physical limitations and psychological needs during the design process, offering practical recommendations for implementation. In terms of governmental policy, the Shandong Provincial Department of Civil Affairs introduced initiatives to enhance the quality of nursing home services, emphasizing the promotion of private and public-private nursing institutions. Significant investments were made to rectify and upgrade facilities, reflecting efforts to address the needs of an aging population. These measures aim to improve the overall quality of life for elderly residents, aligning with the growing trend of elderly individuals opting for nursing home care.

In conclusion, while variations exist between domestic and international studies on senior bathroom design, they converge on the importance of creating safe, comfortable, and aesthetically pleasing environments. Whether focusing on artistic design abroad or cultural and safety considerations domestically, both approaches demonstrate a profound understanding and respect for the needs of the elderly. Additionally, the prioritization of nursing homes by the Shandong Province government underscores a commitment to providing comprehensive care for elderly residents.

Conceptual Framework

This study utilized a mixed-methods research approach. The researchers defined the research conceptual framework based on the Shandong art theory, Aesthetic theory, James-Lange theory (emotion theory), and the principles of bathroom design for the elderly. The details are shown in Fig.1.

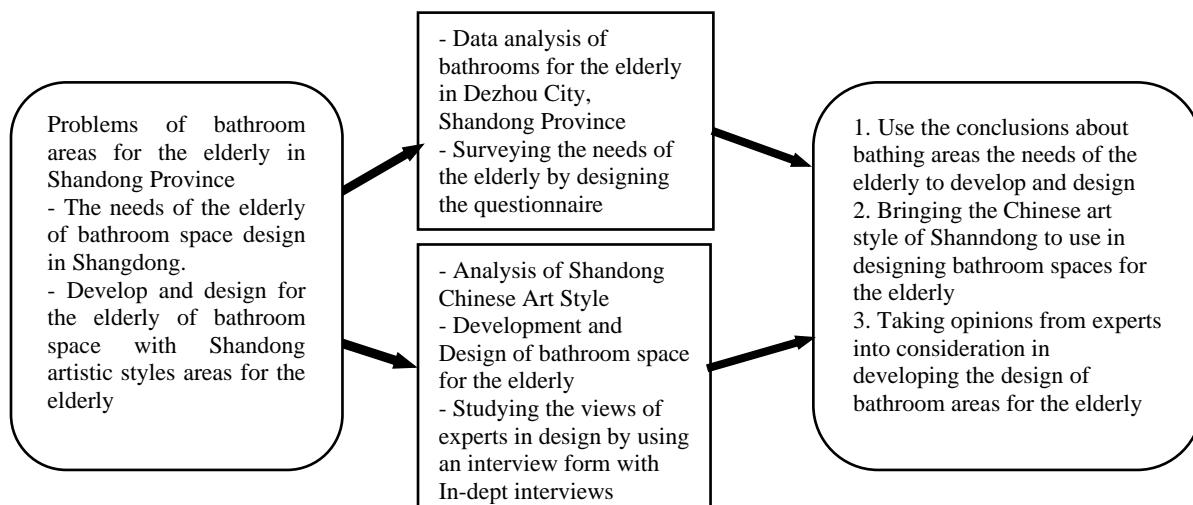


Figure 1 Conceptual Framework

Methodology

In this study, a mixed methods approach was employed to inform the development of a senior citizen bathroom tailored to the unique characteristics of Shandong. The study integrated both qualitative and quantitative research techniques to ascertain the design style and specific requirements for senior citizen bathrooms in Shandong. This comprehensive methodological approach facilitated a holistic understanding of the subject matter, enabling the researcher to effectively tailor the bathroom design to meet the needs and preferences of the elderly in the Shandong region. The methodology is outlined as follows:

Research Population

In the quantitative phase, the population for the questionnaire survey in this study refers to the elderly in the context of Shandong, particularly those residing in nursing homes or similar facilities. In the



qualitative stage, a total of 10 experts were selected as the research population, comprising 2 Gerontologists who provide crucial insights into the needs of the elderly, 3 Interior Designers optimizing aesthetics and functionality, 3 Architects offering structural and architectural expertise, and 2 Accessibility Specialists ensuring adherence to accessibility standards. Simultaneously, these experts also possess a profound understanding of Shandong art. This expert composition ensures a comprehensive examination of various aspects of senior citizen bathroom design, addressing specific requirements, aesthetics, structural considerations, and accessibility, thus enhancing the depth and effectiveness of the research study.

Research Sample

The sample for this research in the quantitative phase consists of 80 respondents who were the elderly from the specified population in Shandong. The participants were selected to engage in the research through the distribution of questionnaires in person, and they offered valuable insights by completing these survey instruments. These 80 valid questionnaires will be used to gather data and insights regarding the design concepts, goals, and preferences of the elderly in Shandong to design the senior citizen bathroom. Due to the limited number of experts, the researchers decided to use all 10 experts as a sample size for the interview part.

Data Collection

In terms of data collection, the researcher used a variety of methods, including field study, literature analysis, questionnaire survey and expert interview to explore the bathroom design needs of the elderly in Shandong and to investigate how to incorporate the bathroom requirements of the elderly and Shandong artistic styles into the design of bathroom spaces for the elderly.

Firstly, the researchers conducted a field study at a nursing home in Dezhou City, Shandong Province to look into the specific needs of the elderly concerning bathroom facilities. This study also employed a literature analysis approach, focusing on past literature related to bathroom spaces of the elderly, Shandong art, and relevant theories. The materials and literature were meticulously extracted from authoritative databases such as Wanfang and Wipu, and subjected to comprehensive analysis to obtain corresponding data. The researchers employed a questionnaire survey to gather and analyze data regarding the elderly bathroom space design. The questionnaire encompassed three sections: respondents' personal information, their requirements for the bathroom design, and their perceptions on the integration of Shandong art and the elderly bathroom space design, allowing for a holistic perspective. Moreover, the researchers conducted semi-structured interviews with 10 experts who are knowledgeable in both bathroom design for the elderly and Shandong art. The aim was to gather insights into the philosophy of designing bathrooms for seniors, the integration of Shandong art into such designs, and future trends in bathroom design for the elderly.

Data Analysis

In the analysis of data collected through a questionnaire survey targeting the elderly, the researchers employed descriptive statistics, specifically focusing on the frequency and percentage distribution. In parallel, for data acquired through field study, literature analysis, and expert interviews, a content analysis approach was adopted by the researchers.



The framework of the Research Methodology

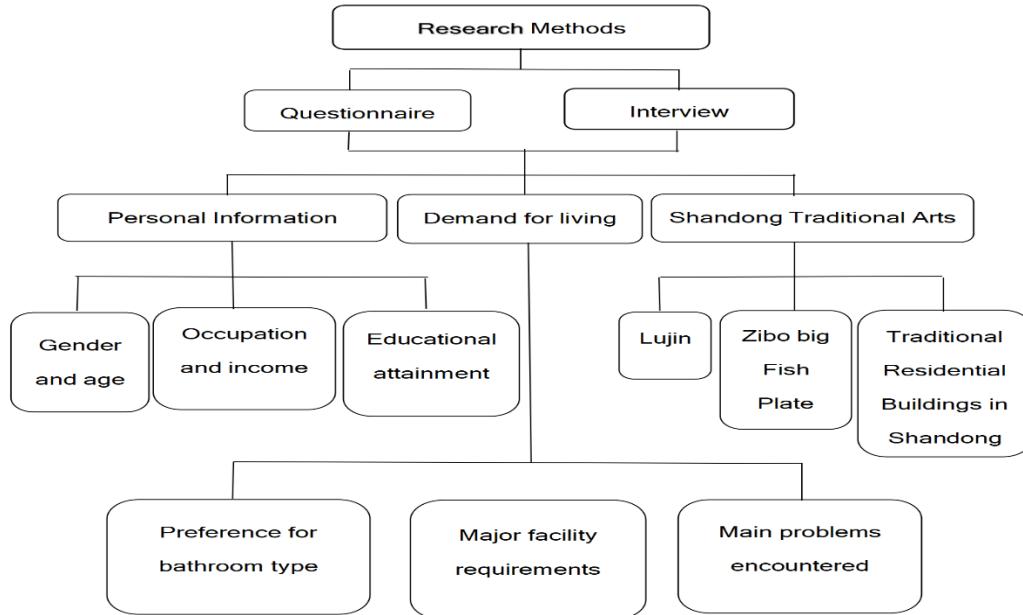


Figure 2 Framework of the Research Methodology

Results

Objective 1 of this study is to study the needs of the elderly of bathroom space design in Shandong. To achieve the objective 1, the researchers conducted a questionnaire survey with 80 elderly people. The respondents are relatively gender-balanced, with 56.25% being men and 43.75% women. Age-wise, the majority (63.75%) are in the 60-70 age group, with smaller proportions in the 70-80 (32.50%) and 80+ (3.75%) categories. In terms of income, a significant majority (58.75%) earns between 2500 and 4000 RMB, suggesting a moderate economic status. Occupation-wise, the largest segment (62.50%) comprises office workers, followed by general staff (18.75%), military personnel (12.50%), and others (6.25%). Educational attainment shows more than half (52.50%) having an education below the secondary level, with the rest having higher academic qualifications. This demographic profile offers an insightful look into the varied lifestyles and backgrounds of these elderly individuals (As shown in Table 1).

Table 1 Demographic data

| Demographic Characteristic | Frequency | Percentage |
|----------------------------|-----------|------------|
| Gender | | |
| Men | 45 | 56.25% |
| Women | 35 | 43.75% |
| Age Group | | |
| 60-70 | 51 | 63.75% |
| 70-80 | 26 | 32.50% |
| 80+ | 3 | 3.75% |
| Income | | |
| Less than 1000 RMB | 11 | 13.75% |
| 1000-2500 | 11 | 13.75% |
| 2500-4000 RMB | 47 | 58.75% |



| Demographic Characteristic | Frequency | Percentage |
|-----------------------------|-----------|------------|
| Over 4000 RMB | 11 | 13.75% |
| Occupation | | |
| Office workers | 50 | 62.50% |
| General staff | 15 | 18.75% |
| Military personnel | 10 | 12.50% |
| Others | 5 | 6.25% |
| Education Attainment | | |
| Below secondary level | 42 | 52.50% |
| Higher qualifications | 38 | 47.50% |

The results of the questionnaire survey presented the special preferences and needs of the respondents for bathroom space design. In terms of bathroom style preferences, the study found that a significant portion of the elderly (41.25%) preferred bathrooms with traditional cultural features, compared to 32.50% who favored modernity and 26.25% who opted for neat bathrooms. This preference for traditional styles underscores the importance of cultural identity among the elderly. Regarding the types of bathrooms used, a substantial majority (75.00%) of the participants reported using shower bathtubs, while 25.00% used swimming pool bathtubs. This indicates a strong preference for shower bathtubs among the elderly cohort. The study also explored the preferences for bathroom equipment. The results showed a diverse range of preferences, with the highest selections for showers (14.29%), lighting (13.79%), mirrors (13.30%), sinks (12.81%), and washbasins (12.32%). Less common choices included water heaters (2.96%) and bathtub heaters (3.94%). This variety in equipment preferences suggests a need for multifunctional and adaptable bathroom designs. Lighting preferences were also examined, revealing that 46.25% of the elderly preferred warm yellow lighting, followed by 36.25% for LED lighting and 17.50% for whiteout. The preference for warm yellow lighting may reflect a desire for a comforting and soothing environment. Mobility to the toilet was another critical aspect covered. A majority of the elderly (57.50%) were able to walk to the toilet without external assistance, while 23.75% required aids like crutches or rails, and 18.75% needed help in a wheelchair. This data underscores the importance of designing accessible and safe bathroom spaces. Finally, the study explored views of the elderly on the representative of Shandong art, finding that brocade (Fig.3) was most favored (56.25%), followed by Zibo Big Fish Plate - Fish Scale (Fig.4) (26.25%) and Traditional Residential Buildings in Shandong (Fig. 5) (17.50%). This preference highlights the connection of the elderly to cultural and artistic heritage.

Table 2 Preferences of the elderly

| Items | Frequency | Percentage |
|---|-----------|------------|
| Bathroom Style Preferences | | |
| Traditional cultural features | 33 | 41.25% |
| Modernity | 26 | 32.50% |
| Neat and tidy | 21 | 26.25% |
| Types of Bathrooms Used | | |
| Shower bathtubs | 60 | 75.00% |
| Swimming pool bathtubs | 20 | 25.00% |
| Preferences for Bathroom Equipment | | |
| Showers | 11 | 14.29% |
| Lighting | 11 | 13.79% |
| Mirrors | 10 | 12.50% |



| Items | Frequency | Percentage |
|---|-----------|------------|
| Sinks | 10 | 12.50% |
| Washbasins | 10 | 12.50% |
| Bathtub heaters | 3 | 3.94% |
| Water heaters | 2 | 2.96% |
| Lighting Preferences | | |
| Warm yellow lighting | 37 | 46.25% |
| LED lighting | 29 | 36.25% |
| Whiteout | 14 | 17.50% |
| Mobility to the Toilet | | |
| Able to walk | 46 | 57.50% |
| Require aids | 19 | 23.75% |
| Need help in a wheelchair | 15 | 18.75% |
| Views on Shandong Art | | |
| Brocade | 45 | 56.25% |
| Zibo Big Fish Plate - Fish Scale | 21 | 26.25% |
| Traditional Residential Buildings in Shandong | 14 | 17.50% |

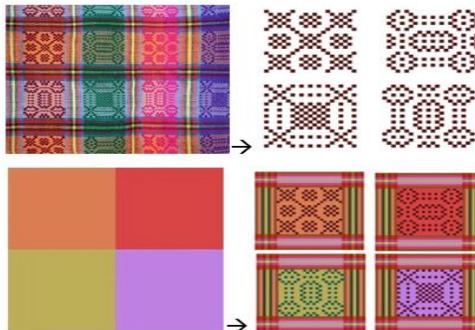


Figure 3 Brocade of Shandong Province
 Source: Created by authors

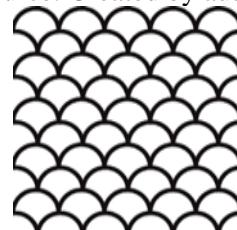


Figure 4 Zibo Big Fish Plate - Fish Scale
 Source: Created by authors

**Figure 5** Traditional Residential Buildings in Shandong

Source: Created by authors

The results of the questionnaire survey provided a comprehensive overview of the bathroom preferences of the elderly, emphasizing the need for culturally sensitive, safe, and functional bathroom designs that cater to the diverse and specific needs of this group of people.

Objective 2 of this study is to develop and design for the elderly of bathroom space with Shandong artistic styles. To achieve this objective, the researchers first conducted a field study to visit a bathroom of a nursing home in Dezhou City, Shandong province (as shown in Fig.6).

**Figure 6** The bathroom for the elderly

Source: Created by authors

The field study conducted on April 28, 2023, in a residence for the elderly, focusing on the bathroom environment, identified several design faults affecting the safety and comfort of the elderly. The primary issues found in the bathroom include:

(1) The bathrooms have a large space with dispersed facilities, leading to increased movement and risk of straining or falling for the elderly during grasping and leaning actions.

(2) The bathroom lighting is non-adjustable, causing difficulty for the elderly in adapting to the brightness when moving from darker to brighter spaces. This can lead to falls, scratches, and collisions. Lack of a ventilation system results in high temperatures during summer, causing physical discomfort for the elderly.

(3) The absence of anti-slip devices in the shower area, along with inadequate drainage and moisture control, makes the floors unsafe. The lack of efficient water absorption and drainage capacity adds to the risk.

(4) The most significant concern is the absence of safety handrails in the shower area. This absence increases the risk of falls due to slippery floors, particularly when the elderly are showering in a standing position. The inappropriate height of the washbasin, compounded by the lack of safety handrails, poses a risk. Prolonged standing and bending can cause lower limb and waist strain, potentially leading to fainting.

**Figure 7** Real-time recording of field study

Source: Created by authors

In summary, the results of the field study highlighted critical design flaws in the bathrooms of senior residences, focusing on safety and ergonomic aspects. These included issues with spatial layout, lighting, ventilation, anti-slip measures, and the lack of essential safety features like handrails. Addressing these problems is crucial to ensure the safety, comfort, and well-being of the elderly in these facilities.

To find out how to incorporate the bathroom requirements of the elderly and Shandong artistic styles into the bathroom space design, the researchers interviewed 10 experts, which comprising 2 Gerontologists who provide crucial insights into the needs of the elderly, 3 Interior Designers optimizing aesthetics and functionality, 3 Architects offering structural and architectural expertise, and 2 Accessibility Specialists ensuring adherence to accessibility standards.

In response to inquiries regarding the integration of Shandong art within bathroom design, experts expressed their enthusiasm, emphasizing the inherent charm and stylistic fusion of tradition and modernity inherent to Shandong art. Particularly in the context of designing bathrooms for elderly individuals, Dong emphasized his consideration of employing classic Shandong color schemes and patterns, such as sky blue, deep green, or golden yellow, citing their capacity to evoke a sense of tranquility and comfort tailored to the needs of the elderly demographic.

Regarding perspective on Shandong art, several experts articulated its stylistic diversity, attributing its evolution to the varying cultural traditions, lifestyles, and aesthetic inclinations prevalent across different countries and ethnic groups. Another expert further underscored the stability of Shandong art, grounded in extensive historical precedent and conceptual refinement. He acknowledged the evolution of Shandong art over time, noting that while superficial changes may occur, its essential essence remains steadfast.

Concerning the design requirements specific to the elderly, experts advocated for meticulous attention to consumer needs, particularly emphasizing the necessity for tailored care and consideration for this demographic. While advocating for the provision of appropriate advice, One expert underscored the importance of respecting the autonomy and emotional well-being of elderly individuals throughout the design process, ensuring the creation of an optimal design solution.



**Figure 7** Expert interview

Source: Created by authors

Based on the interview with 10 experts, several key suggestions emerged for designing bathrooms for the elderly:

Prioritize Safety and Practicality: The foremost consideration in designing bathrooms for the elderly is ensuring safety and practicality. This involves installing features like anti-slip flooring, adequate lighting, safety grab bars around the shower and toilet areas, and ensuring that the layout minimizes the risk of falls.

Functional and Comfortable Design: While functionality is crucial, comfort should not be overlooked. The design should cater to the ease of use and physical limitations of the elderly, with elements like adjustable shower heads, easy-to-use fixtures, and comfortable seating options.

Aesthetic and Emotional Consideration: Incorporating aesthetic elements that resonate with the elderly is important. This includes using colors and patterns that are visually pleasing and evoke a sense of tranquility and comfort. One expert suggested using classic colors and patterns from Shandong art to achieve this.

Respect for Personal Preferences: It's essential to respect the choices and emotions of the elderly in the design process. This means involving them in decision-making and tailoring the design to their specific preferences and requirements.

Integration of Traditional Art with Modern Design: The experts emphasize the importance of blending traditional art and modern design. Incorporating elements of traditional art, like Shandong art, can create a sense of familiarity and cultural resonance in the bathroom space.

Human-Centered Design Approach: Designers should focus on making the design human-centered. This means understanding the unique needs and preferences of the elderly and designing spaces that are not only functional but also emotionally supportive and comforting.

Continual Learning and Adaptation: Designers are encouraged to continually improve their understanding of traditional cultures and humanistic qualities. This broader knowledge base can inspire more targeted and effective designs that meet the specific needs of the elderly.

In summary, designing bathrooms for the elderly should be a careful balance between safety, functionality, comfort, and aesthetic appeal. The incorporation of traditional art and a deep understanding of the users' needs and preferences are key to creating spaces that are not only practical but also emotionally supportive.

Based on the results of the study, the researchers have delineated conceptual drawings for bathroom space design in Fig.7 and Fig.8.

**Figure 7** Conceptual drawing 1

Source: Created by authors

**Figure 8** Conceptual drawing 2

Source: Created by authors

The design concept for the senior bathroom, derived from the study results, emphasizes integrating the Shandong art style to cater to the preferences and needs of the elderly. This approach transforms the bathroom from a simple functional space to one imbued with Chinese cultural elements, featuring fish scale patterns on the walls of the wet and dry areas and traditional Shandong stone walls in the shower area for moisture-proofing. The use of wood-plastic composite (WPC) panels for flooring ensures slip resistance and moisture protection. The design process involved meticulous consideration of the elderly's needs and habits, using 3Dmax for realistic rendering and outputting high-quality image files, ultimately creating a bathroom space that is not only practical but also aesthetically pleasing, comfortable, convenient, and safe for the elderly. This holistic approach exemplifies how traditional art can be harmoniously blended with modern design to enhance the living environment for seniors.

Discussion

The objectives of the study were to study the needs of the elderly in bathroom space design in Shandong and to develop and design the elderly bathroom space with Shandong's artistic styles. This research encompassed a sample of 80 elderly people residing in Shandong, along with one expert possessing expertise in both the design of bathrooms for the elderly and Shandong art. The findings of this study were derived from a comprehensive methodology that included a questionnaire survey targeting the elderly population, interviews with experts, field investigations, and an analysis of relevant literature.

The results of this study offer valuable insights into the preferences and requirements of the elderly population in Shandong regarding bathroom space design. A notable finding is the strong preference for bathrooms that incorporate traditional cultural features. This preference, exhibited by 41.25% of the participants of the questionnaire survey, highlights the significance of cultural identity and heritage among the elderly. The inclination towards traditional styles over modern or minimalist designs suggests a deeper connection with cultural aesthetics, which should be considered in future bathroom designs for this demographic. The preference for traditional elements like the brocade of Shandong province, Zibo Big Fish Plate - Fish Scale, and Traditional Residential Buildings in Shandong, further emphasizes this point. This aligns with Xiao's (2021) research finding, indicating that traditional architectural elements hold significance for older adults, often evoking childhood memories and family traditions. The integration of such elements within bathroom spaces serves as a means to facilitate emotional connections and reinforce seniors' sense of family and cultural identity consistently. Moreover, Safety emerges as a critical aspect of bathroom design for the elderly. The study's findings on mobility to the toilet, with 42.50% of participants requiring some form of assistance, underline the need for accessible and safe bathroom environments. The field study conducted in a nursing home in Dezhou City identified several safety hazards, including large spaces with dispersed facilities and the absence of anti-slip devices and safety handrails, which significantly increase the risk of falls and injuries. Addressing these concerns is essential for enhancing the safety and



comfort of the elderly. Additionally, the diverse range of preferences for bathroom equipment, with showers, lighting, mirrors, sinks, and washbasins being the most selected, suggests a need for multifunctional bathroom designs that cater to varied needs. Furthermore, the preference for warm yellow lighting by 46.25% of participants points to a desire for a comforting and soothing environment, indicating the importance of creating a space that is not only functional but also emotionally supportive. These two aspects are substantiated by Chen et al. (2012), whose perspective underscores the importance of emphasizing safety features, design principles, and any specialized alterations or inventive elements when conceptualizing bathrooms tailored for older adults. Central to this design approach should be the incorporation of non-slip surfaces, the installation of grab bars, the implementation of emergency systems, meticulous attention to lighting, and the inclusion of accessible design elements. These considerations are deemed indispensable for safeguarding the well-being of older adults within the bathroom environment.

The suggestions from experts emphasize the importance of a human-centered design approach that balances safety, functionality, comfort, and aesthetic appeal. The recommendation to integrate elements of traditional Shandong art into modern bathroom designs presents an innovative way to cater to the emotional and cultural needs of the elderly. This approach not only respects the personal preferences of the elderly but also preserves and promotes local cultural heritage. This conclusion aligned with the research presented by Zhou et al. (2016), which emphasized the fundamental principle of designing bathrooms for the elderly. The key objective is to establish an environment that is safe, comfortable, and user-friendly, enhancing the seniors' quality of life. This approach is tailored to accommodate the diverse physical capabilities and psychological requirements of older adults through intelligent and intuitive design features.

The research results presented in this study shed light on how to incorporate the bathroom requirements of the elderly and Shandong's artistic styles into the senior bathroom space design. These findings are instrumental in guiding future designs and renovations of bathroom spaces in senior living environments, ensuring they are tailored to the specific needs of this growing population segment.

Recommendation

The study highlighted several recommendations for future research and practical application.

1. The research primarily examined the Shandong art style, suggesting that future studies could explore other local art styles and tailor the design of senior bathrooms to meet the specific needs of elderly populations in different regions.

2. The proposes incorporating the concept of nostalgia or creating environments that evoke a sense of home-like comfort and happiness, which can be integrated into the design of rooms or other spaces catering to the elderly.

3. The findings also have implications for the business sector, particularly within government-run nursing homes, where the process and design principles identified in the research can be applied to develop areas that better meet the needs of elderly residents

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