Older Tourists' Subjective Well-being: A Social Gerontology Perspective on Technology, Emotional Engagement, and Social Participation

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Abstract

The growing aging population presents unique opportunities and challenges for promoting older adults' well-being through tourism. This dissertation explores the interplay between mobile technologies (MTs), emotional engagement (EE), and social participation (SP) in fostering subjective well-being (SWB) among older adults, positioning tourism as a vital pathway to active aging. In this study, SWB is understood as comprising three core dimensions: hedonic well-being, eudaimonic well-being, and life satisfaction. By adopting an interdisciplinary approach, the research integrates insights from social gerontology, tourism management, and psychology to address gaps in understanding how tourism participation supports cognitive, emotional, and social health in diverse cultural contexts.

To measure SWB's three dimensions, the study conducted three experiments in the context of tourism. The first experiment focused on mobile technologies (MTs) and their contribution to health satisfaction, a key aspect of life satisfaction, by enhancing tourism accessibility and enabling older adults to maintain their well-being during their travel experiences. The second experiment explored emotional engagement within the tourism context, a key driver of eudaimonic well-being, finding that emotionally engaging tourism experiences help older adults find fulfillment and meaning in their travels. The third experiment examined the role of social participation through tourism, particularly activities such as volunteering, card games, and internet use during travel, and their effect on hedonic well-being, highlighting the positive affective experiences and social connections that these activities foster during tourism. The study also emphasizes cross-cultural differences in how these tourism-related activities contribute to well-being, suggesting that tailored interventions are necessary to address the diverse needs of older adults.

In conclusion, this dissertation introduces the EFE (Emotion-Friendly Environment) service design framework, which integrates the key findings of this research into a practical model for developing tourism services that prioritize emotional fulfillment. The EFE framework emphasizes the creation of emotionally meaningful and personalized experiences that support the

well-being of older adults, focusing on fostering emotional engagement and enhancing health satisfaction. This service design framework provides a comprehensive approach to improving SWB in older adults and tourism as a transformative mechanism for active aging.

This research makes significant theoretical contributions by extending technology acceptance frameworks, refining emotional engagement models, and advancing social support theory through cross-cultural perspectives. This research integrates theoretical insights from social gerontology with technological and socio-cultural considerations to develop a comprehensive tourism service framework for older adults. It also provides practical recommendations for designing inclusive tourism services that enhance well-being, foster intergenerational connections, and support cognitive health among older adults. By situating tourism as a mechanism for active aging, the study underscores its transformative potential in addressing global challenges associated with population aging and achieving sustainable development goals.

Keywords: Subjective Well-being, Active Aging, Mobile Technologies, Emotional Engagement, Social Participation

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Chapter One

Introduction

The Introduction chapter lays the groundwork for this dissertation by presenting an overview of the research context, objectives, and significance. It is structured to guide the reader through the study's background, purpose, and scope, while emphasizing the critical role of tourism in promoting active aging and enhancing older adults' subjective well-being (SWB).

1.1 Problem Statement and Research Gap

The global aging population is rising rapidly, with one in six people projected to be aged 60 or older by 2030, increasing from 1 billion in 2020 to 1.4 billion (United Nations Sustainable Development Group, 2023). This demographic transition underscores the pressing need to promote active aging and improve the well-being of older adults, aligning with global sustainable development goals (Foster & Walker, 2015; Qiao et al., 2022). Among various strategies for fostering active aging—such as aerobic exercise, cognitive training (Fabre et al., 1999), preventive health services (Gallegos-Carrillo et al., 2019), and balanced diets (Dwyer, 2001)—tourism stands out for its potential to improve older adults' quality of life (Ku, 2022; Patterson et al., 2021; Xiang & Qiao, 2022). Evidence suggests that travel can increase physical activity (Ferrer et al., 2016), strengthen social ties (Zhang & Zhang, 2018), and help maintain cognitive functions (Kelly et al., 2017).

In contemporary tourism, mobile technologies (MTs) have gained prominence, particularly among health-conscious older travelers (Bakir & Yeygel, 2023). Prior research highlights the utility of MTs in tackling health management, information sharing, and financial transactions (Leite et al., 2021; Zhang, 2023), and in enhancing travel accessibility (Kim et al., 2016). In China, the pandemic propelled rapid adoption of mobile apps for location tracking, identity verification, and information reporting (Ye, 2020), which in turn opened new opportunities for

growth in the older adult's tourism market (Zhai & Shi, 2021). Recent industry data confirm MT's strong performance in Chinese tourism. For instance, Mafengwo (2024) reports that over 85% of Chinese travelers use mobile phones throughout their trips, averaging six hours of daily usage. The most frequently used apps include map/transportation (86%), tourism (72%), photography (68%), social media (64%), and music (43%), pointing to MTs' substantial influence on travel behavior and preferences. However, while existing research has focused on the functional benefits of MTs, such as navigation and booking, limited attention has been given to their psychosocial impact, particularly their role in enhancing mental health, emotional well-being, and social connections. This gap is especially significant for older adults, who often face unique challenges, including caregiving responsibilities and cultural norms such as filial piety, which influence their travel behaviors (Wu, 2022). Understanding how MTs address these challenges and promote subjective well-being (SWB) can provide valuable insights for designing inclusive and supportive travel experiences.

Another critical dimension of tourism experiences is tourists' engagement. Chang et al. (2024) introduced a triple model showing the dynamic relationship between tourist engagement and well-being, while So et al. (2024) demonstrated that engagement has a long-term positive effect on well-being. While previous studies have confirmed strong links between engagement, loyalty, and well-being (Zhou & Yu, 2022; Stylidis et al., 2021), the tourism field lacks detailed classifications of engagement types and levels. There is still limited research on whether different types of engagement have varying impacts on well-being in tourism programs. Besides, current studies on tourist loyalty emphasize surface-level factors like repeat visits but often neglect the emotional and cognitive connections essential for long-term loyalty, particularly for the older adults' market (Wang & Li, 2023). Understanding the distinctions between different types of engagement is crucial for designing effective tourism programs that cater to diverse needs and maximize well-being outcomes. Older adults, as a rapidly growing demographic in the tourism sector, have unique psychological and emotional needs that demand attention. It directly affects both the well-being of older tourists and the sustainability of tourism businesses. To address the research gap, this study proposes a surface and deep level model to classify older adults' engagement, brand loyalty (BL), and SWB into surface-level and deep-level dimensions. The primary goal is to investigate the differential effects of surface-level (behavioral) and deep-

level (emotional) engagement on hedonic well-being (HW), eudaimonic well-being (EW), and BL among older tourists. The findings are intended to support the development of transformative service strategies that foster deeper emotional engagement, thereby promoting sustainable tourism tailored to the needs of older adults.

Social participation is the third issue of active aging in tourism in the dissertation. Participation in social activities (SA) reflects the adaptive strategies of older adults to maintain their quality of life (Lam et al., 2015) and has been shown to play a critical role in mitigating cognitive decline (Lee et al., 2023). Globally, approximately 30% of older adults experience cognitive impairments, with prevalence rates even higher in rural populations (Ren et al., 2018; Wang et al., 2020). Given the aging population's vulnerability to cognitive decline, identifying effective interventions to preserve cognitive health is an urgent priority. Social participation has consistently been identified as a protective factor for cognitive health, promoting delayed memory retention and reducing the risk of cognitive impairments (Lee et al., 2023). By fostering social participation, older adults can maintain their mental agility, emotional resilience, and a sense of purpose, all of which contribute to their subjective well-being. Tourism, as a dynamic form of social participation, holds unique potential to serve as a platform for meaningful engagement. It not only offers opportunities for older adults to connect with others but also exposes them to enriching experiences that support cognitive stimulation and emotional well-being.

However, the relationship between social participation and cognitive health in the context of tourism and across diverse cultural settings remains underexplored. Cultural norms and societal structures significantly influence how older adults engage socially and the cognitive benefits they derive from these interactions. For instance, in collectivist societies like China, social participation may be deeply rooted in family and community ties, while in individualistic societies like the United States, community-based programs and volunteerism play a more prominent role. This study addresses the critical gap by examining the connection between older adults' social participation and cognitive health within different cultural contexts. By exploring how tourism facilitates social engagement and cognitive stimulation, this research aims to uncover culturally specific strategies that enhance the well-being of older adults. These findings

have the potential to inform the design of inclusive tourism experiences that promote active aging and provide actionable insights for policymakers and stakeholders in aging and tourism industries.

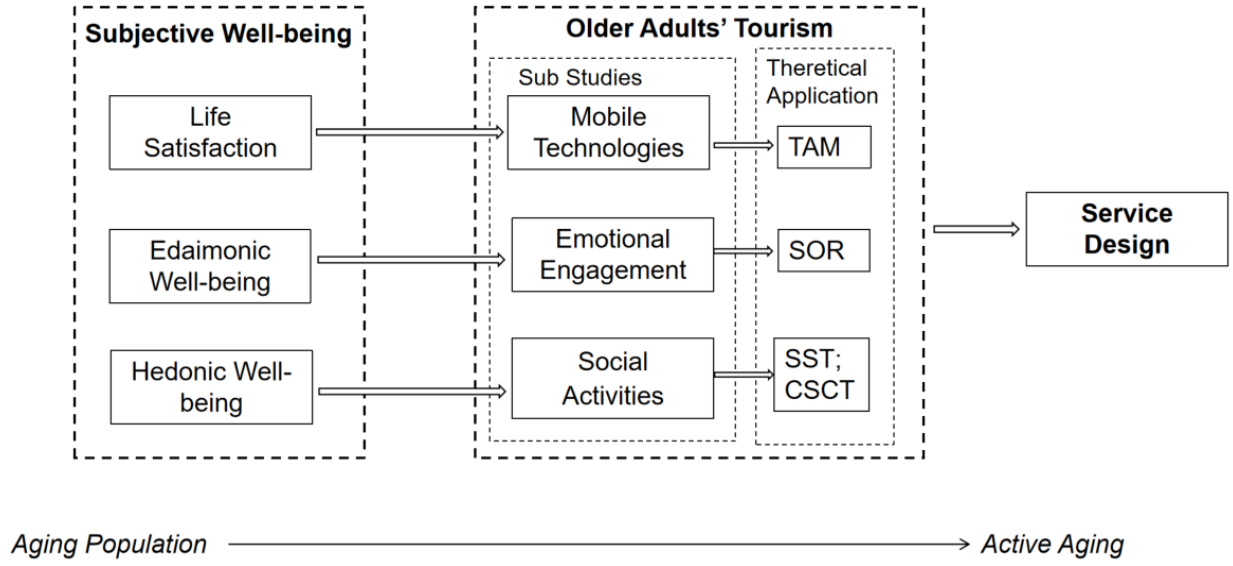


Fig. 1 The Overall Research Framework: The Role of Elderly Tourism in Enhancing SWB and Promoting Active Aging (Source: Authors own work)

Addressing the above gaps, this dissertation explores the interplay of mobile technologies, emotional engagement, and social participation in enhancing older adults' subjective well-being through tourism, as shown in Fig. 1. By employing a mixed methods approach and incorporating cross-cultural perspectives, the research aims to provide actionable insights for policymakers, tourism stakeholders, and social gerontologists. These findings will not only advance theoretical frameworks in tourism and social gerontology but also support the development of inclusive, engaging, and sustainable tourism experiences that contribute to active aging and global well-being.

1.2 Research Objectives

The primary objective of this dissertation is to explore the dynamic factors influencing subjective well-being (SWB) among older adults in tourism contexts, with a focus on the roles of

technology, tourism engagement, and social participation. By addressing these dimensions, the research aims to contribute to the understanding of how tourism participation can enhance SWB and promote active aging, as shown in Fig.1.

The specific objectives are outlined as follows:

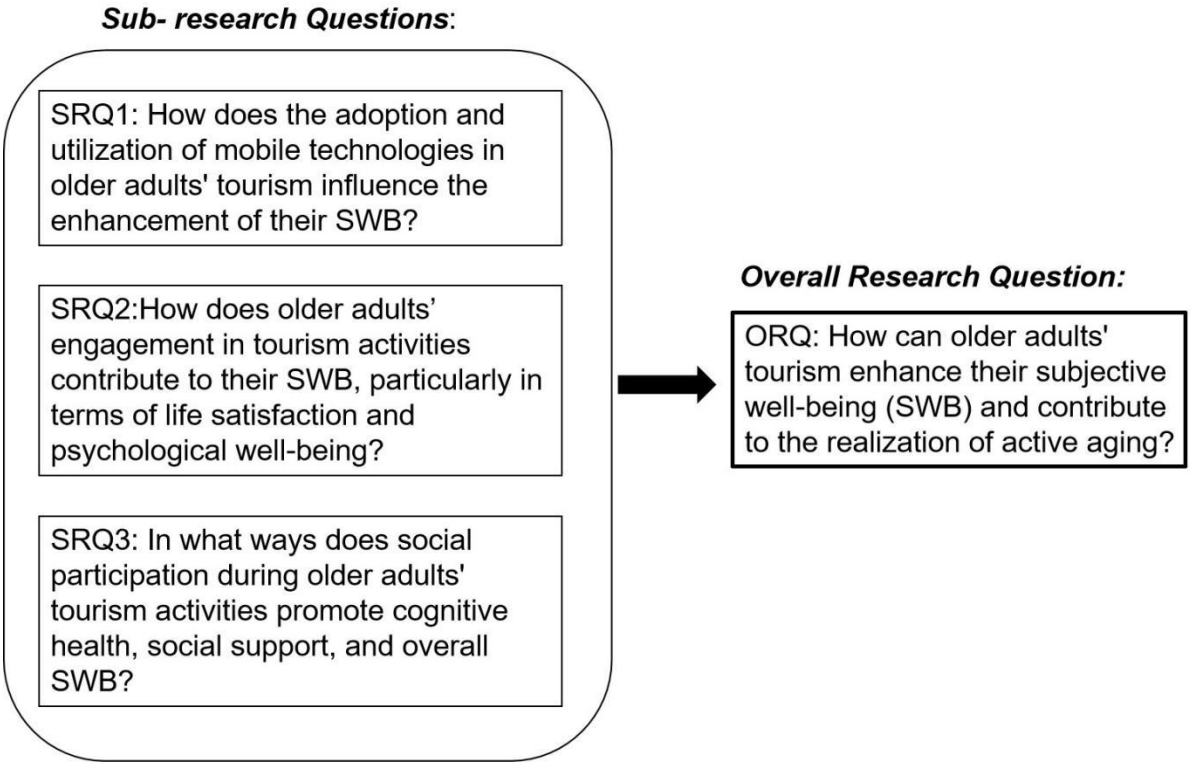


Fig.2 Overview of Research Questions (Source: Authors own work)

Overall Research Question: *How can older adults' tourism enhance their subjective well-being (SWB) and contribute to the realization of active aging?*

Sub-questions

SRQ1: How does the adoption and utilization of mobile technologies in older adults' tourism enhance their life satisfaction, and in turn, contribute to the improvement of their SWB?

First, to examine the role of mobile technologies (MTs) in enhancing older adults' subjective well-being in tourism contexts, this objective investigates how MTs contribute

to improving mental health, fostering social engagement, and addressing emotional well-being among older adults, particularly in the Chinese context. It seeks to understand the broader psychosocial benefits of MTs, including their potential to support older adults who balance caregiving responsibilities with personal leisure during travel.

SRQ2: How does older adults' engagement in tourism activities contribute to their eudaimonic pleasure, in turn to improve SWB?

Second, to investigate the impact of engagement on SWB and brand loyalty (BL) in wellness tourism: This objective focuses on analyzing different levels and types of engagement in wellness tourism, distinguishing surface-level involvement from deep emotional connections. It aims to reveal how emotional engagement influences subjective well-being and contributes to the sustainability of wellness tourism programs for older adults.

SRQ3: In what ways does social participation during older adults' tourism activities promote hedonic pleasure, and overall SWB?

Third, to analyze the role of social participation in promoting cognitive health and subjective well-being across cultural contexts, this objective examines the relationship between social interaction and delayed memory, a key component of cognitive health, through a cross-cultural comparison of older adults in China and the United States. It aims to uncover how cultural norms shape the effectiveness of social participation in fostering cognitive health and subjective well-being in tourism context.

1.3 Research Scope

Scope of Research Population

This dissertation focuses on the older adult population in China, specifically examining individuals aged 60 years and above who engage in tourism activities. Older Adults tourism, also referred to as "senior tourism," encompasses travel activities undertaken by older individuals for

various purposes, including recreation, health improvement, social engagement, cultural exploration (Przybysz & Stanimir, 2022), and personal growth (Mangunsong, 2020). In defining older adult tourists, this study adopts the categorization proposed by Patterson and Balderas (2020), who identified this demographic as individuals aged 60 and above seeking travel experiences that positively contribute to their well-being and necessitate customized services from tourism providers. This definition aligns with the notion that travel promotes the physical and mental health of older adults and supports the concept of active aging. Previous research further segments this group into categories such as empty nesters (55–64 years), young seniors (65–79 years), and seniors (80 years and above) (Patterson & Balderas, 2018). However, the focus here is on those aged 60 and above, as this aligns with China's official retirement age and reflects the stage when individuals typically transition into senior life.

Scope of Older Adults' Subjective Well-being

In this study, Subjective Well-Being (SWB) refers to older adults' subjective experience and evaluation of their well-being, encompassing their emotional, cognitive, and social aspects of life quality. Based on previous research, SWB is primarily understood as consisting of three dimensions: hedonic well-being, eudaimonic well-being, and life satisfaction. Hedonic well-being focuses on the emotional aspect, emphasizing positive and negative affective experiences (Diener, 1984). Eudaimonic well-being centers on the fulfillment of one's potential and the pursuit of meaning in life (Ryff, 1989). Life satisfaction, on the other hand, involves a cognitive evaluation of one's life, assessing how well life measures up to personal standards and goals (Diener, 1984). These three dimensions together form a framework for understanding and measuring SWB, particularly in the context of older adults' experiences.

Scope of Older Adults' Social Participtionn

Social participation has been widely recognized as a key component of active aging, contributing significantly to the well-being and cognitive health of older adults. Despite its recognized importance, the concept of social participation lacks a single, universally accepted definition. Levasseur et al. (2010) defined it as activities that encourage interactions within community

settings, while Wang (2011) described it as benefiting both the individual and the broader community. Dehi Aroogh et al. (2020) emphasized active participation in social activities outside the home. Although varied, these definitions consistently underscore the importance of interaction between older adults and their social environments, whether community-based or familial. In this study, older adults' social participation is defined as involvement in activities that entail interaction with others and result in personal fulfillment. Based on the data from the China Health and Retirement Longitudinal Study (CHARLS) and the Health and Retirement Study (HRS), the scope of social participation is categorized into three key areas:

- Leisure Activities: These include recreational and entertainment activities that foster social connections and personal enjoyment.
- Volunteer Services: Activities where older adults contribute to their communities, supporting both individual well-being and societal benefit.
- Income-Generating Activities: Participation in paid work or economic activities, promoting both engagement and financial independence.

Scope of Brand Loyalty in Older Adults' tourism

In this study, we classified brand loyalty into two categories: action loyalty and social loyalty. This classification reflects a layered approach to understanding loyalty, which aligns with the study's objective of exploring the differences between surface-level (short-term) and deep-level (long-term) brand loyalty. The purpose of this classification is to provide a detailed framework for analyzing how different dimensions of loyalty impact older adults' subjective well-being and their engagement with tourism.

Action Loyalty reflects observable actions such as repeat purchases, active participation, and word-of-mouth recommendations, often driven by financial incentives and convenient customer experiences (Yoon & Uysal, 2005), which represents surface layer of brand loyalty. This surface layer of loyalty is influenced by tangible factors like the company's infrastructure, customer service policies, and specific wellness program structures that ensure consumer ease and satisfaction (Kopp, 2023). On the other hand, Social Loyalty is rooted in a deeper emotional connection, where consumers' beliefs, attitudes toward wellness, personal values, and

perceptions of the brand play a critical role. This dimension is less swayed by price and more by the brand's alignment with the consumer's personal and social identity (Acar et al., 2024).

Scope of Older Adults' Engagement in Tourism

This study examines older adults' engagement in tourism that includes behavioral, cognitive, and emotional dimensions. By adopting and building on the framework established by Harrigan et al. (2017), the research explores how these dimensions influence older tourists' involvement with wellness tourism brands and their subsequent loyalty and well-being. Behavioral Engagement (BE) represents the surface-level form of engagement, encompassing observable interactions and active participation in tourism activities. Interaction, as highlighted by Harrigan et al. (2017), refers to engagement behaviors that go beyond simple transactions, including interactions with the environment, local communities, and fellow travelers. These immediate and transactional behaviors not only reflect a connection to wellness tourism brands but also foster loyalty through meaningful exchanges during the travel experience. Participation is another critical aspect, as So et al. (2016) emphasize the significance of conscious involvement in activities. For older adults, active participation in wellness-focused travel experiences—such as spa retreats, guided tours, or cultural workshops—directly influences their brand loyalty and engagement with wellness tourism services.

Cognitive Engagement (CE) expands the scope of behavioral involvement by highlighting how older tourists acquire new knowledge and understanding through their travel experiences. This learning process, defined as acquisition, is shaped by the quality of information provided by tourism providers. Islam et al. (2017) underscore the importance of accurate, relevant, and timely information in enhancing customer engagement. For older tourists, such information facilitates deeper cultural understanding, encourages healthy lifestyle adoption, and fosters long-term engagement with wellness tourism activities.

Emotional Engagement (EE) delves into the deeper, intrinsic connections older tourists form with wellness tourism brands. Absorption, as described by Hollebeek (2011), reflects the immersive experience of older adults as they become fully engaged and mentally focused on

wellness activities. This sense of immersion enhances their emotional satisfaction and strengthens their connection to the brand. Another key dimension, identification, refers to the emotional bonds older tourists form with the brand, creating a sense of belonging and alignment with their values and identity. This emotional connection is integral to developing loyalty and sustaining long-term engagement with wellness tourism.

1.4 Significant of Research

This dissertation investigates the factors influencing older adults' subjective well-being (SWB) in tourism contexts, with a particular focus on mobile technologies (MTs), emotional engagement, and social participation. By addressing gaps in the literature and integrating interdisciplinary perspectives, the study offers significant contributions across academic, practical, and societal dimensions.

From an academic perspective, this research extends existing frameworks, such as the Technology Acceptance Model (TAM) and social support theories, to reflect the unique needs of older adults in tourism. It bridges the disciplines of tourism management, social gerontology, and psychology, offering a comprehensive understanding of how tourism participation promotes active aging and well-being.

Practically, the study highlights actionable strategies for designing inclusive and engaging tourism experiences tailored to older adults. By focusing on the role of mobile technologies, emotional engagement, and social participation, the research provides valuable insights for tourism operators, policymakers, and community leaders seeking to enhance the quality of life for older adults through innovative services.

At the societal level, this research underscores the importance of tourism as a mechanism for promoting active aging, aligning with global efforts to achieve sustainable development goals (SDG 3.4). It advocates for meaningful social participation, including volunteerism and

intergenerational engagement, as pathways to improving cognitive health and emotional well-being among older adults in diverse cultural contexts.

This research aligns with global and national priorities, such as promoting sustainable and inclusive tourism, designing age-friendly services, and fostering intergenerational solidarity. By integrating theoretical advancements with practical applications, the study bridges the gap between academic research and real-world implementation, contributing to a holistic understanding of how tourism participation can support active aging, enhance subjective well-being, and address the unique needs of older adults across diverse cultural contexts.

1.5 Organization of Dissertation

This dissertation is structured into eight chapters, each designed to systematically explore and address the research objectives, questions, and overarching aim of enhancing older adults' subjective well-being in tourism contexts. Below is an overview of the organization of the dissertation:

Chapter 1 Introduction: This chapter introduces the background and significance of the study, highlighting the research problem, objectives, scope, and expected contributions. It provides an overview of the context and rationale for the research, culminating in an outline of the dissertation structure.

Chapter 2 Literature Review: The literature review synthesizes prior research in the fields of social gerontology and tourism management. It begins with a bibliometric analysis of research trends in older adults' well-being and tourism from 2014 to 2024. The chapter then explores relevant theoretical frameworks, including the active aging model, social support theory, and the Stimulus-Organism-Response (SOR) framework, and discusses their relevance to the study. Key themes such as technology adoption, social participation, and engagement in tourism are also addressed to provide a theoretical foundation for the research.

Chapter 3 Methodology: This chapter outlines the research design and methodologies employed across the three studies. Each study's data collection procedures, sampling strategies, and analytical techniques are detailed. Study 1 and Study 2 adopt a mixed methods approach to examine mobile technologies and emotional engagement, respectively, while Study 3 employs a cross-cultural comparative design to explore social participation's impact on older adults' well-being.

Chapter 4 Results of Study 1: This chapter presents the findings of Study 1, which investigates the role of mobile technologies in enhancing older adults' subjective well-being in tourism. Both quantitative and qualitative results are discussed, highlighting the key technologies and their influence throughout the travel cycle. The chapter concludes with implications for how mobile technologies support well-being in line with SDG 3.4.

Chapter 5 Results of Study 2: The findings of Study 2 focus on the influence of emotional engagement on older adults' tourism experiences and well-being. Quantitative results, including structural equation modeling, are complemented by qualitative insights that reveal factors influencing emotional engagement. A conceptual framework is proposed to deepen understanding of these mechanisms.

Chapter 6 Results of Study 3: This chapter reports the results of the comparative study on social participation's impact on older adults' cognitive function and subjective well-being. Regression analyses using data from CHARLS and HRS reveal significant effects of social activities on delayed memory, while mediation analysis highlights the roles of education and social participation. The chapter emphasizes cross-cultural perspectives and their implications for promoting active aging.

Chapter 7 Discussion and Development of an Integrated Theoretical Model: This chapter synthesizes insights from the three studies to propose an integrated theoretical model for enhancing older adults' subjective well-being in tourism. Each study's findings are revisited to highlight their contributions to the theoretical framework. The proposed model integrates mobile

technologies, emotional engagement, and social participation, offering a comprehensive approach to understanding and improving older adults' tourism experiences.

Chapter 8 Conclusion and Future Directions: The final chapter revisits the research objectives and questions, summarizes the key findings, and highlights the theoretical and practical contributions of the study. It discusses limitations and provides recommendations for future research, emphasizing the importance of advancing social gerontology and sustainable tourism practices for older adults.

Chapter 2

Literature Review

2.1 Overview of Research Trends in Older Adults' Well-being and Tourism (2014-2024): A Bibliometric Analysis

The global aging population has elevated older adults as a critical demographic in tourism research, with increasing emphasis on their well-being. This study explores global research trends on the impact of tourism on older adults' well-being over the past decade through a bibliometric analysis, conducted using the bibliometrix package in R. The articles were selected from the Web of Science Core Collection, with a final sample of 150 papers included for in-depth analysis. Findings reveal a significant shift in focus from service quality and customer satisfaction to health-oriented and community-focused themes, with 2020 emerging as a pivotal year due to the influence of the COVID-19 pandemic. This study provides valuable insights for designing inclusive, sustainable, and health-focused tourism strategies that cater to older adults' unique needs.

2.1.1 Background

The global aging population has become a defining demographic trend of the 21st century, with older adults constituting an increasingly significant portion of society (World Health Organization [WHO], 2023). This shift has profound implications across various sectors, particularly tourism. The unique needs and preferences of older adults have spurred interest in older adult tourism, defined as the travel activities undertaken by individuals aged 60 years and older (Patterson & Balderas, 2020). These activities are often driven by motivations such as recreation, health benefits, social engagement, and cultural exploration (Przybysz & Stanimir, 2022). Scholars have highlighted the multifaceted benefits of tourism for older adults,

emphasizing its role in promoting physical health, mental well-being, and social connections (Duarte, 2015; Aggarwal et al., 2023).

The concept of well-being is central to understanding the impact of tourism on older adults. According to the WHO (2023), well-being encompasses physical, mental, emotional, and social dimensions, representing a holistic view of health. For older adults, well-being is influenced by factors such as health status, social relationships, and living conditions (Sirgy, 2021). In the context of tourism, well-being reflects not only life satisfaction and happiness but also the deeper benefits derived from meaningful travel experiences (Su et al., 2020; Zhang et al., 2023). Recent studies have identified tourism as a key driver of well-being, highlighting its capacity to foster active aging, strengthen social bonds, and support mental health (Hwang et al., 2020; Asan et al., 2024). For instance, Zhang et al. (2023) developed a Well-being Scale for Older Adult Tourists, emphasizing dimensions such as positive emotions, social relationships, and connectedness to nature, further underscoring the strong link between tourism and well-being.

The COVID-19 pandemic, declared a global pandemic by the World Health Organization in March 2020, marked a pivotal moment in the intersection of tourism and public health. Older adults, as a particularly vulnerable group, faced heightened health risks, social isolation, and disruptions to travel opportunities. These challenges have catalyzed a global shift in tourism research and practice toward health-centric and inclusive travel experiences. Post-pandemic policy reforms and the emphasis on accessible tourism facilities reflect the industry's evolving commitment to inclusivity and sustainability (WTO, 2023).

While significant progress has been made in understanding the relationship between tourism and well-being, existing research has primarily focused on isolated aspects, such as health benefits or travel motivations, without providing a comprehensive analysis of thematic trends and evolving research priorities over time. Addressing these gaps is crucial to align tourism practices with the changing needs and expectations of older adults, particularly in a rapidly evolving global context. To bridge these gaps, this study aims to analyze global research trends on the impact of tourism on older adults' well-being over the past decade. It seeks to explore thematic shifts, evaluate the

influence of global transformations, and contribute to a deeper understanding of how tourism can support active aging, resilience, and well-being.

2.1.2 Data Collection and Methodological Approach

Data acquisition:

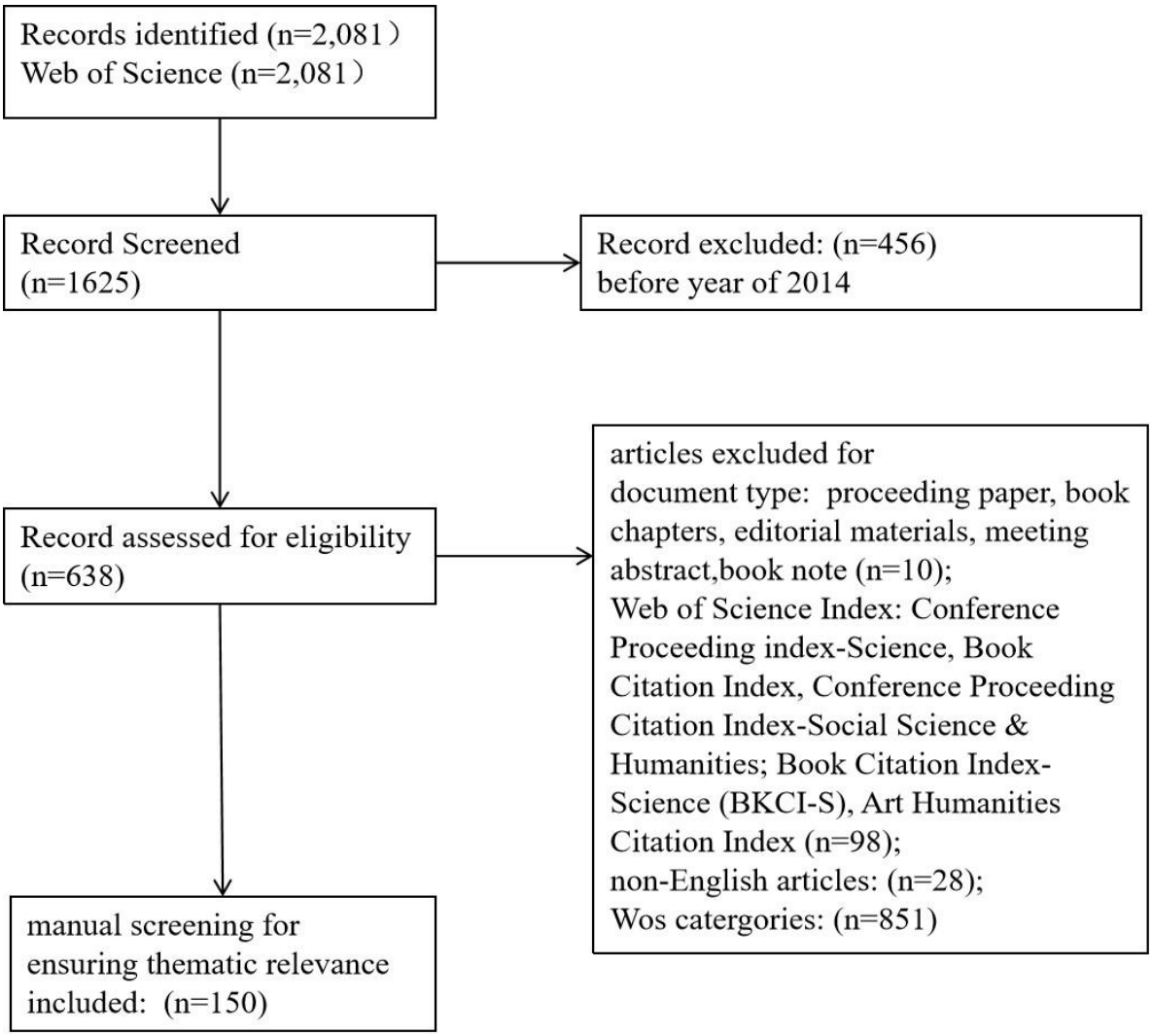


Fig. 3 Flow Diagram of Study Screening and Selection (Source: Authors own work)

Our data was obtained through a search in the Web of Science Core Collection (WoSCC), as Web of Science is regarded as one of the most authoritative scientific literature platforms (Liu & Bornmann, 2023). In constructing our keyword search strategy, we utilized MeSH (Medical Subject Headings) for synonym replacement. Developed by the U.S. National Library of Medicine (NLM), MeSH is widely applied in databases such as PubMed and is highly authoritative. MeSH terms provide a structured, hierarchical vocabulary, encompassing broader terms, narrower terms, and related synonyms, thus ensuring comprehensive coverage of relevant literature.

We conducted a literature search in the Web of Science (WOS) database using the keywords: "(tourism OR travel) AND (older adults OR aging population OR senior) AND (health OR mental health OR well-being OR physical health)." This search, as shown in Fig.1, yielded a total of 2,081 records. In the initial screening phase, 456 records published prior to 2014 were removed, resulting in 1,625 records eligible for further assessment. Subsequently, each record underwent a detailed eligibility review, which excluded an additional 987 records based on specific criteria: document types (e.g., proceeding papers, book chapters, editorial materials, abstracts, book notes; n=10), non-English articles (n=28), records indexed in Conference Proceeding and Book Citation Indexes (n=98), and records outside relevant Web of Science categories (n=851). This refinement yielded 638 records for further consideration.

The final step involved a manual screening to ensure thematic relevance, with a particular focus on alignment with the study's research theme. After this rigorous evaluation, a final selection of 150 articles was included in the analysis. This systematic screening process ensured that only studies directly related to the impact of tourism on older adults' well-being were retained, enhancing the reliability and relevance of the bibliometric analysis, as shown in Fig.3.

Data Analysis

After extracting the final sample of 150 articles, we conducted data analysis using R software, version 4.4.2, applying a bibliometric approach to gain a comprehensive understanding of the research landscape on the impact of tourism on older adults' well-being. Specifically, the

bibliometrix R package was utilized to perform various analyses. The bibliometrix R package was selected due to its comprehensive suite of tools specifically designed for bibliometric analysis, allowing for in-depth exploration of citation patterns, thematic structures, and collaboration networks essential to our study.

A co-citation network analysis was conducted to identify the intellectual structure of the field by examining relationships between frequently cited references, thereby revealing influential studies and foundational works within this research area. Thematic mapping was employed to classify and visualize research themes based on their relevance and development, offering insights into both core and emerging themes within the literature. Additionally, a three-field plot analysis was used to map relationships among authors, keywords, and countries, providing a visual representation of collaboration patterns and research focus areas. Trend analysis highlighted the evolution of key topics over time, identifying shifts in research focus and emerging areas of interest. Country collaboration analysis illustrated international research partnerships and the geographical distribution of research outputs, underscoring the global scope of research on this topic. Finally, we analyzed the most cited sources to identify influential journals and publications, emphasizing key sources and their impact on the field. Collectively, these bibliometric analyses provided a structured understanding of the literature, highlighting significant contributors, collaboration networks, and thematic trends relevant to the impact of tourism on older adults' well-being.

2.1.3 Key Findings and Thematic Insights

Literature distribution:

1. The annual scientific production distribution

The annual scientific production, as shown in Fig.4 shows the development trend of this topic from 2014 to 2024. Between 2014 and 2017, the topic received limited attention, with few publications each year, possibly indicating that research on tourism and older adults was not yet an academic focus. Starting in 2019, the annual number of publications increased rapidly, with particularly notable growth after 2020. This trend reflects a sharp rise in research interest in this field over recent years.

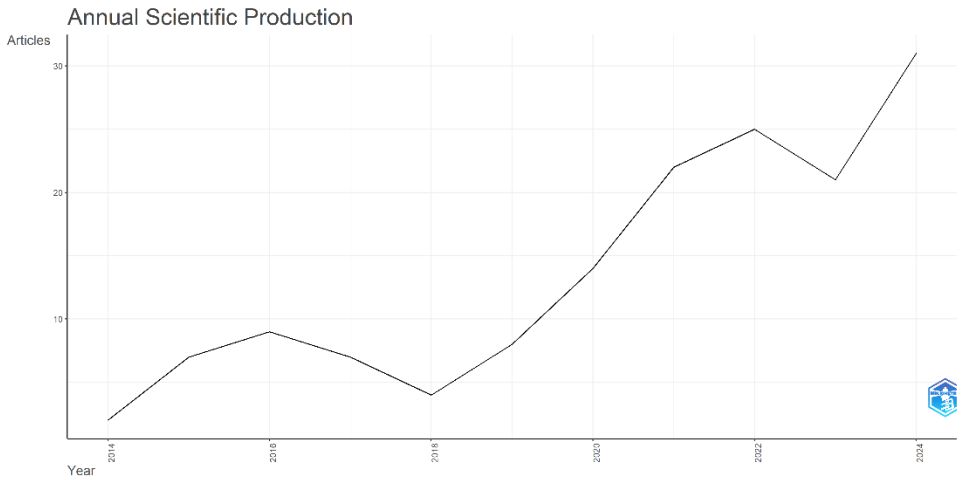


Fig. 4 The annual scientific production distribution **(Source: Authors own work)**

2. Sources' Production over past 10 years

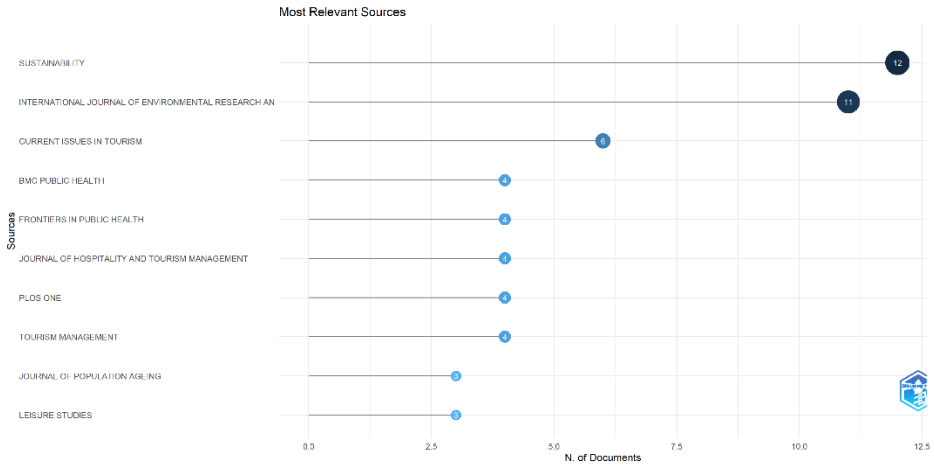


Fig.5 Sources' Production over past 10 years **(Source: Authors own work)**

The analysis of source production over time (as shown in Fig. 5) highlights an increasing academic focus on the impact of tourism on older adults' well-being over the past decade. Certain journals, particularly *BMC Public Health* and *Sustainability*, have shown a notable rise in publications on this topic in recent years, indicating a growing interdisciplinary interest that spans public health, environmental sustainability, and tourism. Other journals, such as *Current*

Issues in Tourism and *Tourism Management*, also display steady contributions, suggesting sustained engagement within the tourism field. This trend underscores the importance of understanding older adults' well-being in the context of tourism, reflecting broader societal priorities related to aging populations, health, and sustainable travel practices.

3. Most Local Cited Sources

As shown in Fig.6, *Annals of Tourism Research* and *Tourism Management* lead with the highest number of citations, indicating their foundational role in shaping discussions within this field. These journals, along with others like *Journal of Travel Research* and *International Journal of Environmental Research and Public Health*, serve as central references, providing critical insights into the intersection of tourism, health, and aging. This citation pattern emphasizes the multidisciplinary nature of the topic, integrating perspectives from tourism studies, public health, and social sciences.

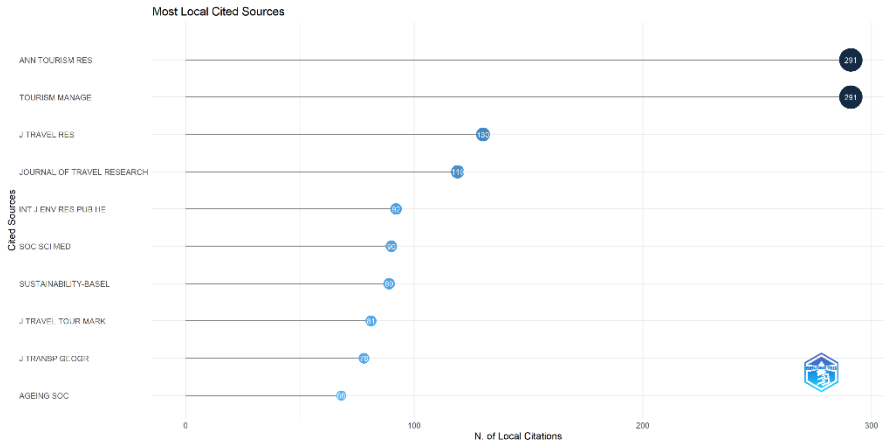


Fig. 6 Most Local Cited Sources (Source: Authors own work)

4. Three-Field Plot: Analyzing Relationships Among Key References, Authors, and Keywords

We examine the relationships among the most frequently cited references (CR), key authors (AU), and predominant keywords (DE) within the research on tourism's impact on older adults' well-being. The Three-Field Plot (as shown in Fig. 7) provides an integrated view of the

knowledge structure in this field, highlighting core literature, influential researchers, and recurring themes. The left side lists the most frequently cited core references, such as Hsu 2007 and Nimrod 2008, which have high citation frequencies, indicating their importance in this field. The middle section presents authors who have made significant contributions to this topic, with Patterson I and Balderas-Cejudo A being the top contributors. The right side shows high-frequency keywords related to this research theme, including "older adults," "subjective well-being," "health," and "physical activity." Notably, author Patterson I is connected to nearly all core references and high-frequency keywords, underscoring their central role in the research field of tourism and older adults.

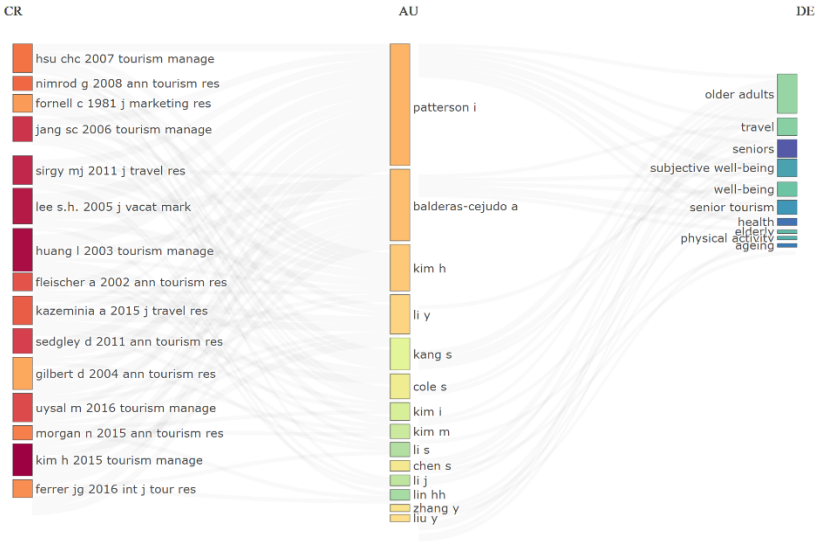


Fig. 7 The Structure of Three-Field Plot (Source: Authors own work)

5. *Conceptual Structure analysis*

Over the past decade, studies have explored the multidimensional concept of the impact of tourism on older adults' well-being. Using Multiple Correspondence Analysis (MCA), we mapped relevant keywords in a two-dimensional space to capture the conceptual structure of this body of literature (as shown in Fig.8). The horizontal axis, which explains 33.29% of the variance, typically reflects variation or differentiation in thematic concepts along one direction,

while the vertical axis explains 16.52% of the variance. The distribution of keywords reveals distinct clusters that capture different aspects of this research concept. On the right side, keywords such as “leisure,” “social tourism,” “quality of life,” and “satisfaction” likely represent a focus on how tourism and leisure activities contribute to the well-being of older adults, particularly in terms of enhancing quality of life and overall happiness. In contrast, the upper left area, with keywords like “obesity,” “prevalence,” “mortality,” and “environments,” seems to emphasize health risk factors and the environmental impacts on older adults, suggesting a perspective centered on physical health concerns. Additionally, the lower left area, containing terms like “accessibility,” “perceptions,” “older adults,” and “walking,” points to issues of accessibility, perception, and potential barriers to participation in tourism activities for older adults.

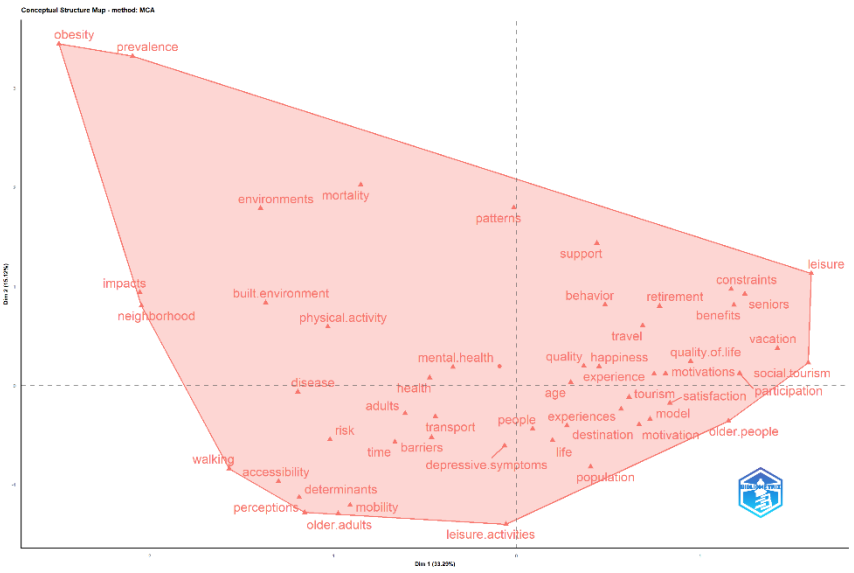


Fig. 8 Conceptual Structure (Source: Authors own work)

Based on the distribution of keywords along the vertical and horizontal axes, the vertical axis can be interpreted as a progression from "physical environmental factors" to "social and psychological factors," reflecting an extension in research on older adults' well-being from physical health to social and psychological dimensions. The horizontal axis can reasonably be interpreted as a shift from "health risk" to "well-being factors," indicating a research focus transitioning from concerns about health status to enhancing quality of life. The keywords “mental health,” “age,” “happiness,” “destination motivation,” “depressive symptoms,” and

"transport" are positioned near the intersection, indicating their high centrality and broad relevance within the study of well-being among older tourists. This clustering reflects a multidisciplinary approach, encompassing psychology (mental health, depressive symptoms, happiness), tourism studies (destination motivation), public health (age), and transportation studies (transport). Such interdisciplinarity suggests that understanding the well-being of older adults requires a comprehensive perspective.

6. Thematic Related Analysis

We conducted a thematic analysis to identify and categorize the main research themes in the study of tourism's impact on older adults' well-being, as shown in Fig. 9. This approach provides insights into the structure and focus areas within the field, helping to distinguish foundational concepts from emerging topics and core themes from niche interests. By mapping these themes, we can better understand how various aspects, such as health outcomes, quality of life, and service-related factors, are interconnected and prioritized in current research.

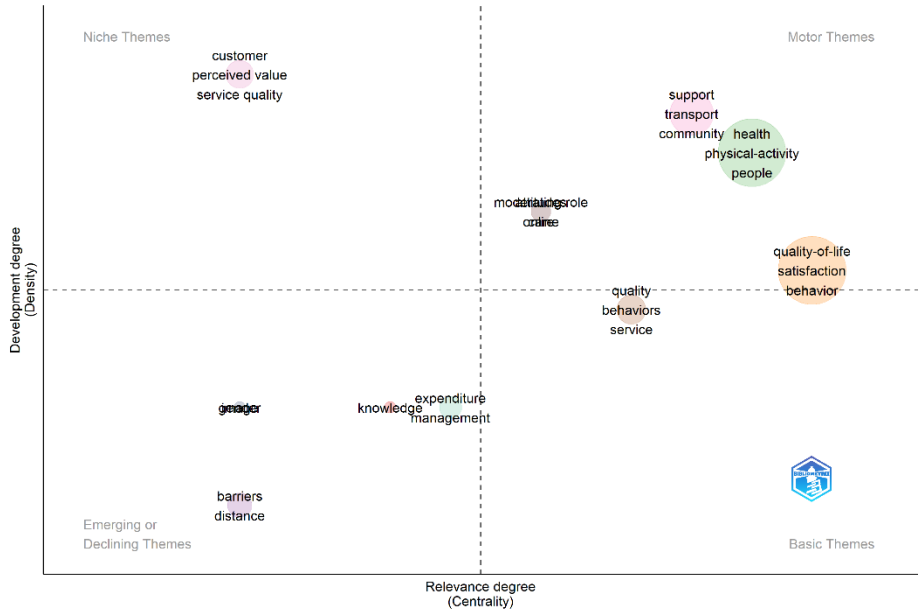


Fig. 9 Thematic Related Map (Source: Authors own work)

The analysis reveals that Motor Themes, including "health," "physical activity," and "people," are highly developed and central to the field, underscoring the emphasis on well-being and

physical engagement as essential components of tourism for older adults. Basic Themes, including “quality” “behaviors” and “service” highlight fundamental aspects that form the basis of well-being research, emphasizing how these factors collectively shape older adults' experiences in tourism. In contrast, Niche Themes like “customer,” “perceived value,” and “service quality” are specialized but less central, reflecting more focused studies on service dynamics and value perception in tourism settings. Lastly, Emerging or Declining Themes, including “barriers” and “distance,” indicate either nascent areas of interest or aspects that are diminishing in relevance within the field.

Through this thematic analysis, we gain a comprehensive view of how the research landscape is structured, highlighting the core aspects of well-being and quality of life while also pointing to potential new directions and specialized topics within the study of tourism for older adults.

7. Temporal Dynamics of Key Research Themes

The analysis of the temporal dynamics of key research themes, as shown in Fig.10, provides valuable insights into the evolving focus within the field of tourism's impact on older adults' well-being. This trend analysis reveals how certain topics have gained prominence over the years, reflecting shifts in research priorities and emerging areas of interest. Initially, themes such as "health," "satisfaction," and "behavior" show sustained relevance throughout the observed period, indicating their foundational role in understanding older adults' engagement with tourism and the associated well-being outcomes. These themes underscore a consistent focus on assessing how tourism activities affect both the physical and psychological aspects of health and satisfaction in older adults. From around 2019 onward, terms such as "quality of life," "motivations," and "social tourism" become increasingly prominent. This shift suggests a growing emphasis on understanding not only the practical motivations driving older adults to engage in tourism but also how these experiences contribute to broader life satisfaction and well-being. "Social tourism" appears as a more specific focus, highlighting the social aspects of tourism, such as inclusivity and accessibility, which may cater to the unique needs of older adults and enhance their quality of life.

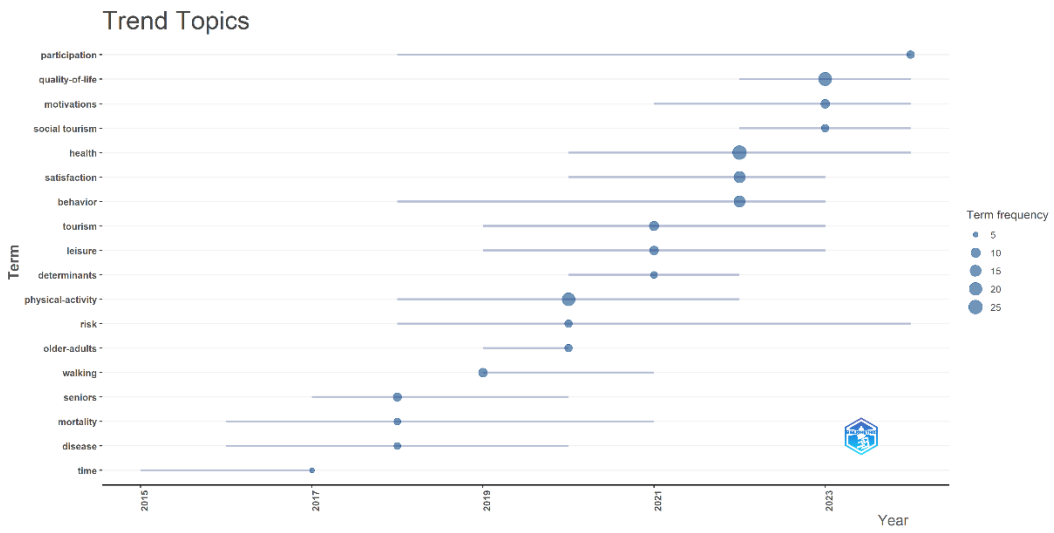


Fig.10 Dynamics of Key Research Themes (Source: Authors own work)

Furthermore, "physical activity" and "participation" emerge as significant themes, reflecting an increasing interest in the role of active engagement in tourism on health outcomes. This aligns with broader health research trends emphasizing the importance of physical activity in aging populations. As such, tourism is increasingly viewed as a vehicle for promoting healthy aging through active participation, which benefits both mental and physical health. Overall, this trend analysis highlights the evolution from a foundational focus on health and satisfaction to a more complex understanding of tourism's role in enhancing quality of life, social engagement, and active participation among older adults.

2.1.4 Implications for Future Research Directions

2020: A Turning Point in Research Trends on Tourism and Older Adults' Well-Being

Data analysis highlights 2020 as a critical turning point in research on tourism's impact on older adults' well-being. This year witnessed the fastest growth in publication output over the past decade “Physical activity,” “risk,” and “older adults” emerged as central themes in 2020, as evidenced by their high frequency and prominence in scholarly discussions. These themes reflect a growing focus on the role of tourism in promoting physical engagement, addressing health

risks, and catering to the specific needs of older adults, aligning closely with the broader shift toward health-oriented research during this period. “Health” and “satisfaction” began to gain prominence in 2020, marking a shift in focus toward exploring the intersection of tourism and well-being. These themes highlight an increasing interest in understanding how travel experiences contribute to both physical health and emotional satisfaction, reflecting broader societal and academic trends during this period.

This surge in health-focused research can be contextualized within the global events of 2020, particularly the COVID-19 pandemic, which was declared a global pandemic by the World Health Organization in March 2020. The pandemic posed unprecedented challenges to the tourism industry while disproportionately impacting older adults, who faced heightened health risks and isolation. Consequently, research began to pivot toward understanding how tourism could support older adults in mitigating health risks, promoting physical activity, and improving mental well-being in a post-pandemic recovery framework. The pandemic not only reshaped tourism practices but also catalyzed an integration of public health considerations into tourism research. By focusing on health, resilience, and inclusivity, the research from 2020 onwards contributes to a more sustainable and adaptive vision for tourism, particularly for vulnerable groups such as older adults. This shift represents not merely a response to a global crisis but a long-term transformation in addressing global health and well-being challenges through the lens of tourism.

Thematic Shifts in Research: From Service Quality to Health and Community Focus

The thematic analysis of research on the impact of tourism on older adults’ well-being reveals the field has progressed from foundational studies on service quality and customer perceptions to a stronger emphasis on health-oriented and community-focused themes. In fig.8, Key Motor Themes, such as “health” and “physical activity,” underscore the central role of tourism in supporting older adults' physical and mental well-being. These themes point to a growing recognition of the preventive and rehabilitative benefits of travel, particularly in addressing sedentary lifestyles and fostering active aging. This focus is complemented by the rise of Basic Themes like “quality” and “behaviors,” which highlight the enduring importance of foundational

aspects in enhancing travel satisfaction and overall quality of life. In contrast, Niche Themes, such as “perceived value” and “service quality,” reflect specialized research efforts aimed at refining service delivery and meeting the specific preferences of older tourists. These themes suggest that while service dynamics remain important, they are increasingly viewed as components of a broader framework that prioritizes health and inclusion.

The study reveals significant transformations in research trends on the impact of tourism on older adults' well-being over the past decade, with 2020 standing out as a pivotal turning point. The unprecedented growth in publication output during this year reflects a profound shift in research priorities, driven by the emergence of health-oriented themes such as "physical activity," "health," and "satisfaction." These themes underscore a growing recognition of the role of tourism in promoting physical engagement, addressing health risks, and enhancing emotional well-being, particularly in the context of older adults' unique needs. This shift in focus can be attributed, in part, to the global impact of the COVID-19 pandemic. In conclusion, the findings of this study emphasize the dynamic nature of research in this field, showcasing a transition toward health and well-being as central priorities in tourism studies.

2.2 Social Gerontology

The concept of social gerontology is an interdisciplinary field of study that has continuously evolved over time (Rosenberg, 2022). It integrates knowledge and methodologies from sociology, psychology, anthropology, public health, medicine, and other disciplines (Suitor et al., 2019) to comprehensively understand the aging process and the social experiences of elderly individuals (Kricheldorff et al., 2015). In recent years, the focus of social gerontology has gradually shifted from emphasizing the inevitable decline in the capabilities of the elderly to highlighting positive and multidimensional aging (Johnson & Mutchler, 2014). This shift not only reflects the progress of the times but also signifies changes in the social status of the elderly. Social gerontology encompasses multiple theoretical frameworks used to explain and predict social phenomena related to the elderly. These frameworks help to fully understand the dynamic roles of the elderly in society, including their roles within families and communities, their participation in social

activities, and how they interact with family, friends, and society (Rosenberg, 2022). They also address how the elderly adapt to and actively cope with aging (Usharani, 2018).

In recent years, social gerontology has increasingly emphasized positive and multidimensional aging concepts (Beltran & Miller, 2021). This change reflects a renewed recognition of the abilities and value of the elderly, emphasizing that the elderly are not only beneficiaries of society but also contributors (Stewart et al., 2022). This shift in perspective promotes sustainable development (Wang et al., 2023) and encourages engagement and self-realization among the elderly in society (Provencher & Poulin, 2020). Under the concept of social gerontology, this study aims to further explore the impact of social activities and educational level on the cognitive health of the elderly, verify its applicability in different social contexts, and provide empirical support for policymakers to promote more effective social participation policies for the elderly.

2.2.1 Active Aging Framework and Its Relevance to Tourism

Worldwide population is steadily aging, and finding appropriate industries and appropriate development paths has become the key to improve the utilization rate of the elderly population. (Nakatsuka, 2018) According to World Health Organization (WHO), (2002, p. 12), Active aging is the process of optimizing opportunities for health, participation, and security in order to enhance quality of life as people age. Komatsu, H., Yagasaki, K., Saito, Y., & Oguma, Y. (2017) found that maintaining not only physical but also cognitive health is highlighted under the concept of ‘active ageing. Hung,K. ,& Lu J.(2016) argue that tourism is recognized as a key element in pursuing a lifestyle full of activity during one's senior years, especially in mental health after retirement. (Nimrod, G.2008) Ian Patterson et al (2021) found that travel was found to have a positive influence on seniors and helped to contribute to a healthy lifestyle. Chudnovsky et al. (2021) examine the positive impact of tourism on life quality and active engagement of the elderly population. Tourism possesses the capacity to bring about transforming effects on older adults, serving not only as a recreational activity but also as a substantial catalyst for their active aging journey.

Within the framework of this prevailing pattern, it is imperative that tourism suppliers are cognizant of the significance of meeting the requirements and desires of elderly consumers. Realizing this objective requires a dedicated approach to deeply grasp the diverse characteristics of this demographic, since varying groups of senior travelers possess distinct requirements, desires, and inclinations (Balderas-Cejudo et. al., 2021). Suban (2022) analyzes the evolving patterns in wellness tourism over the past two decades, with a particular focus on the preferences and needs of senior tourists. Ahn and Back (2019) emphasize the importance of practical utility and health-related benefits in influencing the fulfillment and action plans of elderly tourists. In the post-COVID19 era, the tourism landscape has undergone a significant transformation and has gained increasing popularity. Mohanan and Shekhar (2022) explore this surge in interest, attributing it to increased stress and anxiety due to the pandemic. These trends should be fully considered by the tourism service industry.

2.2.2 Social Support Theory and Cognitive Social Capital Theory: Enhancing Older Adults' Health and Well-being

Cognitive Social Capital Theory

From a social structure perspective, cognitive social capital is one of three types of social capital: structural, cognitive, and relational (Claridge, 2013). The essence of social capital is the exchange that builds relationships (Nahapiet et al., 1998). Building on this, cognitive social capital theory further emphasizes shared language and codes, which facilitate information acquisition and asset formation (Nahapiet et al., 1998). It is a set of acceptable social norms (Anderson et al., 2002). Essentially, cognitive social capital refers to shared understandings and values, which ultimately lead to cooperative and mutually beneficial outcomes (Claridge, 2018).

In social gerontology, social capital plays a key role in spreading health information quickly and encouraging the adoption of healthy behaviors and new technologies. ICTs have been shown to build social capital among older adults in rural Australia (Warburton et al., 2013). The use of electronic health record (EHR) portals is also shaped by social influences and habits (Tavares & Oliveira, 2017). Chiu et al. (2006) developed a model to understand why people share knowledge in virtual communities, highlighting the importance of social ties, trust, and reciprocity. Similarly, Chang et al. (2016) combined Social Capital Theory with Social Presence

Theory to examine how users perceive well-being on social networking sites. Most health behavior theories now include social factors (Rhodes & Beauchamp, 2024). While much research has explored the impact of social support on cognitive health in the elderly, fewer studies focus on Cognitive Social Capital Theory. Through the cognitive social capital theory, it is possible to explore how shared social norms and common values influence individual cognitive processes (Bhandari et al., 2009), thereby affecting delayed memory.

Social Support Theory

Social psychologist Sidney Cobb proposed the Social Support Theory in 1976, suggesting that social support can protect health by reducing stress (Cobb, 1976). The theory has since evolved, with Valente (2010) introducing the Social Network Perspective, emphasizing the dynamic and diverse nature of social support within networks. Cultural variations in social support have been highlighted (Kim & Sherman, 2007), while the physiological processes that connect social support to health outcomes have been explored (Uchino, 2006). After 2000, Social Support Theory increasingly integrated with other disciplines, forming a more complex framework to understand its impact on health.

Social Support Theory categorizes the impact on health into three main functions: emotional support, informational support, and tangible support (Uchino et al., 2018). Emotional support involves providing companionship, love, trust, and encouragement, typically from family, friends, or specific social organizations, helping individuals feel valued (Langford et al., 1997). In our study, we consider leisure-related participation as a form of emotional support. In our study, we consider leisure-related participation as a form of emotional support and hypothesize:

H1: Elderly participation in leisure activities has a significant positive effect on delayed memory.

Informational support refers to providing advice and help when facing challenges (Yan & Tan, 2014). In our study, elderly individuals provide informational support to others through volunteer activities. We hypothesize:

H2: Elderly participation in volunteer service activities has a significant positive effect on delayed memory.

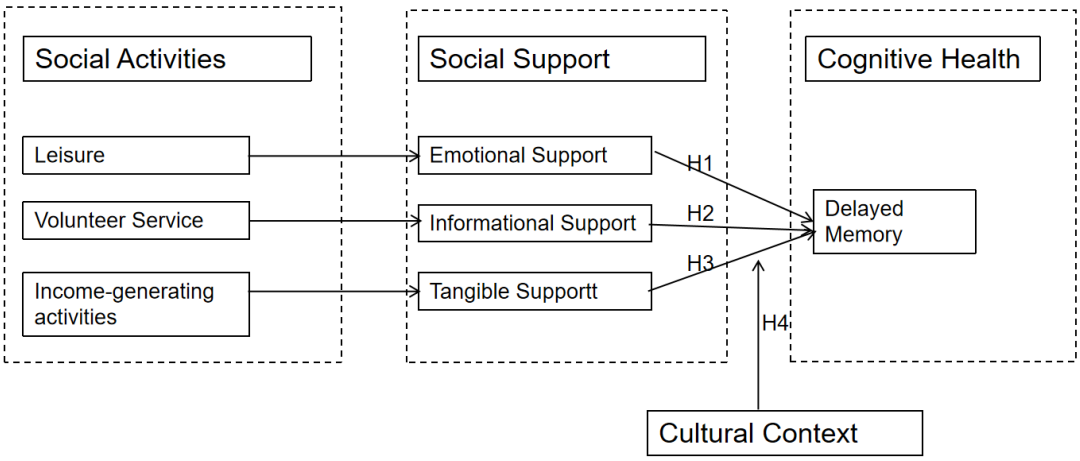


Fig.11 Research Framework from a Social Gerontology Perspective (Source: Authors own work)

Tangible support includes financial, material, and service-related assistance. In our study, elderly engagement in income-generating activities, such as online stock trading, is considered tangible support (Grav et al., 2012). We hypothesize:

H3: Income-generating social activities have a significant positive effect on delayed memory in the elderly.

Although Social Support Theory is widely applied, its effectiveness may vary across cultures. China, with its collectivist orientation, contrasts with the individualistic culture of the United States. These cultural differences may lead to varying impacts of social activities on health. Therefore, we hypothesize:

H4: The impact of social participation on health differs across cultures.

The study provides a new perspective on how educational level and social activities jointly influence cognitive health in the elderly. The ultimate goal of the research is to improve delayed memory and promote active aging through interventions involving education and social activities （as seen in Fig.11）.

2.2.3 Older Adult Well-being in a Social Gerontology Context

Elderly tourism, also known as “senior tourism,” refers to the travel activities of older individuals. This demographic is driven by various motivations, including recreational activities,

health benefits, social engagement, cultural exploration (Przybysz & Stanimir, 2022), and personal growth (Mangunsong, 2020). Patterson and Balderas (2018) categorized elderly tourists into three segments: empty nesters (aged 55–64 years), young seniors (aged 65–79 years), and seniors (aged 80 years and above). They further refined this definition in 2020 to describe elderly tourism as a market segment encompassing individuals aged 60 years and older who seek new travel experiences that contribute positively to their well-being and require customized services from tourism providers. This redefinition acknowledges the age of senior tourists as 60 years and above and underscores the positive impact of travel on their physical and mental health. Duarte (2015) identified senior tourists as actively aging individuals, emphasizing the role of travel in promoting well-being. Alén et al. (2012) defined elderly tourists based on their retirement status, while Aggarwal et al. (2023) positioned them as elderly consumers, stating that elderly tourism should offer health-oriented services that meet their unique needs. Commonalities in the literature regarding the definition of elderly tourism point to a consensus regarding its beneficial effects on senior tourists' welfare, with variations primarily in age categorization. The present study focuses on the elderly tourist population in China, adopting its definition by Patterson and Balderas (2020) to investigate the travel experiences sought by Chinese individuals over 60, as well as the consequent promotion of their well-being and mental health.

Well-being is an integrated concept that includes physical, mental, psychological, emotional, spiritual, and social health (WHO, 2023). The WHO (2023) posits that well-being encompasses equity, justice, peace, and meaningful engagement. Compared with previous research, elderly well-being has been categorized as hedonic, focusing on pleasure and eudaimonia, and relating to deeper fulfillment (Su et al., 2020). Currently, it refers to the life satisfaction, happiness, and mental health of the elderly. Well-being is influenced by various factors, such as health, values, socioeconomic status, living conditions (Sirgy, 2021), gratitude, self-evaluation, control, relationships, and an understanding of life's purpose, all of which contribute to a complete human experience (Karni, 2018).

In recent years, studies have begun to focus on specific tourism-related indicators of the elderly's well-being. For instance, Hwang et al. (2020) argued that tourism services could enhance older adults' well-being perception. Zhang et al. (2023) developed the well-being Scale for Elderly

Tourists, which consists of 28 items across eight dimensions, including positive emotions and social relationships tightly linking tourism and well-being. Asan et al. (2024) analyzed the health benefits of tourism from the perspective of connectedness to nature. Xiang and Qiao (2023) investigated the benefits of mind-body interactions in elderly tourism vis-à-vis well-being. Aggarwal et al. (2023) emphasized that wellness improvement and self-fulfillment are the most significant push and pull factors in elderly travel. Overall, tourism plays an important role in healthy aging (Hwang et al., 2020; Liu et al., 2023; Zhang, 2023); meanwhile, with the continued growth of the elderly population, understanding the well-being of senior tourists and tourism's impact on their health and wellness is essential for the tourism industry.

In the wake of the pandemic, travel trends have shifted markedly, with elderly tourism taking a significant turn toward wellness. The Global Wellness Institution (2023) revealed a vigorous 16.6% annual growth rate in wellness tourism from 2022 to 2027, making it the second-largest segment in the wellness economy and signaling an enduring trend toward health-centric travel experiences. Travel policies have evolved in response to these market transformations. The United Nations' World Tourism Organization (WTO; 2024) reported that post-pandemic visa policy reforms have markedly influenced global tourism patterns, suggesting a trend toward greater openness and easier travel. Additionally, the WHO (2023) emphasized the importance of accessibility, noting that inclusive tourism facilities, products, and services are imperative for achieving responsible and sustainable tourism for the elderly. In conclusion, the landscape of elderly tourism has been reshaped by three trends: a focus on accessibility, policy relaxation to ease travel, and an increasing preference for health-oriented tourism. Such trends point to a future of elderly tourism that is not only more inclusive but also attuned to elderly travelers' health and well-being.

Sustainable tourism, as defined by the United Nations Environment Programme (2005), aims to consider its economic, social, and environmental impacts to meet the needs of visitors, industry, environment, and host communities. At the heart of sustainable tourism are the 17 Sustainable Development Goals (SDGs), where indicators 8.9 and 12. b.1, directly emphasizing tourism's contribution to sustainability and the need to monitor its economic and environmental effects (WTO, 2024). Beyond these two indicators, SDG 3.4 focuses on reducing mortality from non-

communicable diseases by 2030 and promoting mental health and well-being. Mental health refers to mental and psychological health (WHO, 2022). As discussed earlier, well-being comprises physical, mental, and social well-being. SDG 3.4 underscores the value of travel in improving older adults' well-being , particularly through prevention and health promotion (Patterson et al., 2021). This connection illustrates how elderly tourism closely aligns with the objectives of SDG 3.4, showcasing travel's role in supporting sustainable health outcomes.

The existing literature on sustainable development in elderly tourism has extensively explored senior preferences and their implications for sustainability. Research on elderly tourists' preferences has highlighted the critical need for tourism products and services that prioritize comfort, safety, and accessibility. Patterson et al. (2021) understand the specific needs of this demographic, emphasizing the importance of customizing tourism experiences according to their requirements. Echoing this sentiment, Fennell (2021) advocated for sustainable transportation modes, suggesting that environmentally friendly travel options are not only in alignment with broader sustainability goals but also cater to the preferences and physical limitations of older travelers. Similarly, Cheng et al. (2019) stressed the development of accessible built environments to ensure that tourism spaces can accommodate the physical needs of older adults, thereby enhancing their travel experience. This body of research underscores the tourism industry's shift toward offerings that meet elderly tourists' physical and safety needs while contributing to their overall well-being.

Meanwhile, the application of technology marketing strategies targeting elderly tourists has gained increasing attention. Salam (2024), El Archi et al. (2023), Fennell (2021), and Van Nuenen and Scarles (2021) suggested that the effective use of MT platforms can enhance the visibility of sustainable tourism offerings for the elderly population. Through these channels, detailed information about accessible environments, competitive advantages, and sustainable practices is easily accessible, ensuring that elderly travelers are well informed about their travel options. Leite et al. (2021) explored the synergy between sustainable tourism practices and technology, focusing on how technology can enhance tourist experiences. Jeong and Shin (2020) assessed the application and impact of smart tourism technologies in enhancing tourist experiences. Streimikiene et al. (2021) explored the concept of sustained competitiveness in the

tourism industry, advocating strategies that align with senior tourists' economic aspirations and well-being. Zhang (2023) further introduced circular economy models, proposing that the models can support sustainable practices in tourism specifically catering to the elderly demographic, illustrating a growing emphasis on integrating technology to promote tourism that supports elderly travelers' well-being and mental health, in line with SDG 3.4's objectives.

2.2.4 Technologies Adoption and social connectivity in Older Adult Tourism

Technology's impact on tourism

Technology plays a vital role in enhancing community interaction and providing better support while reducing environmental impacts in tourism (Lu, 2020). Among the various technologies being integrated into the tourism industry, AI, IoT, VR, and Mobile Technology (MT) have shown promising potential. However, despite recognition of the importance of these tools, gaps remain in their practical implementation, particularly in relation to older adults.

Technology holds immense potential in transforming older adult tourism by addressing key issues such as accessibility and convenience. Various technologies, like AI, IoT, VR, and Mobile Technology (MT), are proving innovative in improving the travel experience for older adults. These technologies not only enhance safety and overcome physical limitations but also offer personalized support. Previous research highlights that smart mobility systems improve accessibility and safety in tourism (Amendola & La Bella, 2022). Mobile technology enhances autonomy and customization for older travelers, leading to a more enjoyable and tailored experience (Phuthong, 2022). Moreover, technologies like 5G and AI are integral to creating smart tourism ecosystems, which cater to both the accessibility and sustainable needs of senior tourists (Sedarati et al., 2021; Buhalis et al., 2019). By fully leveraging these technologies, tourism providers can significantly improve travel experiences, ensuring older adults can enjoy their journeys while maintaining independence and well-being.

Artificial Intelligence (AI) is increasingly used to improve customer service, offering personalized recommendations and real-time assistance. However, there is a need to further develop AI-driven solutions that cater to the specific cognitive and emotional needs of older

travelers (Olawade et al., 2024). IoT technology enhances convenience by enabling smart environments, such as automated hotel services or personalized room settings (Kuo et al., 2024), though it still requires better accessibility and ease of use for older adults(Keeler & Bernstein, 2021). Virtual Reality (VR) allows older adults to experience destinations virtually before travel, which helps address mobility concerns(Brown, 2019), but the design of such systems must prioritize simplicity to ensure usability(Zhao et al., 2021). Meanwhile, Mobile Technology (MT) remains the most impactful in older adults' tourism, with its applications ranging from health service promotions to navigation aids. By optimizing staff training and device design, MT can help overcome the motor and sensory challenges faced by older adults (Maresova et al., 2023). In addition, proactive marketing strategies through mobile platforms have proven effective for promoting health services, but they must be tailored to the cognitive capacities of older users (Lewis et al., 2017). Future research should focus on refining these technologies, particularly by improving their accessibility and tailoring them to the specific needs of seniors, ensuring that the full potential of AI, IoT, VR, and MT in senior tourism is realized.

In the tourism industry, mobile technologies (MTs) are gaining popularity among travelers for their ability to enhance the quality of travel services, especially among health-conscious elderly tourists (Bakir & Yeygel, 2023; Balderas-Cejudo *et al*., 2021). Previous research has confirmed that MTs can effectively address critical travel challenges such as health management, information sharing, and financial convenience, which are essential for a safe and enjoyable travel experience (Khosravi *et al*., 2016; Leite *et al*., 2021; Zhang, 2023). Moreover, MTs have significantly improved travel accessibility for elderly individuals (Kim *et al*., 2016). In China, the pandemic period saw the introduction of various safety policies, such as mobile apps for information reporting, location tracking, and identity verification, which greatly accelerated the adoption of mobile applications (Ye, 2020). This rapid development of MTs has provided valuable opportunities for the growth of the elderly tourism market (Zhai & Shi, 2021).

Existing research highlights the positive physical impacts of mobile technologies (MTs) on tourists. However, there is limited exploration into how MTs foster active aging in tourism, particularly in terms of mental health support. This gap restricts a comprehensive understanding of MTs' potential to promote well-being among older adults. To address this, the present study

delves into the mental health benefits of MTs for older adults in the context of Chinese tourism, investigating their contributions not only during travel but also in sustaining well-being beyond the tourism experience. By examining how MTs can support active aging, this study aims to provide insights that extend beyond travel, enhancing older adults' quality of life in everyday contexts.

To investigate technology's impact on the elderly market, this study establishes a framework (Table. 1) and four key elements for assessment: the elderly, local communities, tourism suppliers, governance, and agencies. From the perspective of the elderly, research has revealed technology's tremendous potential in enhan cing life convenience for the elderly. The widespread use of smartphone applications has already marked the elderly tourism market, offering key functionalities such as navigation and travel information, significantly improving accessibility and engagement with destinations for elderly travelers. Wearable devices, the next frontier in MT development (Vale Costa et al., 2019), offer the potential for health monitoring and enhanced mobility for elderly tourists. Moreover, user-friendly mobile interfaces and services tailored to the personalized needs of elderly tourists can spark their interest in and acceptance of innovative technologies (Jaana & Paré, 2020).

Table.1. Previous studies on technology and the elderly

(Source: Authors own work)

Perspectives	**Measurement themes**	**Previous studies**
The elderly	Technology usage among elderly	Smartphone ownership: 59% (65–69), 49% (70–74), drops after 75% (Bhate & Thakor, 2023); telehealth and related tech use increased from 4.6% to 21.1% post-pandemic (Choi et al., 2022); 47.4% smartphone usage, 49.8% tablet usage among elderly. Only 19.6% download apps; 12.3% actively use smart devices/wearables (Jaana & Paré, 2020)
	Engagement of the elderly with MT	Health monitoring, entertainment, and learning via apps enhance engagement (Khosravi et al., 2016); social media usage boosts travel engagement and brand loyalty (Khosravi et al., 2016; Li et al., 2020); decisions influenced by app feedback (Myung & Preis, 2016);
	Elderly's participation in tourism via MT	

	platforms	driven by utility, pleasure, and IT experience (Myung & Preis, 2016) Guided cultural activities via Sweet Mobility (Borrelli et al., 2015); real-time health monitoring (Kuerbis et al., 2017); Airbnb selection: cost and social interaction (Nathan et al., 2020); tailored trip planning online (Khaddraoui et al., 2014); personalized travel routes on wearables (Vale Costa et al., 2019)
Local communities	Effects of elderly tourists' tech use	Social media boosts local impact (Moorthy et al., 2021); elderly online ratings shape community image (Jayathilaka et al., 2020).
	Community engagement with elderly tourists through MT	Elderly co-design georeferenced app, enhance historical connection, and self-esteem (Azevedo Gomes et al., 2020); interactive eco-tourism scenarios for the elderly (Lu, 2020).
Tourism suppliers	MT training for elderly services	Staff training with tech for enhanced scenarios (Segercrantz & Forss, 2019); tablet use improves staff–elderly interactions (Segercrantz & Forss, 2019).
	MTs' innovation for elderly tourist services	Help the elderly in need and reduce healthcare costs (Hofmann, 2013); wearables for real-time activity monitoring (Lewis et al., 2017); innovating for motor skill decline: focus on gestures, voice commands, and buttons (Lewis et al., 2017); user-friendly designs for higher tech acceptance (Wanka & Gallist, 2021); tackling sensory and cognitive challenges (Iancu, 2020); simplicity and personalization aid service use (Boccardi et al., 2022); adjust for vision changes, design for glasses wearers, reduce cognitive load (Lewis et al., 2017).
	MT in marketing to elderly tourists	Distribute promotional content via mobile software (Xie & He, 2022); easy booking, information search, and navigation for seniors by simplifying tasks and reducing distractions (Sun, 2023); positive message framing on MT platforms enhances purchase intent for health services among elderly (Wen, 2022).
Governance and agencies	Policies supporting mobile tech for elderly tourism	Advocates partnership between tourism and tech sectors for wellbeing enhancement (Stankov & Gretzel, 2021); China's 2023 initiative boosts 5G tourism, including projects such as the Forbidden City mini-program (Ministry of Culture and Tourism, 2023).

In the realm of senior tourism, technology has proven crucial for enhancing community interaction and support, while mitigating the environmental impact on destinations (Lu, 2020). However, despite tourism providers' recognition of the importance of staff training (Segercrantz & Forss, 2019), the current study reveals gaps in specific guidance and operational implementation. Efforts to improve services through MT-optimized training and device design address the motor and sensory challenges faced by seniors, while proactive marketing strategies are effective in promoting health service options via mobile platforms (Lewis et al., 2017), although these strategies must be carefully tailored to meet the elderly's cognitive needs. Future research and applications should refine these training and marketing approaches to realize the full potential of MT in senior tourism.

Policies at the intersection of governance and tourism have increasingly recognized the symbiotic relationship between the sustainable tourism industry and the technology sector. A significant portion of tourism enterprises influenced by policy directives acknowledge the importance of integrating sustainable practices with MT. According to BCD Travel (2023), 45% of these businesses developed sustainability plans that leverage MT to improve long-term business outcomes. These plans include initiatives, such as mobile-enabled sustainable fuel tracking, green hotel management applications, sustainable procurement platforms, and cultural wellness tourism applications that cater to the elderly. Future developments should combine sustainability with technological innovation to create a resilient and forward-looking tourism environment. While travel has considerable potential to be harnessed as a powerful tool to promote well-being, no research has experimentally tested MTs' role in creating a positive transformation through travel.

Financial and Health Barriers

Financial and health-related barriers significantly limit tourism participation among older adults. Many seniors live on fixed incomes and may perceive travel as financially burdensome. Although limited in direct evidence from the reviewed literature, the need for affordable, subsidized tourism programs has been highlighted in broader discussions of inclusive tourism design (Kim et al., 2021; Filep et al., 2018). Health concerns, however, are extensively addressed

in existing studies. Physical limitations, chronic illnesses, and concerns about mobility and safety create psychological and logistical barriers to travel. Several studies emphasize the importance of health-monitoring technologies and adaptive tourism services to mitigate such challenges. For example, Kuerbis et al. (2017) and Lewis et al. (2017) explore the use of wearable devices for real-time health monitoring, while Boccardi et al. (2022) recommend simple and personalized service features that accommodate cognitive and physical decline. To support emotional well-being and confidence among elderly tourists, Iancu (2020) and Wanka & Gallist (2021) advocate for designs that address sensory limitations and reduce cognitive load, such as larger icons, simplified menus, and voice commands.

Additionally, staff training in elder-friendly service scenarios has been shown to improve not only accessibility but also interpersonal interaction and emotional comfort during travel (Segercrantz & Forss, 2019). These service adaptations play a critical role in encouraging older adults to engage in travel despite physical or psychological health concerns.

The Applicability of Technology Acceptance Model (TAM) and TAM2 in Exploring Older Adults' Tourism Behavior

The Technology Acceptance Model (TAM), introduced by Davis (1989), is a foundational framework for understanding technology adoption. TAM posits that two key factors, perceived usefulness (PU) and perceived ease of use (PEOU), determine an individual's intention to use technology, which subsequently influences actual usage behavior (Davis, 1989). PU refers to the degree to which a person believes that using a particular technology will enhance their performance, while PEOU measures the degree of effort required to use the technology(Davis, 1989). This model has been applied extensively in fields such as education, healthcare, and e-commerce, providing valuable insights into user behavior (Rafdinal & Senalasari, 2021). In 2000, Venkatesh and Davis expanded the TAM model

into TAM2, which incorporates additional constructs to capture the influence of social and contextual factors (Venkatesh & Davis, 2000). Among these, subjective norm is a significant

variable, representing the perceived expectations of important others, such as family, friends, or colleagues, regarding technology use (Venkatesh & Davis, 2000). Recent research suggests that factors like “accessibility” and “digital sociality”. (Tuomi et al., 2023) TAM2 also introduces cognitive instrumental processes, including job relevance, output quality, and result demonstrability, which further explains how task-specific considerations influence perceived usefulness (Doo & Bonk, 2021). These constructs make TAM2 particularly relevant for studying older adults’ adoption of mobile technologies.

In the context of older adults, subjective norm is especially significant due to the influence of family members in shaping technology adoption behaviors (Zhang et al., 2023). Family encouragement often motivates older adults to use mobile technologies for activities such as travel planning, navigation, and sharing experiences, thereby reinforcing their behavioral intention (Marler & Hargittai, 2022). Additionally, hedonic motivation has been identified as an important factor in sustaining engagement, particularly in activities like social sharing during travel (Wong et al., 2024). Similarly, motivated tourists often perceive higher positive tourism impacts, which can enhance their overall engagement and participation. (Dandotiya et al., 2024)

2.2.5 Social Participation and Integration

Studies have shown that social activities among the elderly are associated with enhanced psychological activity (Tcymbal et al., 2022), improved cognitive skills (Wang et al., 2022), and reduced loneliness (Zhao & Wu, 2022; (Lu et al., 2021). Participation in social and leisure activities has been found to improve cognitive function (Iwasa et al., 2012), while religious activities are closely linked to a reduced risk of depression (Roh et al., 2015).

The Vienna International Plan of Action on Aging first highlighted the importance of social participation for the elderly in the aging process (Aslan, 2016). After the UN established the concept of active aging, social participation became a key strategy within it (Aroogh & Shahboulaghi, 2020). In 1991, Japan passed the Basic Law on Measures for the Aging Society, encouraging continued social participation and contribution by the elderly (Usui & Palley, 1997). The United States implemented the Retired and Senior Volunteer Program (RSVP)promoting community service among the elderly (McDonald et al., 2013). China's Law on the Protection of

the Rights and Interests of the Elderly introduced the "Five Principles," emphasizing that the elderly should remain active, continue learning, and enjoy life, all pointing to social participation. In 2000, the European Union formulated the European Strategy on Aging, stressing the importance of social participation and lifelong learning to extend a healthy lifespan (Hosnjak et al., 2020). Social participation remains a global focal point.

Although social activities are highly valued in the elderly, there is no unified definition for it. Levasseur et al. (2010) pointed out that social participation for the elderly includes activities that involve interacting with others in community and shared environments. Wang Lili (2011) defined it as any activity beneficial to both the elderly and society. Dehi Aroogh et al. (2020) described it as active engagement in outdoor social activities. Despite the differences in focus across these definitions, they all emphasize the interaction between the elderly and their community or family.

2.3 Tourism Management

2.3.1 Brand Loyalty in Older Adults Tourism Market

Existing research on brand loyalty highlights its multifaceted nature, encompassing cognitive, emotional, and psychological dimensions. Keller's Customer-Based Brand Equity (CBBE) model identifies brand knowledge, including brand awareness and image, as key determinants of consumer responses (Grassl, 2000). Similarly, Amine (1998) broadens the scope of brand loyalty beyond repeat purchases, attributing it to deeper psychological motivations. Comarch (2020) underscores the evolution of loyalty from transactional behaviors to emotional commitments. Additionally, Gounaris and Stathakopoulos (2004) propose four types of loyalty—premium, inertia, covetous, and no loyalty—highlighting varied consumer behaviors and motivations. Building upon these foundations, this study integrates the concept of brand loyalty within the tourism sector, proposing a two-tiered framework: Action Loyalty and Social Loyalty.

Action Loyalty

This dimension represents observable, surface-level behaviors such as repeat purchases, active participation, and word-of-mouth recommendations. These actions are typically influenced by tangible factors, including financial incentives, convenient customer experiences, and supportive

service infrastructures. In the context of tourism, key drivers of action loyalty include the travel company's infrastructure, customer service policies, and tailored wellness program structures (Kopp, 2023). These factors enhance customer satisfaction by ensuring ease of engagement and meeting immediate consumer needs, thus strengthening the visible layer of brand loyalty (Yoon & Uysal, 2005).

Social Loyalty

Social Loyalty delves into the deeper, emotional connection consumers form with a brand. It is shaped by personal values, beliefs, attitudes toward wellness, and perceptions of the brand's alignment with individual and social identity. Unlike Action Loyalty, Social Loyalty is less influenced by price and convenience and more by the brand's ability to resonate with consumers' core values. This dimension is particularly significant in wellness and travel sectors, where aligning offerings with consumers' holistic wellness needs fosters long-term loyalty (Acar et al., 2024). Personalization, premium service quality, and emotional engagement are critical in cultivating this deeper connection (Tanveer et al., 2021).

By distinguishing between these two layers of brand loyalty—action-based and socially driven—this study sheds light on the complex interplay of factors that influence consumer loyalty in the tourism sector. Understanding these nuances provides practical insights for tourism brands aiming to enhance loyalty, particularly in contexts emphasizing wellness and experiential value, as shown in Fig. 12.

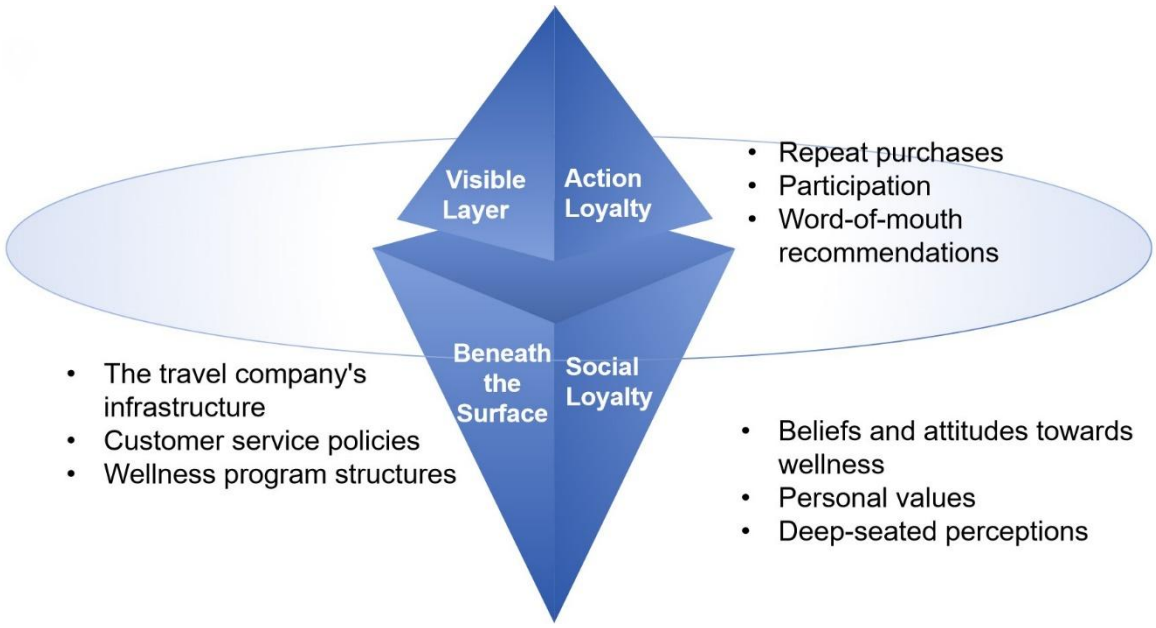


Fig. 12 Brand Loyalty from surface and Deep Layer (Source: Authors own work)

2.3.2 Engagement of Older Tourists: From Behavioral Involvement to Emotional and Cognitive Immersion

The concept of customer engagement (CE) was initially defined by the Advertising Research Foundation (ARF) as the process of activating a prospect to a brand idea, enhanced by the surrounding context (Munjal et al., 2019). Hollebeek (2011) later expanded this by introducing a tripartite framework for customer brand engagement, consisting of activation, identification, and absorption. This framework is particularly relevant in wellness tourism, where consumers identify with wellness brands based on alignment with their health values, engage deeply with wellness services, and are absorbed in personalized wellness experiences. These elements often influence how brands position themselves to create long-term loyalty in this sector. Building on this, Hollebeek et al., (2019) describe CE through the lens of service-dominant (S-D) theory, defining it as a customer's motivational investment of both operant (e.g., cognitive and emotional) and operand (e.g., equipment) resources into brand interactions. In the tourism and hospitality sectors, customer engagement strategies are widely adopted for managing customer–brand relationships. Research by So et al. (2016) explores the connections between customer

engagement and brand loyalty, while Harrigan et al. (2017) further tests models to predict loyalty intentions based on engagement.

Building on the framework established by Harrigan et al. (2017), this research adopts key dimensions to explore how older tourists engage in wellness tourism. Behavioral engagement, as a surface level form of engagement, is exemplified through interaction, where engagement extends beyond simple transactions to include visible and observable interactions with the environment, locals, and fellow tourists. These interactions represent immediate, transactional behaviors that reflect a connection to the wellness brand, helping to foster loyalty (Harrigan et al., 2017). Additionally, participation is critical, as So et al. (2016) emphasize the importance of conscious involvement in activities. In wellness tourism, this active participation of older adults in diverse travel experiences directly influences their connection to the brand and long-term loyalty. These dimensions together illustrate how behavioral engagement shapes older tourists' involvement in wellness tourism.

Expanding on the dimensions of behavioral engagement, older tourists' emotional engagement in wellness tourism further illustrates their deep connection to the brand. Deep engagement includes absorption, where elderly tourists become fully immersed in their travel experiences, demonstrating deep focus and mental engagement with wellness activities (Hollebeek, 2011). The dimension of acquisition highlights the learning process, where tourists acquire new knowledge and understanding from their travel experiences, influenced by the quality of information provided. As Islam et al. (2017) suggest, accurate, relevant, and timely information plays a key role in enhancing customer engagement, allowing elderly tourists to deepen their understanding of different cultures and healthy lifestyles. This cognitive involvement is critical for sustaining engagement in wellness tourism.

On the emotional dimension, identification reflects the emotional bonds elderly tourists form with the brand, as described by Hollebeek (2011). This emotional connection fosters a sense of belonging and identity with the tourism experience, which is integral to developing loyalty. Together, the behavioral, cognitive, and emotional dimensions create a comprehensive framework. For understanding older tourists' engagement with wellness tourism brands,

emphasizing the multifaceted ways in which they interact with, learn from, and emotionally connect to their travel experiences.

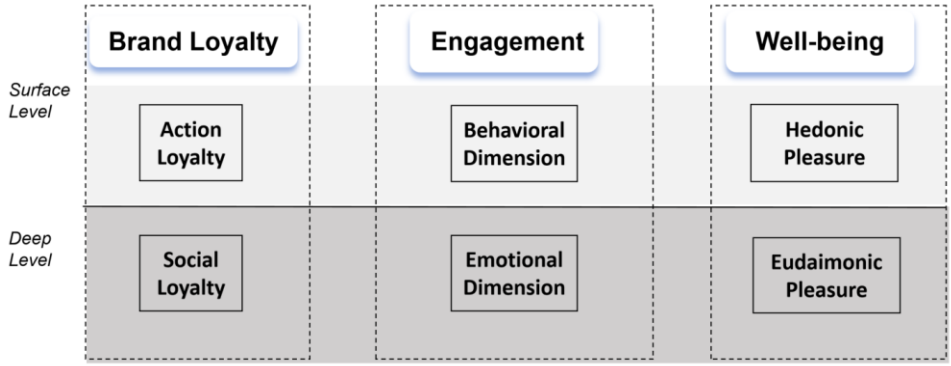


Fig.13 Surface and Deep Structure of Brand Loyalty, Engagement and Well-being (Source: Authors own work)

Current literature suggests that in wellness tourism, older adults' well-being is closely linked to both brand loyalty and engagement (Patterson & Balderas-Cejudo, 2023). Our research introduces a novel approach by categorizing these three constructs into distinct dimensions, as shown in Fig.13. Specifically, we propose that brand loyalty, engagement, and well-being can each be understood across both surface-level and deep-level dimensions, offering a new understanding of how they interrelate in wellness tourism for older adults. Building on this framework, we argue that tourism engagement operates on both surface-level and deep-level dimensions, each influencing brand loyalty and well-being differently. Surface-level engagement, which includes visible behaviors such as participation and interaction, contributes to action loyalty and hedonic pleasure. However, deeper forms of engagement, involving emotional and cognitive connections, are expected to foster social loyalty and eudaimonic pleasure more significantly. To test this layered model, we propose two key hypotheses.

H5(a): Surface-level engagement (behavioral engagement) positively impacts surface-level brand loyalty (action loyalty).
H5(b): Deep-level engagement (e.g., emotional engagement) positively impacts deep-level brand loyalty (social loyalty), with a stronger effect than surface-level engagement on surface-level brand loyalty.

H6(a): Surface-level engagement (behavioral engagement) positively impacts surface-level well-being (hedonic well-being).
H6(b): Deep-level engagement (emotional engagement) positively impacts deep-level well-being (eudaimonic well-being), with a stronger effect than surface-level engagement on surface-level well-being.

2.3.3 Stimulus-Organism-Response (SOR) Framework in Understanding Older Tourists' Behaviors

The SOR model has its roots in behaviorist psychology (Hochreiter et al., 2023). Initially, the Stimulus-Response (S-R) model, developed by scholars like John B. Watson and B.F. Skinner, focused primarily on how external stimuli directly trigger behavioral responses, largely ignoring internal psychological processes (Vargas, 2004). The Organism (O) component then introduced in the theory, which accounts for internal states, including emotions, cognition and motivations (Vieira, 2013). This shift brought cognitive psychology into the fold, highlighting the importance of mental processes in mediating stimulus and response (Goi et al., 2018).

The SOR model has been applied across various fields, particularly in marketing, education, and digital environments. Cao et al. (2023) examined the role of emotions and cognition in impulsive buying behavior within luxury fashion stores using the SOR framework. Duong (2023) explored how education-related stimuli, including entrepreneurship education and course design, affect social entrepreneurial behaviors. With the rise of digital technology, the framework has also been applied to understand how technological stimuli, such as social media and online platforms, influence user behavior through cognitive and emotional responses (Vonoga, 2021). Additionally, the SOR model has proven effective in cross-cultural studies, showing how cultural values and norms shape the relationship between external stimuli and individual reactions (Wei et al., 2020). These applications highlight the SOR model in explaining how various external stimuli influence human behavior through internal psychological processes.

In this study, the SOR theory is applied to explain the relationships between different levels of tourism engagement, brand loyalty, and well-being in older adults' wellness tourism. Stimulus (S) represents external stimuli, specifically surface level factors, which include the visible behaviors

of older adults tourists, action loyalty, and hedonic pleasure during wellness tourism. Organism (O) reflects the internal state of the tourists, manifested through emotional engagement. Behavioral engagement, as an external and surface level factor, is mediated through the organism to influence emotional engagement. Therefore, we propose:

H7: Behavioral engagement has a significant positive impact on cognitive and emotional engagement.

Response (R) in the SOR framework represents the outcomes resulting from the processing of external stimuli (S) through internal states (O). In this study, the response includes the deep-level well-being of older adults, reflecting their psychological satisfaction and happiness gained from engaging in wellness tourism, as well as social loyalty, which represents their relational commitment to the brand. Action loyalty, as a surface level behavior, directly influences social loyalty by reinforcing repeated interactions and fostering a sense of community and trust between tourists and the brand. Therefore, this study hypothesizes that:

H8: Action loyalty has a significant positive impact on social loyalty.

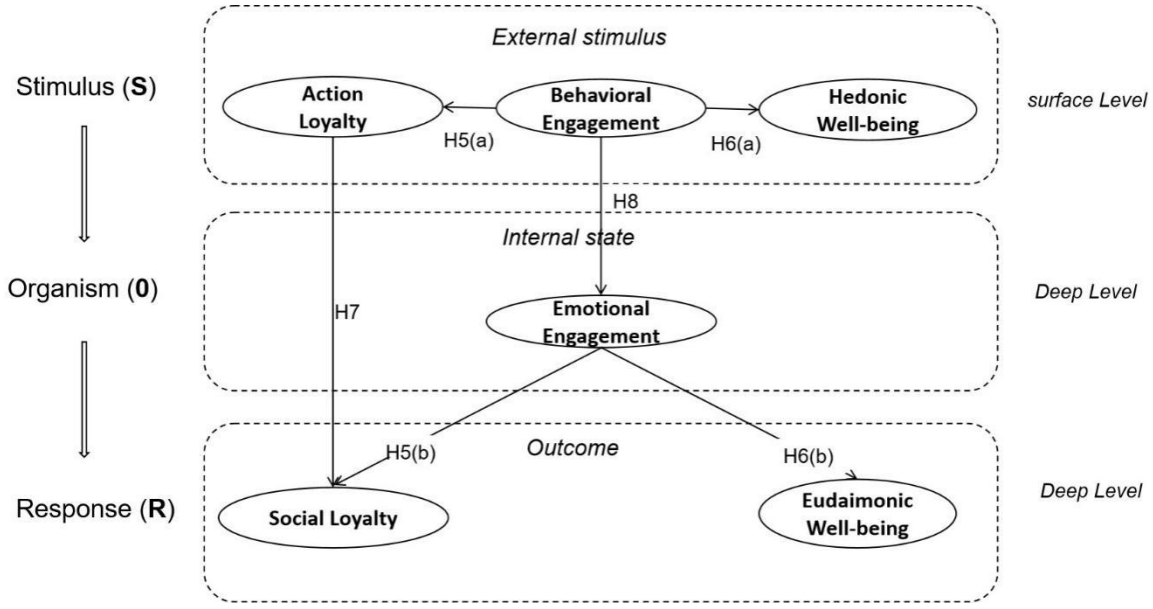


Fig.14 the Hypothesis Framework **(Source: Authors own work)**

This chapter reviewed key research trends and theoretical frameworks related to older adults' well-being and tourism, integrating insights from bibliometric analysis, social gerontology, and tourism management. The bibliometric analysis revealed significant transformations in the field over the past decade, particularly a shift from foundational studies on service quality and customer behavior to themes prioritizing health and community engagement. Notably, 2020 marked a pivotal turning point, with a surge in publications emphasizing the preventive and rehabilitative benefits of tourism in addressing sedentary lifestyles, promoting physical activity, and fostering active aging. Key motor themes, such as "health" and "physical activity," underscored tourism's critical role in enhancing older adults' physical and emotional well-being, while basic themes like "quality" and "behaviors" reaffirmed the enduring importance of foundational travel aspects. Niche themes, including "perceived value" and "service quality," reflected specialized research efforts to refine service delivery and address older tourists' unique needs.

The review of social gerontology highlighted the relevance of the active aging framework and social support theory in understanding how tourism participation enhances older adults' well-being. The integration of technology, such as mobile apps and social media, emerged as a critical enabler for maintaining social connectivity, accessing travel resources, and enriching tourism experiences. This aligns with broader discussions on social participation and inclusion as vital components of health and emotional resilience among older adults.

In the context of tourism management, themes such as brand loyalty and emotional engagement were examined as key drivers of older adults' sustained participation in tourism. Behavioral involvement and cognitive immersion were identified as essential factors influencing travel satisfaction and long-term loyalty. The application of frameworks like Stimulus-Organism-Response (SOR) provided further insights into how external stimuli, including health-oriented travel options, shape older adults' internal responses and behaviors.

Overall, this literature review illustrates the dynamic progression of research in this field, with a growing emphasis on health and well-being as central priorities. It also highlights the need for an integrated approach that combines health, technology, and social participation to design inclusive and effective tourism strategies for older adults. These findings provide a robust foundation for

the subsequent chapters, guiding the exploration of multi-dimensional impacts of tourism on older adults' well-being.

Chapter 3 Methodology

3.1 A Summary of Research Design

The research design for this study adopts a comprehensive, multi-method approach aimed at investigating the well-being of older adults in the context of tourism. It incorporates quantitative, qualitative, and mixed-methods methodologies across three distinct studies, each addressing specific research objectives. This design ensures a holistic exploration of the subject, capturing both the measurable impacts of key variables and the nuanced, subjective experiences of older adults in tourism.

Study 1 explores the role of mobile and other emerging technologies in enhancing older adults' well-being during tourism activities. It seeks to understand how technology influences mental and physical health, engagement, and brand loyalty within the context of wellness tourism. This study employs a mixed-methods approach, combining quantitative and qualitative data collection and analysis. The quantitative component involves the distribution of structured questionnaires to older adults (aged 55 and above) in the Chinese community who have experience in wellness tourism. A total of 1,526 valid responses were collected using the WeChat Questionnaire Star mini program. The qualitative component utilizes semi-structured in-depth interviews with 15 affluent older adults who possess extensive tourism experience. Data from the quantitative survey were analyzed using Structural Equation Modeling Partial Least Squares (SEM-PLS), with bootstrapping of 5,000 resamples to assess the significance of path coefficients. Qualitative data from the interviews were analyzed using the Gioia method, where themes and sub-themes were organized into a data structure that reveals the key insights into how mobile technologies enhance well-being. Importantly, the quantitative and qualitative data collected for Study 1 also serve as the data source for Study 2, with each study focusing on distinct variables and theoretical perspectives.

Study 2 focuses on the role of emotional engagement in promoting older adults' well-being and brand loyalty during wellness tourism. It aims to identify key factors that trigger emotional

engagement and its subsequent impact on hedonic and eudaimonic well-being. Similar to Study 1, a mixed-methods design is adopted, comprising a quantitative survey and qualitative interviews. The quantitative component involves collecting 1,526 survey responses from older adults engaged in wellness tourism, while the qualitative aspect employs semi-structured interviews with 15 older adults selected via snowball sampling. The data collected in Study 1 are reused here, but Study 2 examines different variables and theoretical constructs. Data from the quantitative survey were analyzed using SEM-PLS analysis, performed with SmartPLS 18.0 software. Bootstrapping with 5,000 resamples was used to ensure statistical rigor. Qualitative data were analyzed using Grounded Theory Analysis (GTA) to identify emergent themes and build a theoretical framework on emotional engagement and well-being.

Study 3 examines the impact of social activity participation on cognitive health and delayed memory in older adults from a cross-cultural perspective. By comparing data from China (CHARLS) and the United States (HRS), this study identifies cross-cultural similarities and differences in the relationship between social participation and cognitive well-being. Quantitative data are extracted from the China Health and Retirement Longitudinal Study (CHARLS) and the Health and Retirement Study (HRS) from the United States. A total of 11,332 participants from CHARLS and 7,329 participants from HRS aged 60 and above are included in the analysis. Descriptive statistical analysis and chi-square tests are used to examine demographic characteristics and the distribution of social activity participation. Multiple linear regression analysis is applied to determine the relationship between social activity participation and delayed memory, controlling for covariates such as age and marital status. Separate models are developed for the CHARLS and HRS datasets.

The three studies are interconnected within a broader research framework that seeks to understand the multidimensional impact of tourism participation on older adults' well-being. The integration of quantitative and qualitative methods enables a comprehensive exploration of well-being, brand loyalty, emotional engagement, and the influence of social participation and mobile technologies. By combining large-scale survey data with in-depth qualitative insights, the research achieves a balance between statistical generalization and contextual understanding. Ethical approval was obtained from the Life Science Committee of JAIST (Approval No.: Person

05-085), and informed consent was secured from all participants before their involvement in the research.

This integrated approach facilitates a deeper understanding of older adults' well-being, providing practical insights for tourism service providers, policymakers, and researchers focused on improving older adults' health and social participation through tourism. This design features the triangulation of methods, the use of diverse data sources, cross-cultural comparisons, and multifaceted analysis techniques. The integration of primary data from surveys and interviews with secondary data from CHARLS and HRS databases ensures a comprehensive approach. Advanced analysis methods, including SEM-PLS, bootstrapping, Gioia method, grounded theory analysis, and multiple linear regression, enhance the credibility and robustness of the findings.

3.2 Study 1: A Mixed-Methods Study

Study 1 investigates the application of technology in enhancing the travel experiences of older adults, aiming to identify how technological tools can improve their mental and physical well-being within the context of wellness tourism. The study employs a mixed-methods approach, integrating both quantitative and qualitative research methodologies to provide a comprehensive understanding of the role technology plays in elderly travel.

3.2.1 An Overview of Study 1

The quantitative component involved distributing a structured questionnaire to 1,600 older adults (aged 55 and above) in the Chinese community who had previously participated in wellness tourism. After screening for eligibility—ensuring participants had engaged in wellness tourism and were familiar with at least one tourism brand—1,526 valid responses were analyzed. The questionnaire measured variables such as Brand Loyalty, Engagement, Well-being, and technology-related factors including Artificial Intelligence (AI), Internet of Things (IoT), Virtual Reality (VR), and Mobile Technologies (MT). Data collection was facilitated through the

WeChat Questionnaire Star mini program, which allowed for efficient distribution and response tracking.

The qualitative component complemented the quantitative data by exploring the nuanced experiences of elderly tourists through in-depth semi-structured interviews. Utilizing a snowball sampling method, the study conducted interviews with 15 affluent older adults who had significant travel experience, ensuring a diverse representation of tourism profiles across different regions of China. These interviews, averaging 95 minutes each and conducted in Chinese, focused on understanding how Mobile Technologies (MTs) impact the mental and physical health of elderly tourists. The interview questions addressed how MTs help overcome travel-related challenges, enhance travel experiences, and contribute to sustainable, positive changes beyond travel. This qualitative approach provided rich, detailed insights into the personal narratives and motivations behind technology use in elderly travel, capturing the complexity of their preferences and experiences.

For data analysis, the quantitative data were examined using Structural Equation Modeling Partial Least Squares (SEM-PLS) with SmartPLS 18.0 software, employing bootstrapping techniques with 5,000 resamples to validate the findings. This method ensured robust model validation through the assessment of path coefficients and the reliability of measurement scales. Concurrently, the qualitative data were analyzed using the Gioia method, an inductive approach ideal for developing grounded theories from qualitative data. This involved organizing interview transcripts, initial coding to identify 46 distinct themes, and distilling these into eight overarching concepts. The integration of SEM-PLS and the Gioia method allowed Study 1 to elucidate both the measurable impacts of technological engagement on well-being and the deeper, subjective experiences of older adults. This comprehensive methodology not only validates statistical relationships but also enriches the findings with detailed personal narratives, providing actionable insights for integrating effective technological solutions into wellness tourism to support the health and welfare of elderly travelers.

3.2.2 Sample and Data Collection Procedure

For the quantitative study, the questionnaire was distributed to older adults (aged 55 and above) in the Chinese community who had previously participated in wellness tourism. This study focuses on data collected from Chinese participants, whose cultural background emphasizes the importance of collective activities, traditional health practices, and a growing interest in wellness tourism. These cultural traits may influence their perceptions of well-being and engagement in wellness tourism activities. The sample included a diverse range of age groups, genders, education levels, and income brackets. To ensure participants met the study criteria, two screening questions were placed at the beginning of the questionnaire: one to confirm they had participated in wellness tourism at least once, and another to ensure they were familiar with at least one tourism brand. Only those who met these criteria were allowed to complete the survey.

Participants were approached through social media sharing, including WeChat groups and Moments. Participants received an invitation message written by the researcher, which clearly stated the purpose of the study, assured confidentiality and anonymity, and confirmed that participation was voluntary. No personal identifying information was collected.

To encourage participation, respondents automatically received a small monetary reward of 3 RMB upon successful submission of a valid questionnaire, which was issued by the WeChat mini-program system. This incentive mechanism helped attract a significant number of respondents and increased response rates.

The questionnaire was originally developed in English and then translated into Chinese by a professional translator with expertise in English. The translation was reviewed by two additional English language specialists to ensure accuracy and cultural appropriateness. The questionnaire was distributed using the WeChat Questionnaire Star mini-program, which allowed for tracking of response time.

One of the challenges encountered during data collection was that some older adults completed the questionnaire in an unusually short amount of time, suggesting they may not have read the questions carefully. To ensure data quality, these responses were identified and removed based on system-recorded completion times. Ultimately, a total of 1,600 questionnaires were collected, of which 1,526 were valid after screening. The survey was concluded once the sample size was deemed sufficient to achieve the research objectives.

Ethical approval was obtained from the Life Science Committee of JAIST (Approval No.: Person 05-085).

Table.2 Background Information of the Samples **(Source: Authors own work)**

Variables	Category	n	Percentage
Age	55-65	953	62.46
	66-70	302	19.79
	71-75	237	15.53
	76-80	34	2.23
Gender	male	628	41.15
	female	898	58.85
Education	Elementary school or below	68	4.45
	middle School or High school	964	63.15
	College	495	32.45
	Graduate studies or above	0	0
Monthly Income	Below 2000 RMB	187	12.25
	2001-5999 RMB	780	51.11
	6000-9999 RMB	526	34.47
	10000 RMB and above	34	2.23
Employment	Full-time work	139	9.10
	Part-time work	176	11.53
	Retired	1207	79.10
	Never worked	3	0.2
marital Status	Married	1461	95.73
	Divorced or single	65	4.26
Self-assessment of Health	very good	448	29.37
	good	994	65.13
	poor	71	4.65
	very poor	14	0.85
Living Situation	Living with spouse	1333	87.34
	Living alone	173	11.34
	Living with children	20	1.31
	In a nursing home	0	0
	others	0	0

For the qualitative study, our study employed snowball sampling, a non-probabilistic sampling strategy frequently used in qualitative research (Johnson, 2014). Initially, we established

communication with two advanced-age individuals possessing a wealth of knowledge and expertise in the realm of travel. The first two participants played a crucial role in identifying 13 more travelers who were knowledgeable about tourism. This enabled us to obtain a sample size of 15, which is generally deemed suitable for conducting semi-structured interviews in qualitative studies (Guest et al., 2006).

All interviewees had significant travel experience, indicating that they had the financial means to afford such activities, representing a relatively affluent segment of the elderly Chinese population. Although they do not constitute the majority of the elderly population, their potential economic contribution to the tourism market is substantial, justifying the need for a targeted study of this segment within the elderly tourism market. Data saturation was reached with the 15th participant, at which point additional interviews ceased to yield new insights or themes. This small yet targeted sample size enabled us to thoroughly investigate each participant's experiences, ensuring a rich and detailed understanding of their perspectives on tourism. The emphasis on the quality and depth of information over quantity in our participant selection allowed us to explore the complex choices and preferences of older adults in this field.

Table.3. Basic information of the interviewees **(Source: Authors own work)**

	Age	**Gender**	**Occupation**	**Income (RMB)**	**Educational background**	**Marital status**
M1	66	M	Retired	6,000–8,000	Bachelor’s degree	Married
F1	65	F	Retired	4,000–6,000	Bachelor’s degree	Married
M2	63	F	Retired	4,000–6,000	Bachelor’s degree	Married
F2	64	M	Retired	4,000–6,000	Bachelor’s degree	Married
F3	60	F	Independent contractor	10,000 or more	High-school diploma	Married
F4	61	F	Retired	4,000–6,000	Bachelor’s degree	Married
M3	68	M	Retired	6,000–8,000	Bachelor’s degree	Married
M4	62	M	Retired	6,000–8,000	Bachelor’s degree	Married
M5	66	M	Retired	8,000–10,000	PhD degree	Married
M6	62	M	Independent	4,000–6,000	Below High-school	Married

			contractor		diploma	
F5	61	F	Retired	6,000–8,000	Master’s degree	Married
M7	69	M	Retired	10,000 or more	Master’s degree	Married
F6	62	F	Retired	10,000 or more	Master’s degree	Married
F7	68	F	Retired	6,000–8,000	Master’s degree	Married
M8	66	M	Bank clerk	6,000–8,000	High-school diploma	Married

A preliminary interview outline was formulated in accordance with the research questions and related literature. The 15 interviewees came from different regions of China to ensure the diversity of tourism profiles. The content of the interviews contained different patterns of traveling, including group tours, self-guidance tours, and traveling with family. Table. 3 presents a biographical introduction of each respondent. All interviews were conducted in Chinese and lasted for nearly 95 min on average.

3.2.3 Questionnaire and Measurement items

For the quantitative study, the measurement items evaluate key variables influencing older adults' tourism experiences, as shown in Table. 4. Brand Loyalty examines participants' willingness to pay more and share their travel experiences. Engagement assesses their involvement in preparation, enjoyment of activities, and emotional satisfaction. Well-being captures the positive impacts of travel on their excitement and personal growth. For technology-related variables, AI measures the ability to recommend personalized experiences, IoT focuses on preferences for smart hotel features, VR assesses willingness to use virtual previews, and MT measures the preference for mobile payments during travel. These items comprehensively assess the role of behavioral and technological factors in enhancing brand loyalty and well-being.

Table.4 Measurement items of quantitative study **(Source: Authors own work)**

Items	**Key Ferences**

Brand Loyalty	I am willing to pay more for my preferred tourism brand and share my travel experiences with friends and family.	
Engagement	I actively prepare for my travels, enjoy engaging in activities and local culture, and feel emotionally satisfied and personally enriched by my travel experiences.	So et al., 2012
Well-being	Traveling brings me excitement, emotional satisfaction, and long-lasting happiness, while also enriching my knowledge and personal growth.	Olawade et al., 2024 Kuo et al., 2024
AI	I believe artificial intelligence can recommend more suitable travel destinations, attractions, and activities based on my preferences and past behavior.	Brown, 2019
IoT	I prefer staying in hotels with features like voice control, self-check-in, automatic temperature adjustment, and smart lighting, to enhance convenience and comfort.	Maresova et al., 2023
VR	I'm willing to use virtual reality technology to preview destinations, hotel rooms, and attractions, and plan my trip based on the virtual experience.	
MT	I prefer using mobile payment tools like WeChat or Alipay for shopping, bookings, and dining during travel, to simplify the payment process and avoid carrying cash or dealing with currency exchange issues.	

For the qualitative study, the purpose of this qualitative study was to examine MTs' perceived impact on the mental and physical health of elderly tourists, specifically within the framework of

SDG 3.4. This study aimed to address the gap in understanding how MTs contribute to older adults' well-being and mental health during and beyond travel. To achieve this, semi-structured interviews were designed to investigate three research questions.

1. How do MTs help elderly tourists overcome physical and cognitive challenges during travel?
2. Do you think mobile technologies can benefit your travel experiences? If so, in what ways do they enhance your experiences and impact your health during travel?
3. How do MTs improve accessibility and help create sustainable, positive changes that extend beyond travel, impacting elderly tourists' daily lives?

3.2.4 Data Analysis

For the quantitative study, this study utilized SEM-PLS analysis with the SmartPLS 18.0 software and applied bootstrapping techniques to validate the findings. SEM-PLS is well-suited for managing smaller sample sizes and data that do not adhere to normality assumptions (Hair et al., 2017), making it an ideal choice for this research. To ensure model validation, we employed the bootstrapping method by running 5,000 bootstrap resamples to calculate confidence intervals for the path coefficients and assess their significance. We also evaluated the constructs' convergent validity and reliability by reviewing the AVE and CR values, confirming the robustness of the measurement scales. All analyses were conducted with SmartPLS 18.0, and the results demonstrated a good model fit along with significant path coefficients.

For the qualitative study, our study utilized the Gioia method, a systematic and inductive approach widely recognized for its usefulness in developing a grounded theory that meets the rigorous standards required for credible research and publication in prestigious journals (Magnani & Gioia, 2023). This method effectively captures the essence of organizational experiences by systematically explaining the reasons behind phenomena and how they occur (Gioia et al., 2012). In contrast to hypothesis-testing research, the Gioia method does not commence with a preconceived hypothesis but instead provides a dynamic framework that considers all major emergent concepts, themes, and dimensions, as well as their interrelationships (Gioia et al., 2012). The Gioia method is particularly suitable for our study because it allows for the discovery and categorization of emergent themes from qualitative

interviews. This inductive approach ensures a comprehensive analysis of the diverse motivations, challenges, and outcomes that arise, helping develop a framework for how MT supports the elderly's well-being during and beyond travel.

The first step was to develop a data structure (Magnani & Gioia, 2023). The interview transcripts were imported into Excel to facilitate a systematic and organized preliminary coding process. This initial phase was dedicated to retaining the informants' perspectives, where their experiences were coded in their own lexicons, fulfilling the first criterion of the Gioia method. We meticulously deconstructed the interview content to identify emergent categories, yielding 46 distinct themes that encapsulated key aspects of the informants' experiences. Each theme was coded to capture the essence of the informants' narratives, laying a foundation not only for a rich, informant-level view, but also for building a transferable, theoretically informed framework in subsequent analytical stages.

The second step was to develop an illustrative grounded model (Magnani & Gioia, 2023). In accordance with the evolved Gioia method, our second analytical step focused on developing an illustrative grounded model that determined the interplay of the concepts unearthed during the first ordering category. During this stage, we organized and distilled the various concepts identified earlier. This allowed for an in-depth examination of the interrelationships among these concepts, culminating in the emergence of eight themes. Each theme illustrates a distinct aspect of how MT facilitates manageable, enjoyable, and safe travel experiences for elderly tourists.

The third step was to present convincing findings. Upon the successful creation of the data structure and illustration of the Gioia model, the third step was to present our findings in a compelling manner. This phase was characterized by a retrospective and iterative examination of the collected data through the lens of the eight second-order themes identified earlier. Ultimately, we identified three themes that were integral to this study's theoretical constructs.

3.3 Study 2: A Mixed-Methods Study

Study 2 aims to investigate the pivotal role of emotional engagement in the well-being of older adults participating in wellness tourism and to identify the specific factors that influence this emotional engagement. Employing a mixed-methods approach, the study integrates both quantitative and qualitative methodologies to provide a comprehensive understanding of how emotional engagement impacts elderly tourists and the underlying factors that drive this engagement. The quantitative component serves to establish the critical importance of emotional engagement, while the qualitative component delves deeper into the specific elements that influence it within the context of elderly tourism.

3.3.1 An Overview of Study 2

The quantitative aspect of Study 2 involved the distribution of 1,526 online questionnaires to older adults (aged 55 and above) within the Chinese community who had previously engaged in wellness tourism. The demographic characteristics of the respondents were meticulously summarized, highlighting a diverse sample in terms of age, gender, education, income, employment status, marital status, and self-assessed health. The questionnaire was designed to measure key constructs such as Brand Loyalty, Engagement, and Well-being, utilizing a refined Customer Engagement with Tourism Brands (CETB) scale adapted from existing literature. Data collection was facilitated through the WeChat Questionnaire Star mini program, ensuring efficient distribution and response tracking. The quantitative data were analyzed using Structural Equation Modeling Partial Least Squares (SEM-PLS) with SmartPLS 18.0 software, incorporating bootstrapping techniques with 5,000 resamples to validate the model and assess the significance of path coefficients. This analysis confirmed the robust measurement properties and highlighted the essential role of emotional engagement in enhancing brand loyalty and overall well-being among elderly tourists.

Building upon the quantitative findings, the qualitative component of Study 2 employed snowball sampling to conduct in-depth semi-structured interviews with 15 affluent older adults who had substantial travel experience. This purposive sampling ensured a diverse representation of participants in terms of gender, occupation, income, education, and marital status. The interviews, conducted in Chinese and averaging 95 minutes each, explored the motivations and triggers of emotional engagement, as well as its impact on eudaimonic pleasure during and after

travel. Prior to the interviews, participants were briefed on the concepts of emotional engagement and eudaimonic pleasure to ensure a common understanding. The qualitative data were analyzed using Grounded Theory Analysis (GTA), which involved open coding, axial coding, and selective coding to develop a nuanced theoretical framework. This inductive approach allowed for the identification of emergent themes and the exploration of complex relationships between mobile technologies, emotional engagement, and well-being. By integrating the quantitative and qualitative findings, Study 2 not only substantiates the critical importance of emotional engagement in elderly tourism but also elucidates the specific factors that foster this engagement, providing actionable insights for enhancing wellness tourism services to better support the health and welfare of older adults.

3.3.2 Sample and Data Collection Procedure

The data used in Study 2 were collected through the same process as described in Section 3.2.2. For the quantitative study, a total of 1,526 online questionnaires were collected for this study, and the demographic characteristics of the respondents were summarized. The majority (62.46%) are aged 55-65, followed by 19.79% aged 66-70, 15.53% aged 71-75, and 2.23% aged 76-80. Females make up 58.85% of respondents, while males account for 41.15%. In terms of education, 63.15% have a middle or high school education, 32.45% have attended college, and 4.45% have only elementary education, with no respondents holding a graduate degree or higher. Monthly income is predominantly between 2,001-5,999 RMB (51.11%), followed by 34.47% earning 6,000-9,999 RMB, 12.25% earning less than 2,000 RMB, and 2.23% earning over 10,000 RMB. Most respondents are retired (79.1%), with 11.53% working part-time, 9.1% employed full-time, and 0.2% never having worked. In terms of marital status, 95.73% are married, while 4.26% are divorced or single. Regarding self-assessed health, 65.13% rate their health as good, 29.37% as very good, 4.65% as poor, and 0.85% as very poor. Finally, 87.34% live with their spouse, 11.34% live alone, and 1.31% live with their children, with none residing in nursing homes or other arrangements. Approval was obtained from the Life Science Committee of JAIST (Approval No.: Person 05-085)

For the qualitative study, our study employed snowball sampling, a non-probabilistic sampling strategy frequently used in qualitative research (Johnson, 2014). Initially, we established communication with two advanced-age individuals possessing a wealth of knowledge and expertise in the realm of travel. The first two participants played a crucial role in identifying 13 more travelers who were knowledgeable about tourism. This enabled us to obtain a sample size of 15, which is generally deemed suitable for conducting semi-structured interviews in qualitative studies (Guest et al., 2006). All interviews were conducted in Chinese and lasted for nearly 95 min on average. Before the interview, each participant will be provided with an explanation of what emotional engagement and eudaimonic pleasure mean.

The 15 individuals are an distribution of eight males and seven females. The majority of the participants are retired (12 out of 15), while two are independent contractors, and one is a bank clerk. The participants' income levels vary, with most earning between 4,000–8,000 RMB per month. Three participants earn 10,000 RMB or more, while one earns 8,000–10,000 RMB. Educational backgrounds range from high-school diplomas to PhD degrees, with the majority holding a bachelor's degree. All participants are married.

3.3.3 Questionnaire and Measurement items

For the quantitative study, we adapted and refined the Customer Engagement with Tourism Brands (CETB) scale originally proposed by King and Sparks (2014), which consisted of 25 items. Harrigan et al. (2017) later condensed this into an 11-item, three-factor model focused on assessing customer engagement and its impact on brand loyalty. This model, validated in prior research, has been shown to effectively measure customer engagement in tourism. In our study, we further enhanced this model by incorporating content related to well-being, drawing on the Activity Theory of Aging (Diggs, 2008) and refining the evaluation of brand loyalty by integrating three indicators from Sohaib and Han (2023) , These adjustment led to build a new Customer Engagement, Well-being, and Brand Loyalty Scale as shown in Table.5. Each question has multiple choices measured with 5-point Likert scales.

Table.5 Measurement Items**(Source: Authors own work)**

	Items	Key references
Brand Loyalty	**Action Loyalty** I am willing to pay more for my preferred tourism brand. **Social Loyalty** I consider myself to be loyal to my preferred tourism brand. I will share my health travel experiences with friends and family.	Sohaib,M. ,& Han H.(2023)
Engagement	**Behavioral Dimension** Before traveling, I look up many reviews and ratings of health travel destinations. Before deciding on my travel itinerary, I prioritize wellness destinations that are known for their quality of service and customer satisfaction. Before traveling, I prepare myself for healthy activities that require specific gear or clothing. During the trip, I made friends with other tourists. I post pictures of my travels on social media. **Emotional Dimension** The more actively I participate in the activities during my trip, the more satisfied I am with my trip. When I participate in travel activities, I feel emotionally satisfied. My travels have given me personal growth and a sense of belongings.	Harrigan et al., 2017;
Well-being	**Hedonic Pleasure** Before traveling, I will be excited and looking forward to the upcoming travel experience. During the trip, I felt a strong sense of happiness. After successfully arranging a trip, I felt a great sense of accomplishment.	Diggs, J. (2008)

	When I participate in travel activities, I feel emotionally satisfied.
	Eudaimonic Pleasure
	The happiness that comes with traveling lasts long after the trip is over.
	Learning about health while traveling or learning about the local culture makes me feel more alert and focused.

For the qualitative study, the purpose of this qualitative study was to examine: (1) the close connection between emotional engagement and its motivations by identifying specific emotional engagement triggers and motives among the elderly; (2) the processes by which emotional engagement impacts eudaimonic pleasure (EP). To achieve this, semi-structured interviews were designed to investigate three research aims:

1.What environments, activities, or social interactions are most likely to trigger your emotional engagement? Please describe a specific experience.

2.Which moments in your past travel experiences brought you feelings of happiness, achievement, and satisfaction? How did these emotions increase or decrease in the context of wellness tourism?

3.How does emotional engagement specifically contribute to eudaimonic pleasure in wellness tourism?

3.3.4 Data Analysis

For the quantitative study, we conducted SEM-PLS analysis using SmartPLS 18.0 software, along with bootstrapping to validate the results. SEM-PLS is particularly well-suited for handling smaller sample sizes and data that do not meet the assumption of normality (Hair et al., 2017), making it an appropriate choice for our study. To validate the model, we employed the bootstrapping method, conducting 5,000 bootstrap resamples to obtain confidence intervals for the path coefficients and evaluate their significance. Additionally, Fornell and Larcker (1981) recommended using AVE to assess convergent validity, while Hair et al. (2010) emphasized the importance of CR for evaluating composite reliability. Following these guidelines, we ensured

that the scale demonstrated strong measurement properties. All analyses were performed using SmartPLS 18.0, and the results indicated a good model fit with significant path relationships.

For the qualitative study, our study employs grounded theory analysis (GTA), a systematic methodology widely used in the social sciences for constructing theories grounded in empirical data. This approach involves the iterative and systematic collection and analysis of data to derive theoretical insights (Martin, P. Y., & Turner, B. A., 1986). Unlike hypothesis-testing research, grounded theory does not begin with a preconceived hypothesis. Instead, it allows the theory to emerge inductively from the evidence itself, ensuring that the theoretical framework is deeply rooted in the data. This makes GTA a dynamic and flexible methodology, capable of adapting to the research context and providing a robust foundation for theory construction (Glaser, B., & Strauss, A., 1967).

Grounded theory analysis in our study follows three key steps: open coding, axial coding, and selective coding, which collectively form the core of the data analysis process. These steps were instrumental in uncovering the complex and nuanced relationships between mobile technologies and the well-being of older adults in tourism.

In the initial phase of analysis, open coding was employed to break down the qualitative data into discrete units and assign conceptual labels to significant phrases, sentences, or paragraphs. This process allowed for the identification of a wide range of initial concepts without any preconceived categorization. For instance, through open coding of participant interviews, recurring concepts such as "pro-nature experiences," "psychological compensation," "happiness," "family interactions," and "safety concerns" were identified. These concepts provided the foundation for developing broader categories, including psychology, activities, social interaction, safety, and tourism service.

In the second stage, axial coding was used to explore the relationships between the categories identified during open coding. This phase reassembled the data by linking subcategories to main categories, establishing causal relationships, and identifying conditions, contexts, and consequences. For example:

- Psychology was linked to outcomes such as happiness and mental recovery, mediated by subcategories like "pro-nature experiences" and "psychological compensation."
- Social interaction emerged as both a positive and negative influence, with themes like "family interactions" and "poor interpersonal interactions" showing contrasting impacts on well-being.
- Connections were also identified between tourism services (e.g., overly commercialized attractions) and negative emotional outcomes, such as reduced personal growth.

This stage was critical for identifying the interplay between mobile technologies and their effects across different dimensions of tourism experiences.

The final stage, selective coding, involved the integration of categories into a cohesive theoretical framework. A central phenomenon—the role of mobile technologies in enhancing older adults' well-being in tourism—was identified, with emotional engagement (EE) and overall well-being (EP) serving as the core constructs. Subcategories such as "safety concerns," "preventive therapeutic activities," and "community interactions" were systematically related to the core phenomenon. This stage synthesized the findings into a theoretical model, illustrating how mobile technologies influence well-being across positive and negative dimensions.
For instance:

- Positive influences, such as wellness sports and mental recovery, were shown to directly enhance happiness and personal growth.
- Negative influences, such as poor interpersonal interactions and overly commercialized attractions, were found to detract from emotional engagement and limit personal achievement.

Throughout the analysis, the process remained iterative, with ongoing refinement of codes and categories as new data were collected and analyzed. This iterative approach ensured that the emerging theory was firmly grounded in the participants' lived experiences, reflecting the complexities of their tourism-related interactions with mobile technologies. By employing these three steps, our study was able to construct a nuanced theoretical framework that captures the diverse and multifaceted impacts of mobile technologies on older adults' tourism well-being.

3.3 Study 3: A Cross-Cultural Comparative Study

In this study, we conducted two separate studies using quantitative analysis methods, employing Stata 18.0 software for data analysis. The data were sourced from two large databases: the China Health and Retirement Longitudinal Study (CHARLS) and the Health and Retirement Study (HRS) from the United States. Using data from these two databases, this study aims to investigate the impact of social activities on delayed memory in the older adults and to conduct a cross-cultural comparative analysis.

3.3.1 An Overview of Study 3

Study 3 aims to identify which social activities positively impact the well-being of older adults and to determine which of these activities should be incorporated into next year's tourism services to enhance the health and welfare of the elderly. To achieve this, the study examines the influence of social activity participation on elderly health through a cross-cultural comparative analysis using data from the United States and China. Specifically, the 2018 Core Final, Version 2.0 of the Health and Retirement Study (HRS) and the 2018 China Health and Retirement Longitudinal Study (CHARLS) were utilized.

Both datasets employ identical measurement tools for assessing delayed memory, ensuring comparability and validity of the findings across different cultural contexts. The study focuses on various social activities, including leisure activities (e.g., interacting with friends, using the internet, playing card games, attending educational courses, participating in sports or social clubs), volunteer activities (e.g., voluntary or charity work, caring for a sick or disabled adult), and income-generating activities (e.g., stock trading). By harmonizing these variables across both datasets, the research aims to identify universally applicable social participation factors that contribute to cognitive health.

To analyze the data, multiple linear regression analyses were conducted using Stata 18.0. These analyses examined the relationship between participation in different social activities and delayed memory performance, while controlling for key covariates such as age, marital status, and educational level. The regression models were developed separately for the CHARLS and HRS datasets to account for potential cultural differences. Additionally, descriptive statistical analyses categorized participants into groups based on memory function (good, fair, and poor) and assessed demographic and social activity distributions using chi-square tests.

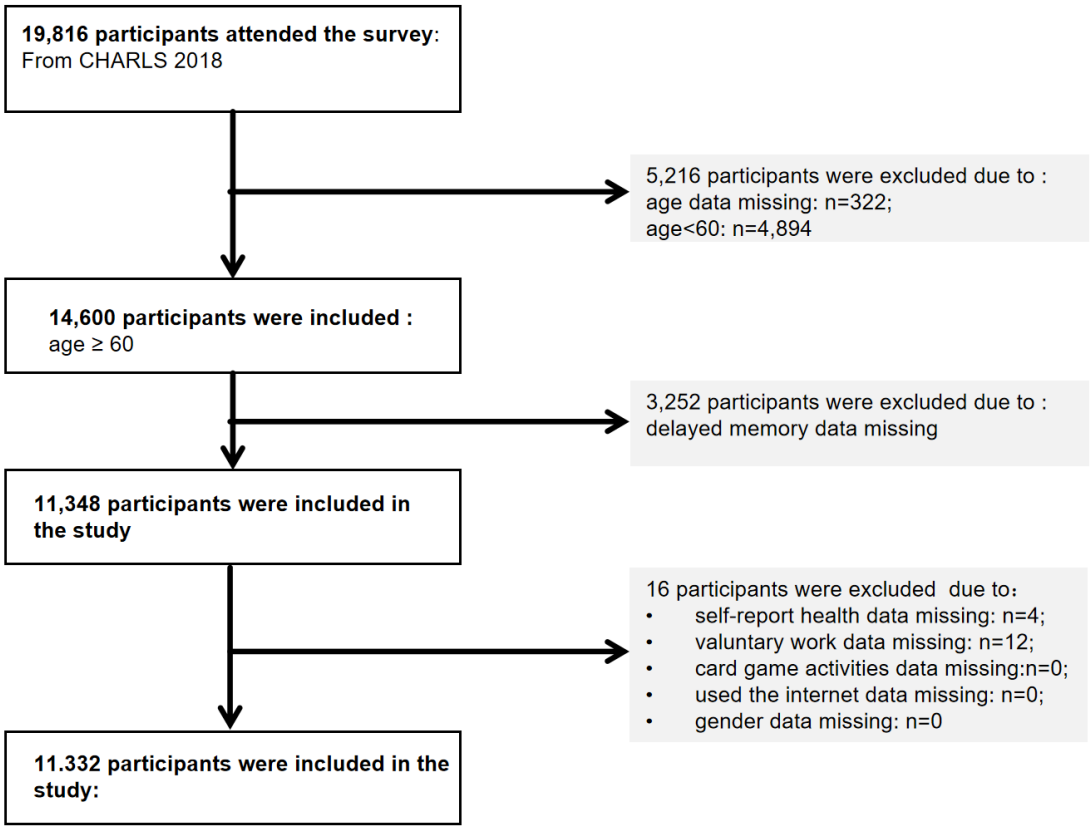
By leveraging advanced statistical techniques in Stata 18.0, Study 3 seeks to elucidate the specific social activities that most significantly enhance cognitive health among older adults. The cross-cultural approach not only highlights common determinants of elderly well-being but also provides actionable insights for integrating effective social activities into tourism services. This integration aims to support cognitive longevity and overall well-being, thereby improving the quality of life for aging populations across different cultural settings.

3.3.2 Sample and Data Collection Procedure

For this study, we utilized the 2018 Core Final, Version 2.0 of the Health and Retirement Study (HRS) and the 2018 data from the China Health and Retirement Longitudinal Study (CHARLS). These two databases were chosen due to their identical measurement content and standards for assessing delayed memory, enhancing the comparability of our analysis. The CHARLS database (2018) initially consisted of 19,816 participants, from which certain groups were gradually excluded (Figure15). From these participants, 5,216 were excluded, including 322 due to missing age data and 4,894 who were under the age of 60. This resulted in 14,600 participants aged 60 or older. Subsequently, 3,252 participants were excluded due to missing delayed memory data, leaving a sample of 11,348 participants. A further 16 participants were excluded due to missing data on self-reported health (n=4), voluntary work (n=12), card game activities (n=0), internet use (n=0), and gender (n=0).

Fig.15. Flowchart of the enrollment of CHARLS participants **(Source: Authors own work)**

After these exclusions, a total of 11,332 participants were included in the final analysis. The HRS



data (2018) used in this study initially included a sample of 12,066 participants (Figure 16). Out of these, 3,454 participants were excluded for being under the age of 60, leaving 8,612

participants aged 60 or older. A further 1,283 participants were excluded due to missing delayed memory data, resulting in 7,329 participants. After reviewing
or missing data related to self-reported health and cognitive health, no additional exclusions were made, leaving a final sample of 7,329 participants for analysis.

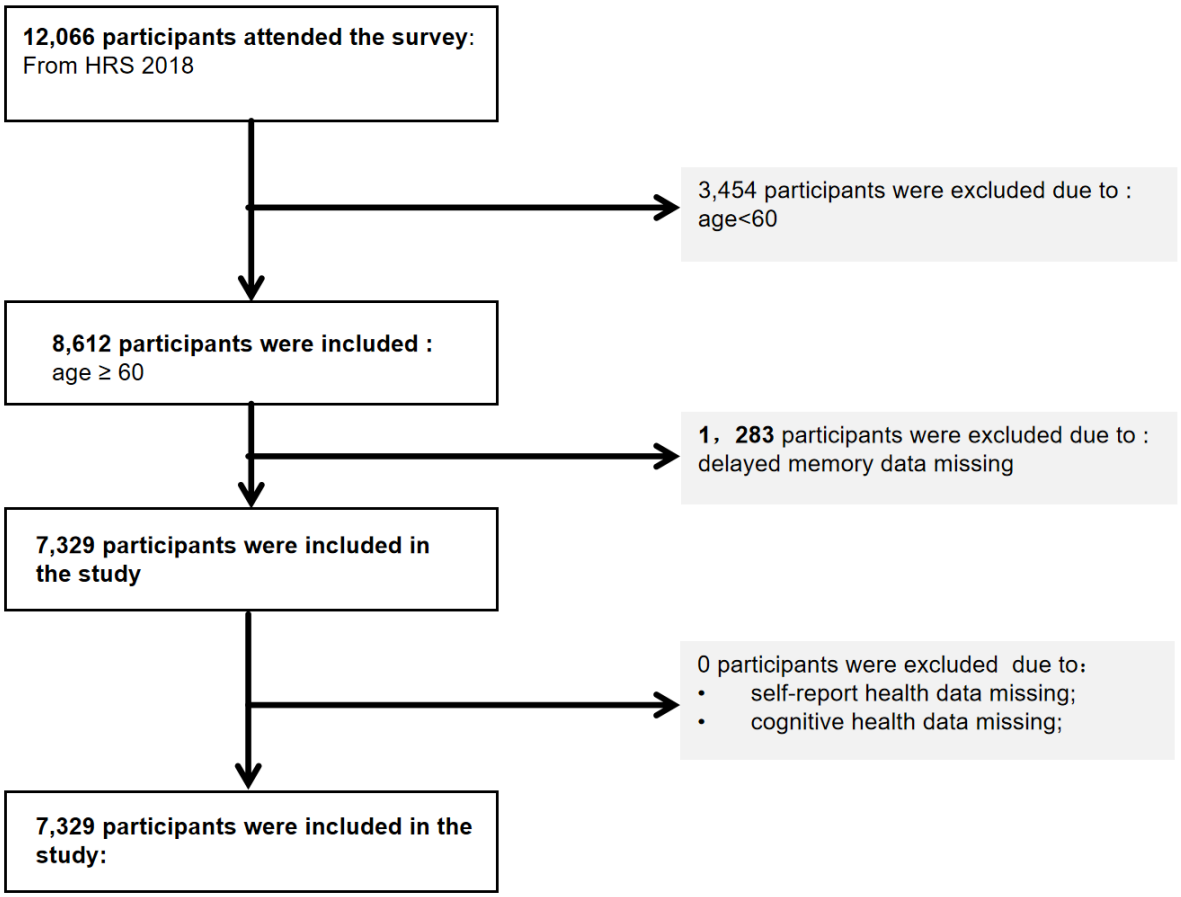


Fig.16. Flowchart of the enrollment of HRS participants **(Source: Authors own work)**

3.3.3 Measurement Items

Dependent variable: Delayed Memory Measurement

Both HRS and CHARLS ask respondents to recall the same list of ten words: butter, arm, shore, letter, queen, cabin, pole, ticket, grass, and engine. The recall task is scored on a scale of 1-10, where each correctly recalled word counts as one point. The use of the same word list and scoring system in both studies strengthens the validity of our comparative analysis.

Independent Variables

To ensure maximum similarity in sample selection between the HRS and CHARLS databases, we focused on binary variables indicating whether respondents had engaged in certain activities within the past month. Leisure activities include interacting with friends, using the internet, playing card games, attending educational courses, and participating in sports or social clubs. Volunteer activities involve participating in voluntary or charity work and caring for a sick or disabled adult. The third category, income-generating activities, includes stock trading. We conducted regression analyses on delayed memory for each database separately and excluded variables that were not statistically significant.

Covariates

In the regression analysis, we controlled for two key covariates—age and marital status—both of which are known to affect cognitive health and social participation among older adults. Age was categorized into three groups (60–70, 70–80, and 80+) to account for its influence on delayed memory, as cognitive decline generally increases with age. Marital status was included as it plays a significant role in social support. Besides, Barro's (1993) approach for comparisons of different education is utilized in our research to reclassify the educational level. From illiteracy to doctoral studies, ten levels of education are represented in the CHARLS. To facilitate comparisons and streamline analysis across various levels of education, we reclassified the subjects into three categories: those below the primary school, those between middle and high school, and those above university. This method of classification facilitates a clearer illustration of the influence that varying levels of education have on the findings of the research.

Social activities represent whether participants attended any activities in the past month. Four social activity variables. These variables are binary, with 0 indicating that the respondent did not participate in any activities and 1 indicating that the respondent participated in at least one activity. The activities include six types: 1. interaction with friends, 2. card play activity, 3. sports activity, 4. community-related organization activity, 5. voluntary or charity work, and 6. educational or training courses.

3.3.4 Statistical Analysis

A descriptive statistical analysis was conducted on 11,332 respondents from the CHARLS database and 7,323 respondents from the HRS database, categorizing them into three groups based on memory function: good, fair, and poor. The analysis included demographic characteristics, gender, age, education level, marital status, and participation in various social activities. Results were presented as percentages and means. Chi-square tests were applied to assess the distribution differences across memory function levels.

Multiple linear regression analysis was used to examine the relationship between participation in various social activities and delayed memory function, controlling for age and marital status. Separate models were developed for the CHARLS and HRS datasets. Social activities, as independent variables, included volunteer or charity work, playing card games, internet use, attending educational courses, communicating by social media, caring for a sick or disabled adult, participating in sports activities, attending community-related activities, and interacting with friends. Age and marital status were included as control variables in the analysis to account for their potential confounding effects on memory function. The regression models were assessed using R-squared values to evaluate the model fit, and robust standard errors were employed to correct for potential heteroskedasticity. A significance level of $P < 0.05$ was applied to all analyses.

This chapter has outlined the comprehensive research methodology adopted for this study, which integrates quantitative, qualitative, and mixed methods approaches across three distinct studies. Each study is designed to address a specific research objective related to the well-being of older adults in tourism. By employing advanced analytical techniques, such as Structural Equation Modeling Partial Least Squares (SEM-PLS), Grounded Theory Analysis (GTA), and multiple linear regression, this research ensures the robustness and credibility of its findings. The integration of diverse data sources, including large-scale surveys, in-depth interviews, and secondary data from the CHARLS and HRS databases, enhances the depth and generalizability of the results.

The subsequent chapters will present the key findings from each of the three studies. Chapter 4 will focus on Study 1, which examines the role of mobile technologies (MTs) in promoting older adults' well-being in tourism, emphasizing the mechanisms through which MTs influence engagement, brand loyalty, and overall well-being. Chapter 5 will present the results of Study 2, which delves into the role of emotional engagement in tourism and its impact on well-being and brand loyalty, drawing from perspectives in social support theory and social gerontology. Finally, Chapter 6 will discuss the findings of Study 3, which investigates the impact of social activity participation on cognitive health and memory among older adults through a cross-cultural comparison of the CHARLS (China) and HRS (United States) datasets.

Together, these studies form a cohesive narrative that illustrates the multiple pathways through which older adults' well-being can be enhanced in tourism. From the technological support offered by MTs to the human engagement fostered by social participation, the following chapters will provide critical insights for policymakers, tourism service providers, and researchers dedicated to promoting healthy, engaged, and sustainable tourism experiences for older adults.

Chapter 4

Results of Study 1 (SRQ1): Mobile Technologies and the Enhancement of Well-being in Older Adults' Tourism: A Pathway to SDG 3.4

This chapter presents the findings of Study 1, which investigates the role of mobile technologies (MTs) in enhancing the well-being of older adults in the context of tourism. The study adopts a mixed-method approach, beginning with a quantitative analysis that examines the influence of various emerging technologies—Artificial Intelligence (AI), Internet of Things (IoT), Virtual Reality (VR), and Mobile Technology (MT)—on older adults' tourism experiences. The results reveal that, among these technologies, mobile technology stands out as the most influential factor in promoting brand loyalty, engagement, and well-being among older tourists. Recognizing the central role of MTs, the study then shifts to a qualitative analysis using the Gioia method to explore the specific mechanisms through which MTs exert this influence.

The qualitative analysis delves into older adults' lived experiences with MTs before, during, and after travel. It identifies key themes that illustrate how MTs extend travel capabilities, reshape perceptions of tourism experiences, and drive meaningful personal transformations. MTs enable older travelers to overcome challenges related to accessibility, safety, and engagement, while also fostering continuous learning, emotional support, and social connectedness. These qualitative insights provide a deeper understanding of the pathways through which MTs contribute to well-being, highlighting their transformative role in enhancing the overall quality of life for older adults. By integrating quantitative and qualitative evidence, this chapter offers a comprehensive perspective on the strategic role of mobile technologies in sustainable tourism for older adults, aligning with the goals of SDG 3.4 on promoting well-being and healthy living.

4.1 Quantitative Results: Identifying the Key Technologies Enhancing Older Adults' Tourism Well-being

4.1.1 Measurement Reliability and Validity

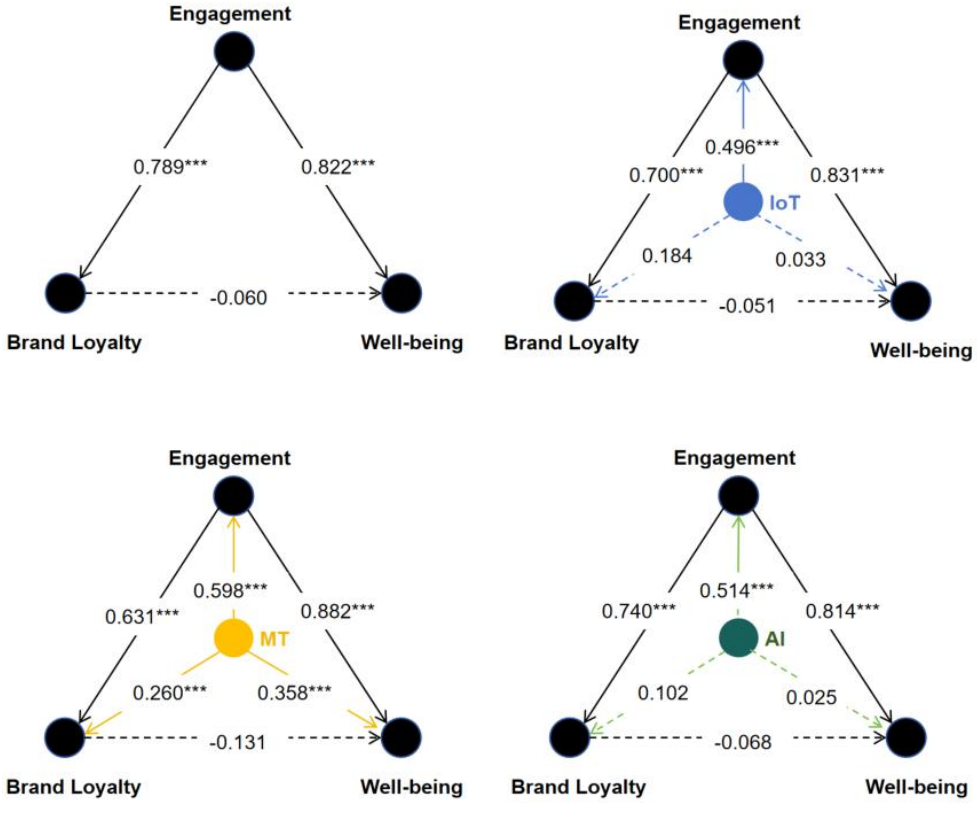
The reliability and validity analysis of this study demonstrates overall reasonableness, with some lower values still falling within acceptable ranges for exploratory research, as shown in Table6. First, Cronbach's Alpha typically requires values above 0.7 for strong internal consistency, but values above 0.6 are acceptable in exploratory contexts (Hair et al., 2010). In this study, Brand Loyalty (0.637), MT (0.692), VR (0.602), and IoT (0.552) show slightly lower Alpha values, but they remain within the acceptable range, particularly for emerging fields like IoT and VR, where moderate reliability is expected. Moreover, Composite Reliability (CR) shows that most constructs exceed the 0.7 threshold, indicating solid internal consistency. While VR and IoT have slightly lower CR values, they are still close to the standard, making them reasonable for exploratory research. Finally, all constructs have Average Variance Extracted (AVE) values above 0.6, which confirms good convergent validity. Therefore, despite some lower values, the overall reliability and validity meet the required standards, ensuring the model's suitability for further analysis.

Table.6 Reliability and Validity Test

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Brand loyalty	0.637	0.644	0.777	0.667
Engagement	0.883	0.897	0.905	0.650
Well-being	0.824	0.844	0.878	0.611
MT	0.692	0.741	0.792	0.674
VR	0.602	0.671	0.676	0.642
AI	0.648	0.653	0.712	0.733
IoT	0.552	0.643	0.725	0.641

4.1.2 Conclusion: Mobile Technologies as the Most Influential Factor

As shown in Fig.17, the engagement construct significantly impacts both brand loyalty and well-being among older adults. Specifically, the Mobile Technology (MT) path demonstrates strong positive effects, with engagement significantly influencing brand loyalty ($\beta = 0.631$, $p < 0.001$) and well-being ($\beta = 0.882$, $p < 0.001$). This underscores the crucial role of MT in enhancing both loyalty and overall well-being for older adults in travel contexts. Additionally, MT has a direct positive impact on brand loyalty ($\beta = 0.260$, $p < 0.001$) and well-being ($\beta = 0.358$, $p < 0.001$), further highlighting its importance in driving favorable travel outcomes. The findings suggest that mobile technology is particularly effective in engaging older travelers, fostering brand loyalty and improving their well-being, making it an essential tool in tourism services for this demographic. In contrast, other technologies such as IoT, VR, and AI show weaker or non-significant effects in some areas, particularly in their influence on well-being. This indicates that MT plays a more prominent role in shaping the travel experiences and satisfaction of older adults compared to other emerging technologies.



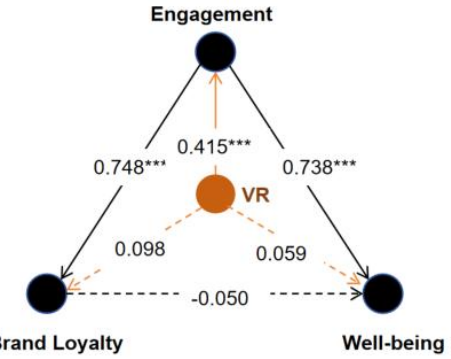


Fig.17 Comparative Impact of Engagement, Brand Loyalty, and Well-Being Across AI, IoT, VR, and Mobile Technology in Older Adult Tourism **(Source: Authors own work)**

In this study, we found that engagement among older adults has a significant impact on both brand loyalty and well-being, emphasizing the critical role of enhancing older adults' engagement in tourism experiences. Given the importance of engagement, tourism services targeted at older adults should focus on improving their involvement in travel activities. In exploring the application of different technologies in older adult tourism, mobile technology stood out as particularly impactful, significantly influencing brand loyalty, well-being, and enhancing engagement. This makes mobile technology a key element in improving the overall travel experience and engagement of older adults.

Older Adults' Engagement and Its Impact on Brand Loyalty and Well-being

Our findings demonstrate that older adults' engagement has a significant positive impact on both brand loyalty and well-being within the context of tourism. This reinforces the importance of focusing on older adults' active participation during travel, which has been shown to strengthen their connection to brands and improve their overall travel satisfaction. Su et al. (2020) supports this by showing that engagement enhances well-being. Our study further adds new insight by emphasizing the role of mobile technology as a key facilitator of this engagement among older travelers. This distinction highlights how mobile platforms, including apps and online resources, play an essential role in not only increasing engagement but also in fostering brand loyalty. Kaur et al. (2020) previously identified that engagement in digital environments strengthens brand loyalty. Our research extends this by focusing on mobile technology within the tourism sector, showing that it effectively bridges the gap between older adults and the brands they interact with

during their travels. This connection, driven through mobile platforms, enhances both brand loyalty and well-being—two critical outcomes that have not been as extensively explored in prior studies.

The Significant Role of MT in Older Adults' tourism

MT stands out as the most impactful among the four technologies in older adults' tourism, particularly when compared to IoT, VR and AI. While these other technologies hold potential, they have yet to achieve the same level of influence as mobile technology in this demographic. One of the key reasons for the greater impact of MT is its widespread accessibility and usability. IoT and VR technologies, though promising, often require more technical expertise or investment in devices that older adults may find less intuitive or accessible. In contrast, MT is already deeply integrated into the daily lives of many older adults. Mobile phones and apps are familiar tools, easily accessible, and offer a wide range of services that directly enhance travel experiences. From booking accommodations to accessing health monitoring apps, MT provides practical and immediate solutions that align with older adults' needs. The convenience and familiarity of using mobile apps for travel planning, navigation, and communication make it an ideal platform for increasing both brand loyalty and well-being in this demographic.

Additionally, MT supports real-time communication and updates, offering older adults' immediate access to information, health monitoring, and travel-related services. This immediacy creates a greater sense of security and independence, allowing older adults to feel more confident and engaged during their travels. The adaptability of mobile platforms also allows for tailored marketing strategies that resonate with older adults, further driving brand loyalty and enhancing their overall travel satisfaction. Therefore, while IoT and VR may have their roles in future tourism developments, mobile technology currently plays the most significant role in improving the travel experiences of older adults, making it an indispensable tool in this sector.

In conclusion, mobile technology plays a central role in improving the travel experience for older adults, surpassing other technologies like IoT, VR, and AI in its impact. Its ease of use and widespread adoption make it a practical tool for addressing the specific needs of older travelers. Mobile technology provides older adults with convenient access to essential travel services, from

health monitoring and booking to real-time updates, enhancing their sense of independence and security while traveling. From a service perspective, leveraging mobile technology should be a priority for the tourism industry when catering to older adults. By enhancing older adults' engagement through mobile-friendly services such as personalized recommendations, real-time assistance, and simplified communication, travel providers can foster stronger brand loyalty and improve the overall well-being of older travelers. Focusing on these aspects will not only improve the travel experience for older adults but also contribute to the long-term success and reputation of tourism brands. As the use of mobile technology continues to grow, its application in improving the quality of life and travel satisfaction for older adults should remain a key focus for service providers.

One primary limitation of this study is that the sample focuses exclusively on older adult tourists in China, which may limit the broader applicability of the findings. Preferences, behaviors, and the use of technology among older adults can differ considerably across cultures and regions. These variations can influence how mobile technology impacts aspects such as brand loyalty and well-being, making it difficult to generalize the results to older adults in other countries. Additionally, the model's explanatory power, while sufficient, could be improved. Although the model successfully meets established thresholds, it does not fully capture all the factors that may influence the relationships between older adults' engagement, brand loyalty, and well-being. Further refinement and the inclusion of additional variables could provide a more comprehensive understanding of these dynamics.

Future research could extend this study by including older adults from a wider range of cultural and geographical contexts. A cross-cultural approach would provide a more comprehensive understanding of how mobile technology affects brand loyalty and well-being in different regions. In addition, future studies could benefit from using qualitative research methods to study on how mobile technology shapes older adults' travel experiences. This qualitative exploration would offer richer insights into the practical impact of mobile apps and health monitoring tools, revealing nuances that quantitative data might overlook. Such research could uncover new aspects of mobile technology’s role in enhancing brand loyalty and improving the overall travel experience for older adults.

4.2 Qualitative Results: Understanding the Role of Mobile Technologies in Older Adults' Tourism Well-being

This study investigates the role of mobile technologies (MTs) in enhancing travel experiences for older adult tourists, with a particular focus on MTs' impact on mental health and well-being. In the preceding quantitative analysis (Section 4.1), we identified a significant influence of MTs on the well-being of older adult tourists. To gain a deeper understanding of the underlying mechanisms behind this impact, we conducted a qualitative study using the Gioia method. The findings from this qualitative inquiry reveal that MTs not only extend older adults' travel capabilities but also deepen their engagement and enrich their perceptions of travel experiences, leading to meaningful personal transformations. The results indicate that MTs' influence extends beyond logistical convenience, fostering continuous learning, social connection, and emotional support, all of which positively affect their daily lives. This study highlights MTs' potential to improve mental health and well-being, thereby contributing to a higher quality of life for older adult travelers.

4.2.1 Emergent Themes from Gioia Coding

Our interview data reveals that older adult tourists clearly recognize the positive role of technology in their travel experiences. To better understand the specific impact of mobile technologies (MTs), we conducted a detailed coding analysis following the Gioia method. This analysis allowed us to systematically categorize and conceptualize the key dimensions of MTs' influence on older adults' tourism experiences.

The coding process identified three core themes that capture the comprehensive role of MTs: **(1) Impact on Travel Capability, (2) Impact on Perceptions of the Travel Experience, and (3) Impact on Travel-Induced Transformation.** Each of these themes represents a distinct yet interconnected aspect of how MTs shape the experiences of older adult tourists before, during, and after their trips.

To provide a clear and structured understanding of these themes, we present the data structure in three separate Fig.18, 19 and 20. Each table illustrates the relationship between first-order categories (direct observations or statements from participants), second-order themes (conceptual groupings of related categories), and the broader aggregate dimension (the core thematic area).

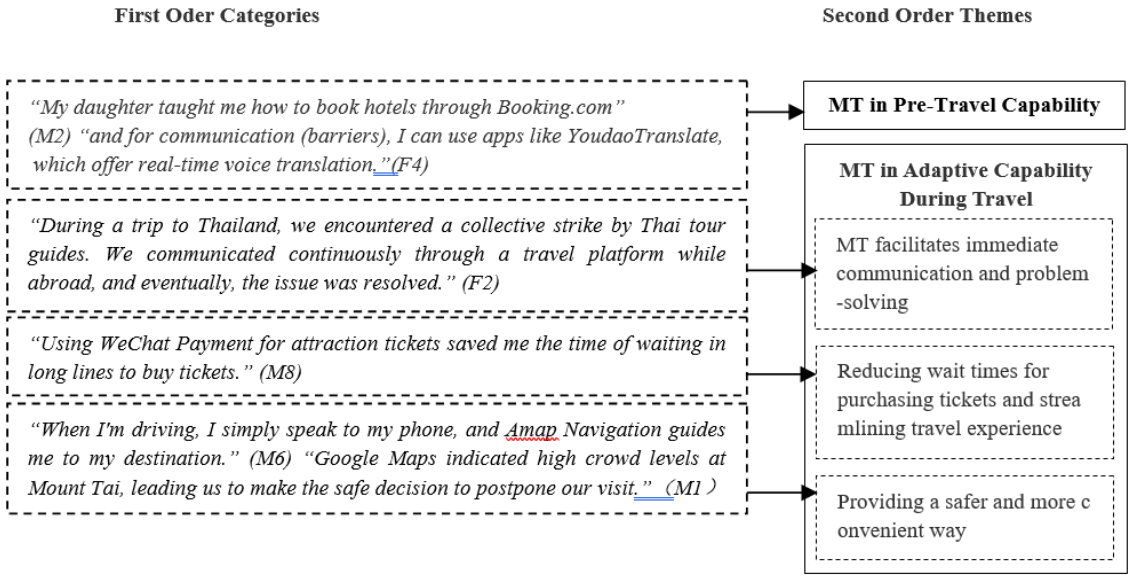


Fig.18. Aggregate Dimensions 1: MT in Travel Capability **(Source: Authors own work)**

MTs' impact on travel capability

This dimension highlights how mobile technologies (MTs) enhance older adults' ability to plan, manage, and navigate their travel experiences. The coding analysis reveals that MTs play a dual role by facilitating **pre-travel preparation** and supporting **adaptive problem-solving during travel**. These roles are critical for older adults, as they help to overcome cognitive, physical, and linguistic barriers that are often encountered in tourism contexts. By enabling older tourists to address these challenges, MTs promote a greater sense of autonomy and confidence throughout the travel process.

Pre-Travel Capability: Prior to travel, older tourists utilize MTs to prepare and plan their trips. Tools such as online booking platforms, real-time voice translation apps, and trip planning applications allow older travelers to make informed decisions regarding accommodations, transportation, and destinations. For instance, voice translation apps help them overcome

language barriers, while hotel booking platforms enable them to secure accommodations that match their preferences and needs. This proactive use of MTs reduces uncertainty and builds confidence before the trip even begins.

Adaptive Capability During Travel: Once the journey begins, older adults continue to rely on MTs for real-time decision-making and problem-solving. GPS navigation, mobile payment systems, and real-time updates on crowd density at tourist sites allow them to adjust their plans dynamically. For example, GPS services provide turn-by-turn navigation, enabling older travelers to find alternative routes or avoid crowded areas. Mobile payment systems eliminate the need for cash, making transactions at tourist sites faster and more convenient. Additionally, apps that provide crowd density information help older adults avoid congested areas, ensuring a safer and more comfortable travel experience.

Through first-order theme analysis, it became evident that older tourists actively use a range of MTs, including smartwatches, GPS services, mobile payment systems, online booking platforms, and health management apps. These tools are not only seen as functional aids but also as enablers of independence and empowerment. For instance, smartwatches with health-tracking features allow older tourists to monitor their physical condition while traveling, thereby supporting better health management. The use of mobile payment systems, such as WeChat Pay, streamlines the process of purchasing tickets and accessing tourist sites, reducing the physical strain of waiting in long lines.

Based on second-order coding, two key themes emerged: MTs' impact on pre-travel capability and MTs' impact on adaptive capability during travel. These two themes illustrate how older adults' use of MTs evolves from preparation to real-time adjustments during travel. By addressing critical issues such as language barriers, health monitoring, and navigation challenges, MTs contribute to a safer, more convenient, and more accommodating travel environment for older tourists. This enhanced capability leads to higher travel satisfaction, greater confidence, and an improved sense of well-being throughout the entire travel experience.

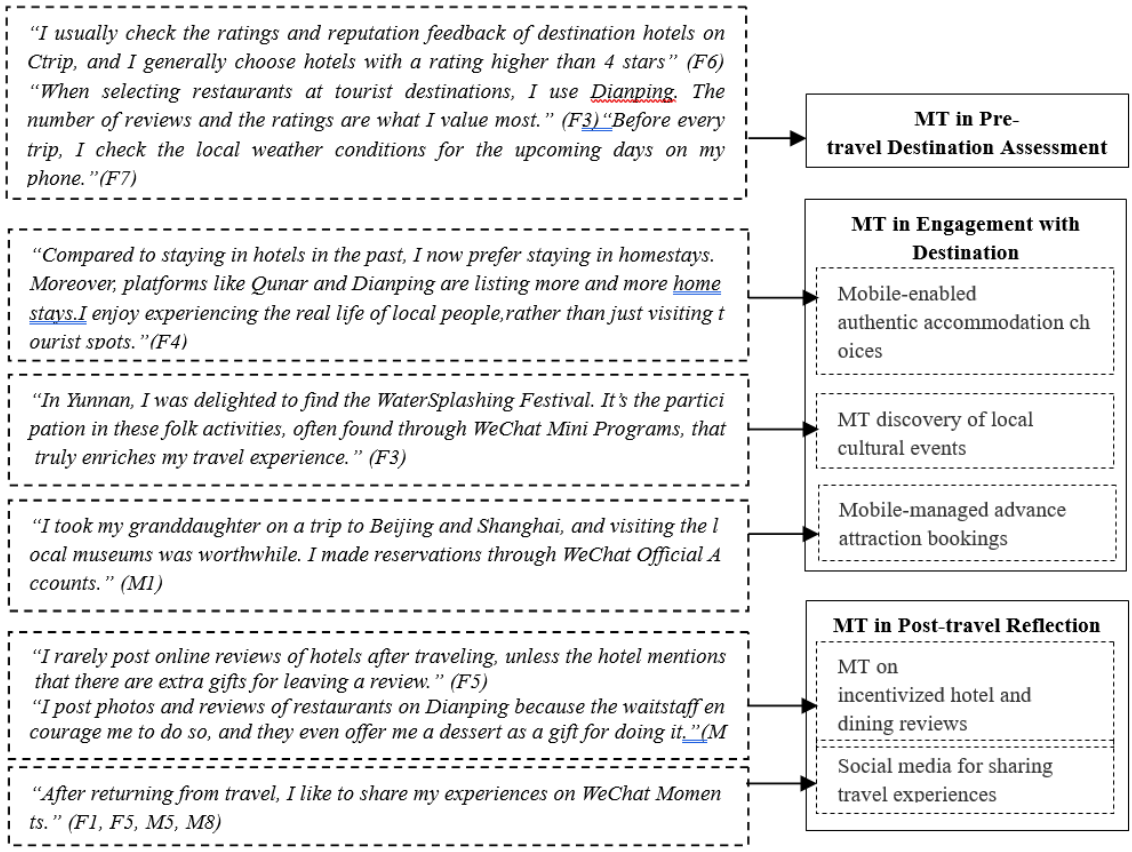


Fig.19 Aggregate Dimensions 1: MT in Perceptions of Travel **(Source: Authors own work)**

MTs' impact on perceptions of the travel experience

Through an analysis of our first-order themes, it became apparent that the elderly participants displayed selective engagement in providing destination feedback on mobile platforms, often prompted by incentives. However, mobile ratings and reviews can substantially guide travel-related decisions. Elderly travelers reported a tendency to choose accommodations with higher ratings, typically above four stars, and sought well-reviewed dining establishments through mobile apps. This reliance on MTs for travel perception permeates the travel process. Consequently, our second-order themes concentrated on three interrelated themes reflecting this continuum: MTs' impact on pre-travel destination assessment captures how prior ratings influence accommodation and restaurant choices; MTs' impact on travelers' engagement with the destination summarizes MTs' role in discovering and engaging with local culture and events; and MTs' impact on post-travel reflection represents how experiences are shared and reflected upon after travel.

This theme highlights how MTs shape older adults' experiences and perspectives throughout their journey. Older adults rely on MTs for pre-travel decision-making, such as selecting hotels and dining options based on app ratings and reviews. Additionally, MTs support the discovery of local cultural events and help users engage with destinations in more meaningful ways. During travel, older tourists use MTs to create and share their experiences, such as posting photos and reviews on social platforms like WeChat and Dianping. The shared experiences contribute to the formation of memories, reinforcing the emotional and social value of travel.

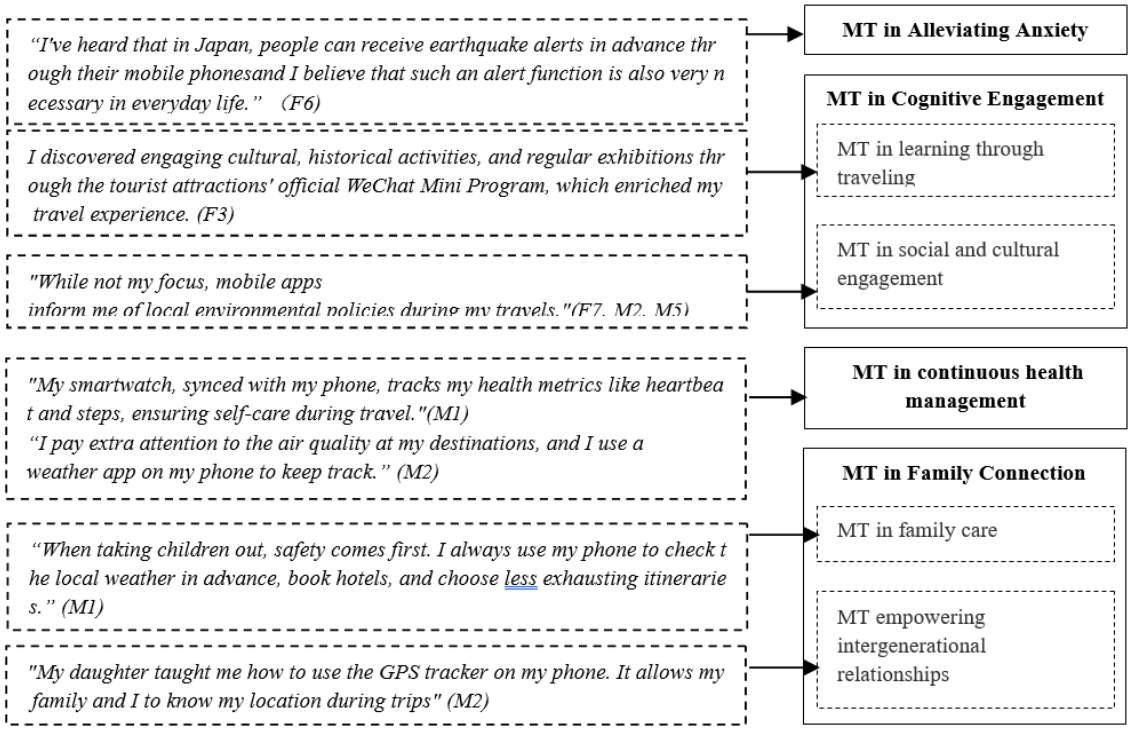


Fig.20. Aggregate Dimensions 1: MT in Travel-induced Transformation **(Source: Authors own work)**

Furthermore, our interviews revealed that all 15 participants utilized mobile phones to capture memorable moments during their travel, highlighting MTs' essential role in preserving travel memory. Five female respondents specifically mentioned using photo-editing applications for beautification, color adjustment, and transforming pictures into short videos. Additionally, four seniors actively posted their travel narratives on WeChat Moments, treating them as crucial

components of their travel journeys. These actions demonstrate that elderly tourists are actively participating in the digital narrative of travel, including the trend of posting photos from famed “check-in” locations, thereby maintaining their connectivity and engagement with the community.

MTs’ impact on travel-induced transformation

Based on our interviews, elderly tourists exhibited diverse motivations for travel, ranging from food preferences to concerns about medical facilities due to conditions such as heart disease. Despite their diverse needs, there was a clear consensus regarding travel safety. Mobile applications that display visitor flow, provide natural disaster warnings, and GPS locations are crucial for mitigating travel risks. We categorized this finding in our second-order coding as “MTs’ impact on alleviating anxiety.”

However, the respondents’ awareness of environmental protection was not particularly strong, with three participants noting that the mobile apps reminded them to pay attention to local environmental issues. Additionally, they frequently mentioned the official WeChat Mini Programs, which enriched their travel experiences by providing information on cultural and historical activities and regular exhibitions. These observations led us to establish "MTs’ impact on learning through traveling" and "MTs’ impact on social and cultural engagement" as thematic categories. Moreover, prioritizing safety when traveling with children, using WeChat Mini Programs for cultural insights, and utilizing weather apps to monitor conditions were classified under "MTs’ impact on continuous health management." Similarly, elderly individuals enhanced their travel safety by using mobile technology, especially when traveling with grandchildren, with the help of their children, which we coded as "MTs’ impact on family connection."

These thematic categories ultimately fall under the category “MTs’ impact on travel-induced transformation,” as they all represent ways in which MTs contribute to transformative changes in elderly tourists’ travel experiences. MTs can reshape how older adults engage in travel by alleviating travel-related anxiety, enabling learning, enhancing social engagement, supporting ongoing health management, and strengthening family connections. This positive impact extends

beyond travel, leading to sustained changes that enhance individuals' well-being in everyday contexts. The mediating variables were emotional and cognitive support, health management, and family connections. These factors work together. Sustained health management and strengthened family connections, coupled with cognitive support, enhance the emotional fulfillment and cognitive engagement of the elderly, ultimately improving their overall quality of life and promoting long-term lifestyle changes.

This dimension captures the broader, long-term effects of MTs on older adults' well-being and personal growth. Beyond the immediate travel experience, MTs contribute to transformations in emotional, cognitive, and social aspects of older adults' lives. The analysis highlights how MTs alleviate anxiety (e.g., natural disaster alerts and weather forecasting apps), promote cognitive engagement (e.g., discovering local customs, exhibitions, and historical information through mobile mini-programs), and enable continuous health management (e.g., smartwatch health tracking). Additionally, MTs strengthen family connections as older adults maintain communication with family members during travel, enhancing their sense of security. These transformations have a lasting impact on older adults' quality of life, leading to ongoing benefits that extend well beyond the travel experience itself.

4.2.2 The Results of the three phases of Mobile Technologies in the travel cycle

In the process of analyzing qualitative data using the Gioia method, we identified a dynamic theme spanning the entire travel cycle of elderly tourists (Figure21). In the first phase, seniors leveraged MTs to improve travel accessibility, significantly increasing their ability to fulfill travel aspirations by providing essential information and resources. In the second phase, MTs' role became increasingly prominent throughout the travel planning, execution, and review stages.

MTs not only aided elderly travelers in efficiently gathering information, making decisions, and booking, but also enhanced their immersion in and experience of the cultural aspects of travel destinations through real-time information and interactive platforms. Elderly tourists can share and provide feedback using MTs, thereby deepening their travel experience. The third phase focused on the profound impact of travel experiences on older adults' everyday lives. This

impact may manifest as educational enrichment, the expansion of social circles, and overall improvements in the quality of life.

This study has provided a comprehensive analysis of how mobile technologies (MTs) enhance the well-being of older adults in tourism. Through both quantitative and qualitative methods, we have identified the central role of MTs in improving older adults' engagement, brand loyalty, and well-being during travel. The quantitative findings highlight MTs as the most influential among various emerging technologies, such as AI, IoT, and VR, in supporting older adult tourists. The subsequent qualitative exploration offered deeper insights into the specific mechanisms by which MTs influence the travel experience. Key themes such as enhanced travel capabilities, shifts in travel perceptions, and travel-induced transformations demonstrate how MTs not only improve travel convenience but also promote personal growth, continuous learning, emotional well-being, and social connectedness. Collectively, these findings underscore the vital role of mobile technologies in supporting sustainable, inclusive, and health-oriented tourism for older adults, directly contributing to the achievement of SDG 3.4 on well-being and healthy living.

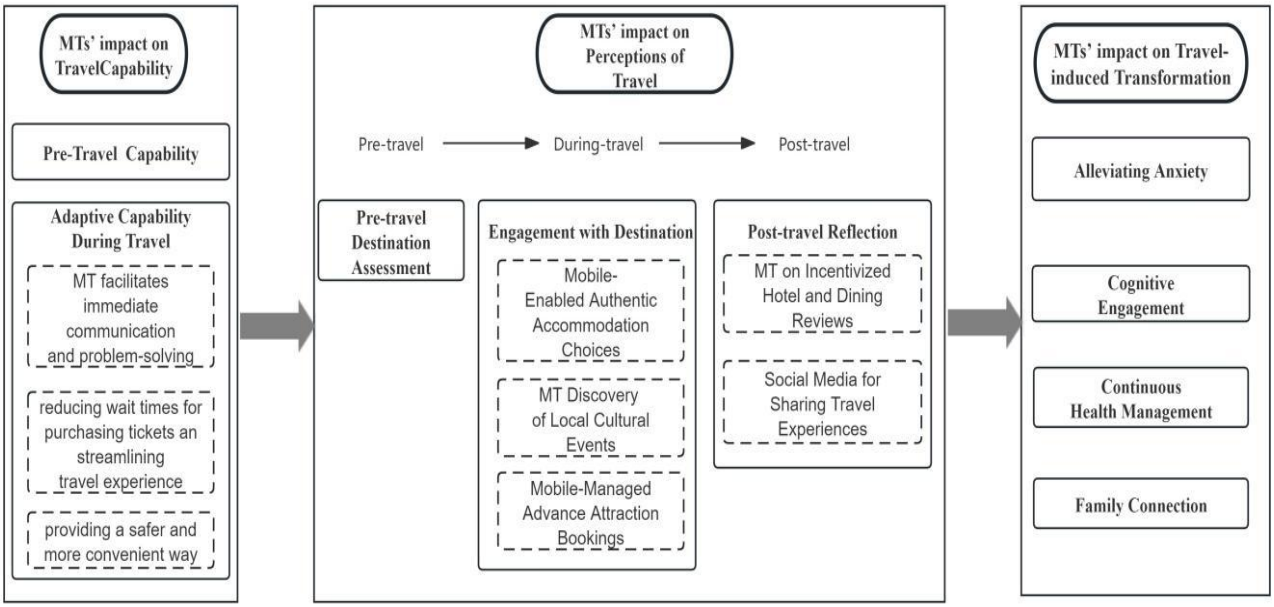


Fig. 21 The three phases of MTs in the travel cycle

(Source: Authors own work)

Building on this foundation, the next chapter will extend the discussion beyond the role of technology and shift the focus to the concept of surface and deep engagement in tourism.

Drawing from perspectives in social support theory and social gerontology, Chapter 5 will examine how different forms of engagement influence older adults' well-being. While Study 1 emphasized the technological pathways to well-being, the next chapter will explore the human, social, and emotional dimensions of tourism participation. This transition reflects a shift from a technology-driven approach to a social and engagement-oriented perspective, thereby offering a holistic understanding of how older adults' well-being can be enhanced through diverse mechanisms in tourism.

Chapter 5

Results of Study 2: Surface and Deep Engagement in Tourism: Enhancing Well-being Among Older Adults

Building upon the previous discussion on the role of technology in enhancing engagement and well-being among older adults, this section further explores the central role of emotional engagement (EE) in tourism experiences by integrating both quantitative and qualitative findings. While technology facilitates cognitive and behavioral engagement, our results underscore that emotional engagement holds a core position in driving older adults' well-being, particularly in enhancing eudaimonic pleasure (EP)—a sense of personal growth, meaning, and fulfillment—beyond immediate hedonic satisfaction.

The quantitative findings reveal that emotional engagement exerts the strongest influence on eudaimonic pleasure compared to behavioral and cognitive engagement, highlighting its critical role in fostering deeper, more sustainable well-being outcomes. Emotional engagement also strengthens the interconnected dimensions of engagement and loyalty, mediating the pathway to long-term satisfaction and commitment among older tourists. These findings reinforce that while surface-level engagement (e.g., behavioral participation) contributes to short-term pleasure, deeper emotional connections are essential for achieving lasting well-being and loyalty.

Complementing the quantitative results, the qualitative analysis further categorizes the positive and negative factors influencing emotional engagement. Positive factors include psychological experiences such as mental recovery and pro-nature preferences, wellness activities like Tai Chi and therapeutic practices, and meaningful social interactions involving interpersonal, community, and family connections. These factors collectively foster feelings of happiness, achievement, and personal growth, which are key components of eudaimonic well-being.

However, the study also identifies several negative factors that can weaken the positive effects of emotional engagement. Concerns regarding safety (e.g., health risks, air quality, and medical access), overly commercialized tourism services, and exhausting travel itineraries can lead to

disappointment and stress. Moreover, poor social interactions, such as interpersonal conflicts, can disrupt emotional satisfaction and reduce engagement levels.

Overall, this integrated analysis highlights the core position of emotional engagement in enhancing older adults' well-being, as evidenced by both quantitative and qualitative findings. By understanding the pathways through which emotional engagement influences eudaimonic pleasure and recognizing the challenges that may undermine it, this study provides practical insights for tourism service providers. Prioritizing emotionally enriching, safe, and flexible travel experiences will be essential for sustaining older adults' well-being and fostering long-term engagement and loyalty in the wellness tourism sector.

5.1 Quantitative Results: Establishing the Impact of Emotional Engagement

In light of both global aging trends and the post-pandemic recovery, wellness tourism for older adults is gaining practical importance. Various studies have made significant progress in understanding services within this sector. Gu et al. (2016) found that tourism experiences positively impact older adults' self-rated health, enhancing their overall well-being. Similarly, Han et al. (2021) emphasized the role of brand engagement via social media in strengthening loyalty, particularly when emotional connections are formed. More recently, Chang et al. (2024) introduced a triple model showing the dynamic relationship between tourist engagement and well-being, while So et al. (2024) demonstrated that engagement has a long-term positive effect on well-being. Current research has confirmed the strong links between brand loyalty, well-being, and tourism engagement from multiple perspectives,

Although many studies have confirmed the strong link between tourist engagement, brand loyalty, and well-being (Zhou & Yu, 2022; Stylidis et al., 2021; Rahmasari et al., 2024), the wellness tourism field lacks detailed classifications of engagement types and levels. There is still limited research on whether different types of engagement have varying impacts on well-being in wellness programs. Besides, current studies on tourist loyalty emphasize surface-level factors like repeat visits, but often neglect the emotional and cognitive connections essential for long-

term loyalty, particularly for the older adults' market. The deep emotional and attitudinal aspects, crucial for sustaining loyalty among older adults in wellness tourism, remain under-explored (Wang & Li, 2023).Understanding the distinctions between different types of engagement is crucial for designing effective wellness programs that cater to diverse needs and maximize well-being outcomes. Older adults, as a rapidly growing demographic in wellness tourism, have unique psychological and emotional needs that demand attention. Without addressing the deeper emotional and attitudinal aspects of engagement, it becomes challenging to sustain engagement in wellness programs, which directly affects both the well-being of older tourists and the sustainability of wellness tourism businesses.

To address the research gap, our study builds on previous work by classifying brand loyalty, older adult engagement, and well-being into surface level and deep level dimensions. This study aims to examine the differential impacts of various levels of tourist engagement, ranging from surface engagement to deep engagement on well-being and brand loyalty among older tourists. Specifically, the study seeks to explore how surface-level and deep-level components of engagement and loyalty interact to influence two dimensions of well-being—hedonic pleasure and eudaimonic pleasure—and their implications for sustainable wellness tourism strategies targeting the older adults' market. By addressing these interactions, the study aims to provide insights into implementing transformative service designs that enhance older adults' well-being through more meaningful and personalized experiences, fostering deeper emotional and cognitive engagement.

5.1.1 Measurement Reliability and Validity

To ensure the validity and reliability of the constructs used in this study, we first calculated the Cronbach's alpha, composite reliability (rho_a and rho_c), and AVE for each construct. The results, as shown in Table.7, demonstrate acceptable reliability and validity for the constructs. Cronbach's Alpha values ranged from 0.648 to 0.828, indicating acceptable internal consistency for exploratory research (Nunnally & Bernstein, 1994). While a Cronbach's Alpha value above 0.7 is often recommended, values between 0.6 and 0.7 are considered acceptable in early-stage research or when developing new scales (Hair et al., 2010). Composite reliability (CR) values, measured using both rho_a and rho_c, also confirmed reliability, with rho_c values exceeding the

0.7 threshold for most constructs (e.g., BE = 0.814, EP = 0.896) and approaching acceptability for others (e.g. HP = 0.653, SL = 0.781) (Hair et al., 2010). The average variance extracted (AVE) for all constructs was above 0.6, meeting the criterion for convergent validity (Fornell & Larcker, 1981). These results collectively indicate that the scale demonstrates strong measurement properties, suitable for the research objectives. The structural equation model, as shown in Fig. 3, demonstrated strong explanatory power, with R^2 values ranging from 28.7% for action loyalty (AL) to 67.3% for eudaimonic pleasure. These results support the hypothesized relationships and the overall robustness of the model.

Table.7 Reliability and Validity Test

	Cronbach's alpha	**Composite reliability (rho_a)**	**Composite reliability (rho_c)**	**Average variance extracted (AVE)**
AL	0.693	0.659	0.779	0.645
BE	0.683	0.76	0.814	0.642
EE	0.791	0.829	0.827	0.632
EP	0.828	0.857	0.896	0.744
HP	0.648	0.653	0.85	0.739
SL	0.657	0.695	0.781	0.643

5.1.2 The Structural Equation Model Results

As shown in Fig.21, the results of this study demonstrate the distinct impacts of surface-level and deep-level engagement on well-being (hedonic and eudaimonic pleasure) and brand loyalty (action and social loyalty). For the surface level engagement, behavioral engagement (BE) positively influenced action loyalty (AL) with a standardized path

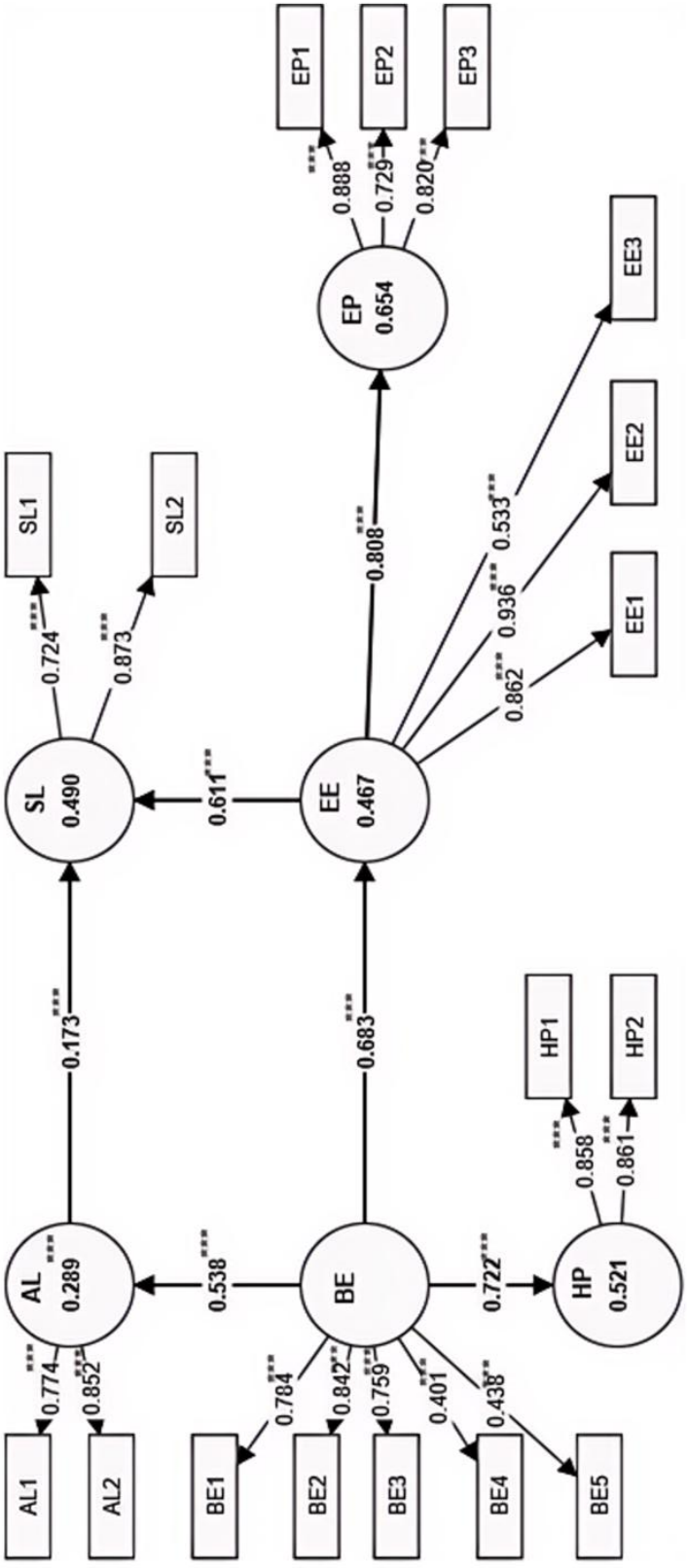


Fig.22 The structural equation model **(Source: Authors own work)**

coefficient of 0.538 ($p < 0.001$), confirming the significant impact of surface-level engagement on surface-level brand loyalty. Additionally, hedonic pleasure (HP) was significantly predicted by behavioral engagement ($\beta = 0.722$, $p < 0.001$), indicating the role of surface-level engagement in promoting short-term well-being outcomes. For deep-level engagement, emotional engagement (EE) exhibited a strong positive impact on eudaimonic pleasure (EP) ($\beta = 0.808$, $p < 0.001$) and social loyalty (SL) ($\beta = 0.611$, $p < 0.01$), highlighting its critical role in fostering deeper well-being and sustained loyalty. Furthermore, eudaimonic pleasure (EP) was found to mediate the relationship between emotional engagement (EE) and long-term brand loyalty. H5and 6 have been validated in this research.

The study also validated H7, showing that action loyalty (AL) has a significant positive impact on social loyalty (SL) ($\beta = 0.173$, $p < 0.001$), and H8, demonstrating that behavioral engagement (BE) significantly enhances cognitive and emotional engagement (EE) ($\beta = 0.683$, $p < 0.001$). These findings reinforce the interconnected nature of engagement, loyalty, and well-being dimensions. Overall, the findings illustrate that deep-level engagement (cognitive and emotional) exerts a stronger influence on deep-layer constructs (social loyalty and eudaimonic pleasure) compared to surface-level engagement.

The findings of our analysis also reveal distinct relationships between the three types of engagement—behavioral engagement (BE), cognitive engagement (CE), and emotional engagement (EE)—and two critical dimensions of well-being: hedonic pleasure (HP) and eudaimonic pleasure (EP), as shown in Fig.22 . The results highlight how older adults' engagement in tourism activities impacts their overall well-being. Among the three types of engagement, emotional engagement (EE) demonstrates the most substantial influence on eudaimonic pleasure (EP), with a coefficient of 0.633, $P<0.001$. This result underscores the importance of fostering emotional connections and experiences for older adults during tourism activities. Eudaimonic pleasure, which is associated with personal growth, meaningfulness, and purpose, is significantly enhanced when older adults are emotionally engaged. This finding suggests that creating emotionally enriching tourism experiences, such as opportunities for social

bonding, culturally immersive activities, and reflective experiences, can effectively enhance deeper, long-term well-being.

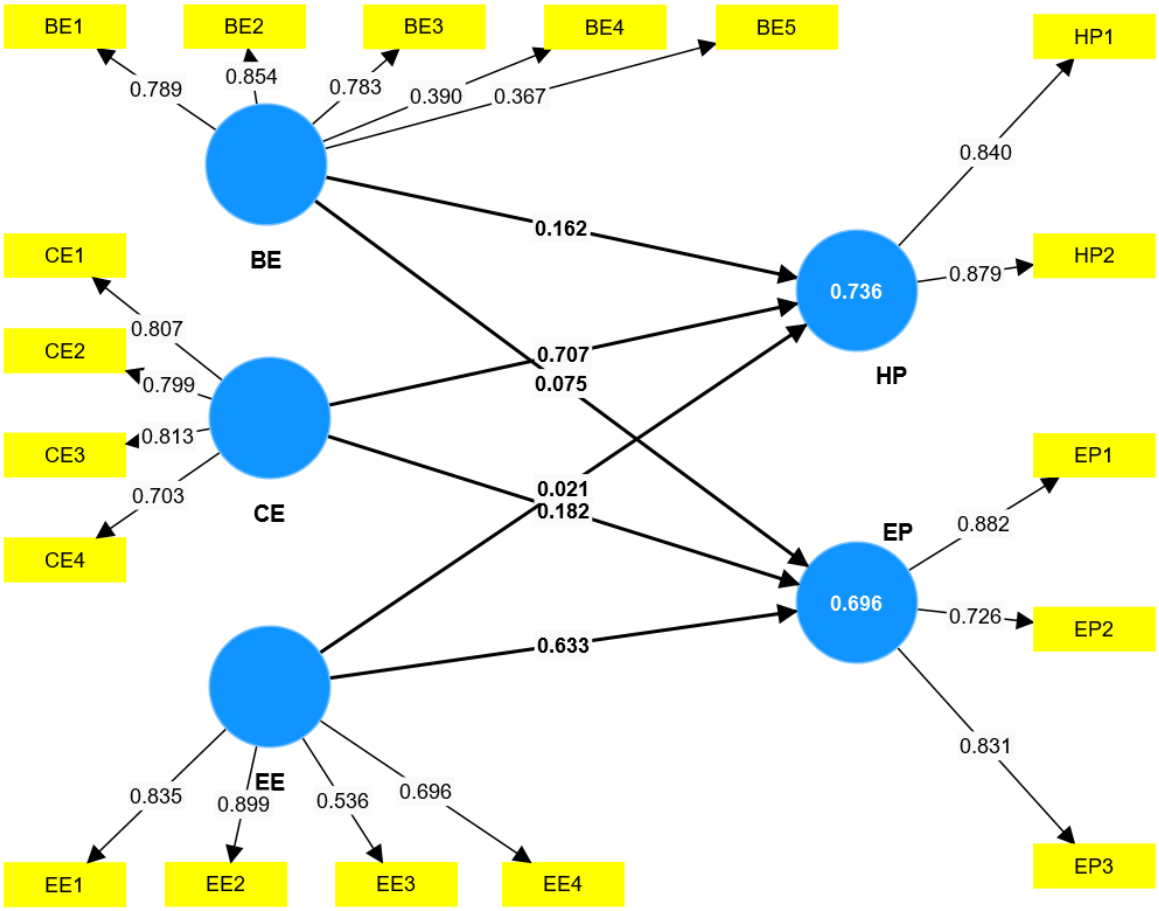


Fig. 23 The Impact of Different Types of Engagement on Well-being: The Importance of Emotional Engagement **(Source: Authors own work)**

On the other hand, cognitive engagement (CE) exhibits the strongest effect on hedonic pleasure (HP), with a coefficient of 0.707, P<0.001. Hedonic pleasure relates to immediate satisfaction, enjoyment, and happiness derived from engaging in activities. The substantial influence of CE on HP highlights the role of mental stimulation and cognitive involvement in improving short-term pleasure among older adults. Tourism experiences that engage older adults intellectually—such as guided tours, storytelling, and educational components—can significantly enhance their immediate happiness and enjoyment. In comparison to EE and CE, behavioral engagement (BE) shows smaller impacts on both dimensions of well-being, with coefficient values of 0.162 for hedonic pleasure and 0.075 for eudaimonic pleasure. While behavioral engagement is an

essential aspect of participation, it appears that the emotional and cognitive components of engagement are far more influential in determining older adults' well-being outcomes. This result suggests that service providers should prioritize enhancing cognitive and emotional engagement rather than focusing solely on behavioral aspects.

A notable finding is the strong mutual influence between the explicit and tacit dimensions of tourism engagement, as indicated by a coefficient of 0.796, $P<0.001$. This relationship emphasizes the interconnected nature of these two dimensions. Explicit engagement (such as observable behaviors) and tacit engagement (such as emotional and cognitive involvement) reinforce one another, creating a holistic tourism experience that contributes to overall well-being. Service providers should aim to integrate these dimensions, ensuring that observable behaviors are accompanied by emotional and cognitive stimulation. The results clearly indicate that emotional engagement plays a pivotal role in enhancing eudaimonic pleasure, which is critical for long-term well-being. As eudaimonic well-being is considered a more sustainable and profound measure of life satisfaction, service providers must prioritize initiatives that foster emotional engagement among older tourists. Examples include organizing activities that promote deep emotional connections, such as cultural immersion, intergenerational exchanges, and reflective or meaningful experiences like nature retreats and art workshops. Encouraging social interactions and group participation further enhances feelings of belonging and joy.

Similarly, to enhance hedonic pleasure, tourism experiences should engage older adults cognitively, offering activities that challenge and stimulate their minds while providing immediate enjoyment. These could include interactive learning sessions or guided tours, hands-on activities such as cooking classes or historical reenactments, and tech-assisted tools like virtual reality (VR) to offer immersive and educational experiences. Overall, this analysis highlights that enhancing emotional engagement should be a priority for tourism service providers aiming to improve older adults' eudaimonic well-being. While behavioral engagement is valuable, the greater impacts of emotional and cognitive engagement on different dimensions of well-being emphasize the need for a multi-faceted approach. By addressing hedonic pleasure through cognitive stimulation and eudaimonic pleasure through emotional enrichment, tourism activities can significantly contribute to the overall well-being of older adults.

5.2 Qualitative Results

The transformation of Emotional Engagement (EE) into eudaimonic pleasure (EP) occurs through a series of interconnected pathways driven by various positive and negative factors. Positive emotional engagement originates from psychological factors, including the opportunity for mental recovery, connection with nature and psychological compensation. These experiences create a foundation of emotional satisfaction that directly enhances the overall well-being of elderly participants. Wellness activities including sports, recreational activities, and preventive therapeutic exercises drive the feelings of achievement and personal growth. These activities provide participants with opportunities to develop skills, improve physical health, and achieve personal milestones, thus fostering a deeper sense of fulfillment and progression. In addition, social interactions—whether through interpersonal connections, community activities, or family interactions—play a crucial role in building emotional bonds and enhancing feelings of belonging and achievement. These interactions create a supportive environment where individuals feel valued, promoting a sense of achievement and personal growth.

On the other hand, the negative influences in the transformation from Emotional Engagement (EE) to Eudaimonic Pleasure (EP) can be categorized into three areas: safety concerns, tourism service limitations, and social interaction challenges. Safety concerns, including issues with the environment, hygiene, and security, can prevent individuals from fully engaging and feeling secure in their surroundings. Tourism service limitations, including overly commercialized experiences and exhausting itineraries, diminish emotional connection by reducing the authenticity and enjoyment of the activities. Finally, social interaction challenges, including poor interpersonal dynamics or conflicts within the group, weaken the emotional bonds necessary for achieving a sense of community and personal growth. These three negative factors collectively reduce the effectiveness of emotional engagement in fostering eudaimonic pleasure. The successful transformation of EE to EP depends on maximizing positive influences and reducing or mitigating the negative ones.

5.2.1 Thematic Analysis Results

The qualitative data (Table.7) reveals that emotional engagement (EE) plays a crucial role in enhancing eudaimonic pleasure (EP) among elderly tourists, as it connects deeply with their psychological well-being, social interactions, and meaningful activities. Positive influences of emotional engagement are reflected through various aspects of their travel experiences. For instance, the desire for mental recovery emerges as a key driver, where elderly tourists seek relief from stress and emotional fatigue through restorative activities such as hot spring visits and extended stays in peaceful natural settings. This intentional pursuit of tranquility and relaxation highlights the therapeutic benefits of tourism for their mental well-being.

Participation in wellness activities further enhances emotional engagement, as older adults engage in Tai Chi, dance, and preventive therapeutic practices like acupuncture therapy. These activities not only promote physical health but also create a sense of accomplishment and enjoyment, reinforcing eudaimonic pleasure through meaningful and purposeful engagement. Additionally, elderly travelers derive significant emotional satisfaction from social and community interactions, which serve as avenues for fostering interpersonal connections, alleviating loneliness, and strengthening their sense of belonging. Whether it is sharing travel photos through WeChat Moments, celebrating holidays in resort communities, or enjoying family travel with grandchildren, these experiences enhance emotional bonds and contribute positively to their well-being.

However, the data also highlight significant challenges that can undermine emotional engagement and, consequently, eudaimonic pleasure. Safety concerns are a primary issue, including worries about high-altitude destinations, poor air quality, inadequate medical facilities, and health-related anxieties such as venous thrombosis or high blood pressure. These concerns reflect the vulnerability of older tourists and their heightened need for secure and health-conscious travel environments. Additionally, negative experiences with overly commercialized attractions and exhausting travel itineraries are cited as sources of disappointment and frustration. Elderly tourists express dissatisfaction with destinations that prioritize commercial activities over genuine cultural or natural experiences, as well as itineraries that lack flexibility and impose

physical strain. These issues reduce their emotional satisfaction and impede their ability to fully immerse themselves in meaningful travel experiences.

Furthermore, while social interactions generally enhance emotional engagement, poor interpersonal dynamics—such as conflicts or disagreements within travel communities—can result in negative emotional outcomes. Instances where tourists avoid participating in group activities due to interpersonal conflicts emphasize the importance of fostering inclusive and harmonious social environments.

Table.7 Coding Results

Category	Sub-category	
Psychology (Positive)	**Pro-Nature**	*"I enjoy soaking in hot springs, visiting vast forests or grasslands, and being close to nature. As I've gotten older, I prefer not to visit overly crowded places. I like staying in one place for a while instead of constantly moving to the next destination." (F3)*
	Psychological Compensation	*"I didn't have much time for travel while working, so I want to make up for it after retirement." (F5,F1,M7)*
	Mental Recovery	*"I get pretty stressed taking care of my granddaughter, and it often keeps me up at night. So every winter, I go to Hainan for a hot spring trip to relax." (F4)*
Activities (Positive)	**Wellness Sports**	*"Every year, we organize trips for our Tai Chi team to participate in Tai Chi events across the country. It's a great way to travel and stay fit, and I really enjoy it." (M4,M6)*
		"At the resort, we have a Xinjiang dance teacher, and a group of us often work out together. We even bought matching outfits for our dances." (F5)
	Recreational Activities	*"In the resort community, when there's a holiday, the elderly gather to celebrate. Each of us prepares a dish, and everyone*

		enjoys being together." (F3）
	Preventive Therapeutic Activities	*"I've been going to a wellness center in Sanya for acupuncture therapy. The place is great for a wellness recovery, and I've gone three years in a row. I like it more each time."(M1, F2)*
Social Interaction (Positive)	**Interpersonal Interactions**	*"Previously, I would print out photos to keep them, then I switched to digital versions, and now I prefer to enjoy sharing travel food and views via WeChat Moments. It's not just about sharing with friends; it's also how I preserve my photos."(M3)*
	Community Interactions	*"After retiring, I felt a bit lost. But since moving to the resort community, my spouse and I joined activities with other seniors. I even became the lead singer in the choir, and it really helped me find myself again." (F8)*
	Family Interactions	*"My husband and I often take our granddaughter out; she is five years old and will start elementary school next year. We really enjoy traveling with her." (F1); "During the Spring Festival, I went to see the ice lanterns in Harbin with my children and they arranged everything."(M6)*
Safety (Negative)	**Destination Community Environment**	*"Because of my high blood pressure, I avoid choosing high-altitude destinations for travel. I would feel upset."(M1, M2, M4, M7); "I'm very concerned about the air quality at my destination. If there's pollution, I definitely won't go." (M5)*
	Hygiene	*"Because I need to take medication regularly, I must ensure that I bring enough medicine for each trip. Additionally, I check the hospital information at the destination in advance. If there are no medical facilities available locally, I become*

		very anxious." (M2)
	Security	*"Because I've had a venous thrombosis in my calf, I worry about the recurrence of my condition if I become fatigued during travel." (F2)* *"If the local security is poor, I won't go out at night." (F4)*
Tourism Service (Negative)	**Overly Commercialized Attractions**	*"I once visited a famous longevity village for a vacation, but it turned out to be just a place full of vendors selling goods. I was disappointed."(F3)*
	Exhausting Travel Itinerary	*"Following a tour group requires waking up early every day, which I find particularly exhausting. "(F4)* *"After retirement, I have enough time to plan my travels. I try to schedule my days more leisurely, ensuring that my daily itinerary doesn't wear me out. Joining a tour group does not meet my requirements." (M6)*
Social Interaction (Negative)	**Poor Interpersonal Interactions**	*"We enjoy the resort because of the activities and the sense of belonging from connecting with others. But it's not always perfect because arguments happen too. Two people I know stopped coming because they didn't get along." (F6);*

Wellness tourism not only improves the health of the elderly but also fosters a deep sense of belonging. Wellness tourism is typically a long-term group activity (Dillette et al., 2020), where the elderly participate in specific activities, such as Tai Chi or onsen therapy, gradually forming stable small groups. This type of group differs from traditional travel groups, as it is typically formed spontaneously by the elderly themselves. This group-based model has a significant impact on their mental health, fostering a sense of mutual support among the elderly. It especially enhances their feelings of achievement and belonging, often more so than activities focused solely on health.

From the perspective of social identity theory, individuals find self-worth through the roles they assume within the group (Tajfel & Turner, 1986). In wellness tourism, the elderly not only develop a strong social identity through group activities but also act as social actors, taking on specific roles that influence group dynamics. These roles, whether as an organizer or a supporter, allow them to actively shape the group experience while reinforcing their self-worth and contributing to a shared sense of belonging.

"*Before the Spring Festival, we practiced Tai Chi together, and my wife and her choir prepared a performance. Our friends all helped prepare food, and we celebrated with the locals. Everyone had a role in the event, and it made me feel like part of the team, which gave me a strong sense of accomplishment*." (M3)

Through this group-based participation, the elderly act as social actors who contribute to and shape group interactions, thereby achieving greater psychological satisfaction and strengthening their social identity.

Besides, there are clear differences in the wellness tourism experiences and needs of males and females. Males are more inclined to use wellness tourism as a way to compensate for missed travel opportunities during their working years.

"I didn't have much time for travel while working, so I want to make up for it after retirement." （M5,M7)

They are typically more goal-oriented and prefer activities like fitness and Tai Chi, which provide challenges and a sense of accomplishment.

"Every year, we organize trips for our Tai Chi team to participate in Tai Chi events across the country. It's a great way to travel and stay fit, and I really enjoy it." （M4,M6）

These activities help them maintain both physical vitality and mental balance. Additionally, males often focus on sharing personal achievements, such as travel photos, as a way to experience personal growth and satisfaction.

"Previously, I would print out photos to keep them, then I switched to digital versions, and now I prefer to enjoy sharing travel food and views via WeChat Moments. It's not just about sharing with friends; it's also how I preserve my photos."(M3)

In contrast, females are more likely to seek happiness and fulfillment through emotional connections. They prioritize psychological recovery through nature experiences and extended rest, often using wellness tourism as a way to relieve stress from family caregiving or other pressures.

"I get pretty stressed taking care of my granddaughter, and it often keeps me up at night. So every winter, I go to Hainan for a hot spring trip to relax." (F1, F4)

Females also emphasize emotional interactions within family, community, and group activities, which help them build a sense of belonging and emotional support. Participation in activities like choir or community events allows them to rediscover themselves and strengthen their emotional bonds with others.

"My husband and I often take our granddaughter out; she is five years old and will start elementary school next year. We really enjoy traveling with her." (F1)

When it comes to safety and health concerns, females are more detail-oriented, focusing on medication management, the availability of medical facilities, and potential health risks. Males, however, are more concerned with broader environmental factors like air quality and the suitability of the destination for health conditions such as high blood pressure.

"Because of my high blood pressure, I avoid choosing high-altitude destinations for travel. I would feel upset."(M1, M2, M4, M7)

Lastly, females express stronger dissatisfaction with overly commercialized or busy itineraries, preferring relaxation and emotional recovery, while males tend to prioritize autonomy in planning their schedules and avoiding fatigue.

"Following a tour group requires waking up early every day, which I find particularly exhausting."(F4)
"After retirement, I have enough time to plan my travels. I try to schedule my days more leisurely, ensuring that my daily itinerary doesn't wear me out. Joining a tour group does not meet my requirements." (M6)

5.2.2 A Conceptual Framework of Factors Influencing Emotional Engagement in Tourism Among Older Adults

The theoretical framework (Figure 23) provides a comprehensive understanding of the role of emotional engagement (EE) in enhancing eudaimonic pleasure (EP) among elderly tourists. It highlights the multi-dimensional nature of EE, identifying both positive and negative factors that influence well-being outcomes. On the positive side, EE contributes to eudaimonic pleasure through psychological experiences, participation in activities, and meaningful social interactions. These positive aspects of EE are closely linked to feelings of happiness, a sense of achievement, and personal growth, which collectively foster long-term well-being.

In terms of psychology, factors such as pro-nature preferences, psychological compensation, and mental recovery play a central role in improving emotional well-being. Elderly tourists express a desire to reconnect with nature, avoid crowded places, and seek opportunities to relax and recover from stress accumulated during daily life. For example, some individuals prioritize quiet, natural environments such as hot springs and forests to achieve mental recovery, while others use travel as a way to compensate for the lack of leisure opportunities during their working years.

Participation in activities also significantly contributes to positive emotional engagement. This includes wellness sports (e.g., Tai Chi and group dance), recreational activities (e.g., holiday

celebrations and communal gatherings), and preventive therapeutic activities (e.g., acupuncture therapy and wellness center visits). Such activities not only improve physical health but also provide opportunities for socialization, accomplishment, and enjoyment, reinforcing feelings of happiness and achievement.

Participation in activities also significantly contributes to positive emotional engagement. This includes wellness sports (e.g., Tai Chi and group dance), recreational activities (e.g., holiday celebrations and communal gatherings), and preventive therapeutic activities (e.g., acupuncture therapy and wellness center visits). Such activities not only improve physical health but also provide opportunities for socialization, accomplishment, and enjoyment, reinforcing feelings of happiness and achievement.

However, the framework also identifies several negative factors that can weaken the positive effects of emotional engagement and hinder the achievement of eudaimonic pleasure. Safety concerns, such as health-related anxieties, hygiene issues, and security risks, are particularly significant for elderly tourists. Examples include avoiding high-altitude destinations due to health conditions, worrying about air quality, or ensuring access to medical facilities at travel destinations. These concerns highlight the vulnerability of elderly travelers and their need for secure and health-conscious travel environments.

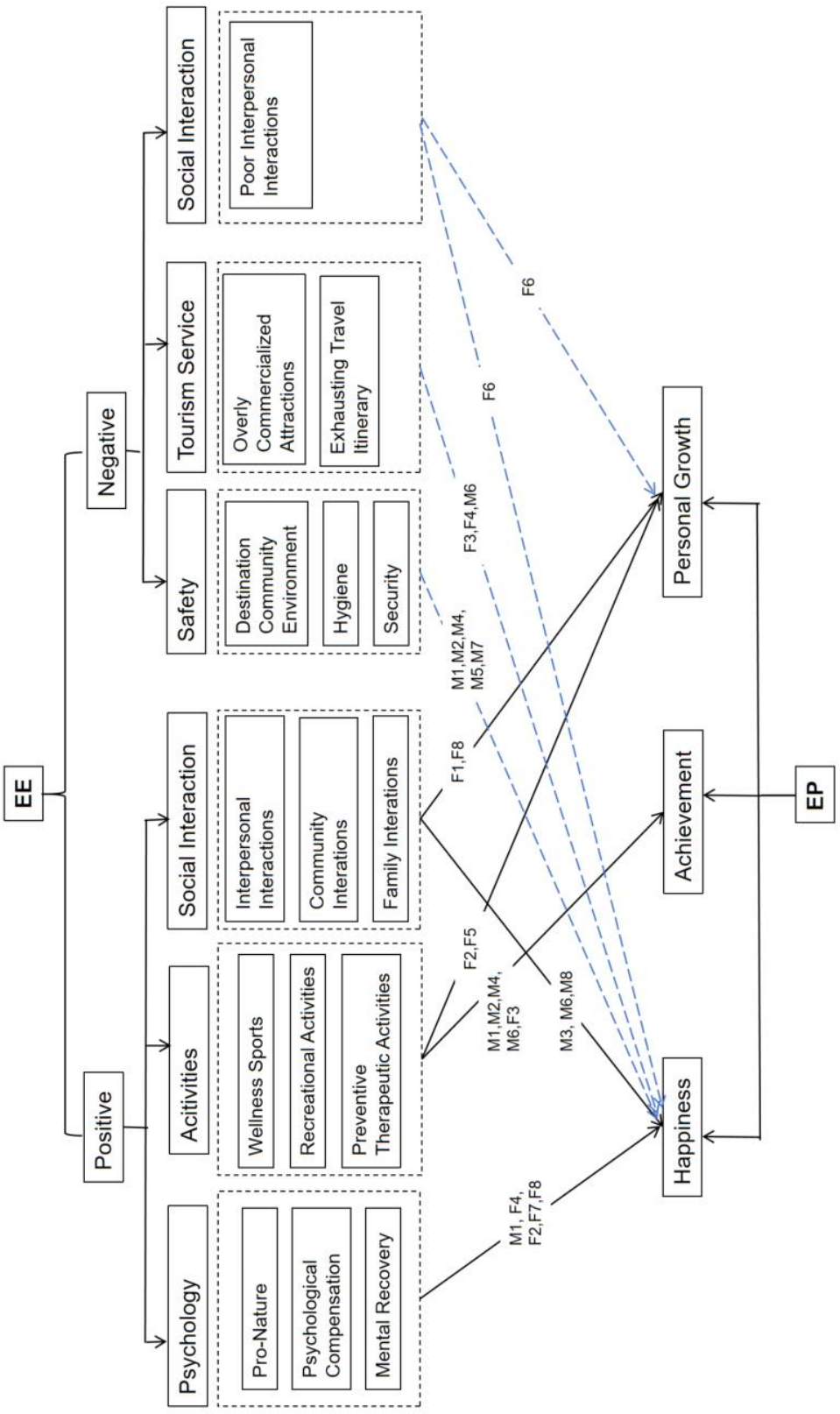


Fig. 24 the Results of Qualitative Coding **(Source: Authors own work)**

The commercialization of attractions and exhausting travel itineraries within tourism services are additional negative factors. Overly commercialized destinations, where cultural or natural value is overshadowed by vendor activity, can lead to disappointment and frustration. Similarly, rigid and physically demanding travel schedules—often associated with tour groups—create fatigue and reduce enjoyment, particularly for elderly individuals who prioritize leisurely, restorative experiences.

Lastly, the framework addresses poor interpersonal interactions as a negative aspect of social engagement. While community and interpersonal interactions generally enhance emotional engagement, conflicts and disagreements within groups can create stress and reduce emotional satisfaction. For instance, elderly tourists who experience arguments or social exclusion may withdraw from group activities, undermining their sense of belonging and happiness.

In summary, this study highlights the central role of emotional engagement (EE) in enhancing older adults' well-being through tourism, with a particular emphasis on its profound impact on eudaimonic pleasure (EP). By integrating quantitative results, which demonstrate EE's dominant influence over other engagement types, and qualitative findings, which identify both facilitators and barriers to EE, the study provides a comprehensive understanding of how emotional connections contribute to happiness, personal growth, and a sense of achievement. While positive factors such as mental recovery, wellness activities, and meaningful social interactions enhance emotional engagement, challenges like safety concerns, commercialized services, and interpersonal conflicts must be addressed to fully sustain its positive effects.

Building on these insights, the next study: A Comparative Study on the Influence of Social Participation in Older Adults' Well-being, extends this exploration by examining how different forms of social participation impact well-being across various contexts. This comparative approach will provide further clarity on the role of active engagement in social activities, shedding light on universally beneficial strategies to support older adults' well-being in diverse cultural and social settings.

CHAPTER 6

Results of Study 3: A Comparative Study on Influence of Social Participation in Older Adults Well-being

Building on the findings from the previous chapter, *Study 2: Surface and Deep Engagement in Tourism: Enhancing Well-being Among Older Adults*, this chapter delves deeper into the social dimensions that influence older adults' well-being. While Study 2 highlighted the importance of emotional and cognitive engagement during tourism activities, it became clear that social participation plays an equally vital role in supporting the health and well-being of older adults. The well-being of older adults extends beyond individual engagement, as social connections, shared experiences, and community interactions are crucial in shaping their sense of purpose, emotional support, and cognitive health.

To address this dimension, this chapter introduces *Study 3: The Role of Social Participation in Promoting Older Adults' Well-being*. This study aims to identify which social activities within tourism services most effectively enhance the well-being and health of older adults. Drawing on comparative data from the China Health and Retirement Longitudinal Study (CHARLS) and the U.S. Health and Retirement Study (HRS), this study examines the specific social factors that influence older adults' health and well-being. By focusing on activities such as volunteer work, card games, internet use, and other forms of social participation, the study explores how these activities contribute to cognitive engagement, emotional support, and social inclusion.

This chapter is structured to answer the following key questions:

1. Which social activities should be integrated into tourism services for older adults to enhance their well-being and health?
2. How do demographic factors such as age, educational level, and health status shape older adults' participation in these activities?
3. How do the impacts of social participation differ across cultural contexts, specifically between older adults in China and the United States?

To answer these questions, *Study 3* adopts a quantitative approach, using descriptive and inferential statistical methods to assess the effects of social activities on older adults' well-being. The analysis focuses on key demographic and social participation variables, highlighting how these factors contribute to cognitive, emotional, and social well-being. By examining the comparative effects of social participation across two cultural contexts, the study provides new insights into how tourism services can be designed to support older adults more effectively.

The insights gained from this chapter will inform the development of a comprehensive framework for enhancing older adults' well-being in tourism. The findings will also serve as a foundation for Chapter 7, where the results from Studies 1, 2, and 3 will be integrated into an Integrated Theoretical Model for Promoting Older Adults' Well-being in Tourism. This model will highlight how social participation, emotional engagement, and technological support interact to create a multi-dimensional approach for fostering active aging and sustainable well-being in older adults through tourism experiences.

6.1 Demographic Characteristics of Participants

A descriptive statistical analysis was conducted on 11,332 respondents from the CHARLS database, as shown in Table.8 and 7,323 respondents from the HRS database, as shown in Table.9 The respondents were categorized into three groups based on memory function levels: Good, Fair, and Poor. The analysis included key demographic characteristics such as gender, age, education level, and marital status, as well as participation in various social activities. The results were presented as percentages (%) for categorical variables and means (M) ± standard deviations (SD) for continuous variables. To assess differences in distribution across the three memory function groups, Chi-square tests were conducted, with a statistical significance level set at $p < 0.05$. The analysis revealed significant differences in gender, age, education level, marital status, and social activity participation among the three memory function groups ($p < 0.05$). Notably, age and education level showed the most pronounced differences across the groups, with older respondents and those with lower educational attainment more likely to be in the "Poor" memory function group.

Table 8 statistical Analysis from CHARLS

	CHARLS (n=11,332)			
Characteristics	n (%) / Mean ± SD	cognitive function (self-report)		
		Good	Fair	Bad
Age				
60-70	6450(56.92)	768(52.53)	3783(56.69)	1899(53.77)
70-80	3720(32.83)	509(34.82)	1984(31.30)	1227(34.74)
80 above	1162(10.25)	185(12.65)	571(9.01)	406(11.49)
Sex				
Male	5720(50.48)	832(56.91)	3514(55.44)	1374(38.90)
Female	5612(49.52)	630(43.09)	2824(44.56)	2158(61.10)
Martial Status				
Married	9618(84.87)	1207(82.56)	5456(86.08)	2955(83.66)
Other Martal Status	1714(15.13)	255(17.44)	882(13.92)	577(16.34)
Educational Level				
Below High School	9691(85.52)	1144(78.25)	5287(83.42)	3260(92.30)
High School	1121(9.89)	191(13.06)	727(11.47)	203(5.75)
College or Above	520(4.59)	127(8.69)	324(5.11)	69(1.95)
Delayed Memory	2.25(±1.60)	2.30(±1.67)	2.47(±1.56)	1.83(±1.60)
Vigorous Physical Activity				
Often	3381(29.84)	438(29.96)	1845(29.11)	1098(31.09)
Seldom	7951(70.16)	1024(70.04)	4493(70.89)	2434(68.91)
Moderate Physical Activity				
Often	5608(49.49)	721(49.32)	3167(49.97)	1720(48.70)
Seldom	5724(50.51)	741(50.68)	3171(50.03)	1812(51.30)
Light Physical Activity				
Often	9487(83.72)	1241(84.88)	5393(85.09)	2853(80.78)
Seldom	1845(16.28)	221(15.12)	945(14.91)	679(19.22)

Interacted with Friends (at least once a month)				
Yes	3742(33.02)	521(35.64)	2145(33.84)	1076(30.46)
No	7590(66.98)	941(64.36)	4193(66.16)	2456(69.54)
Playing Card Game Activity (at least once a month)				
Yes	2121(18.72)	295(20.18)	1299(20.50)	527(14.92)
No	9211(81.28)	1167(79.82)	5039(79.50)	3005(85.08)
Doing Voluntary or Charity Work (at least once a month)				
Yes	202(1.78)	46(3.15)	123(1.94)	33(0.93)
No	11130(98.22)	1416(96.85)	6215(98.06)	3499(0.93)
Going Sport Activity (at least once a month)				
Yes	796(7.02)	124(8.48)	484(7.64)	188(5.32)
No	10536(92.98)	1338(91.52)	5854(92.36)	3344(94.68)
Attending Community-related Activity (at least once a month)				
Yes	306(2.70)	62(4.24)	193(3.05)	51(1.44)
No	11026(97.30)	1400(95.76)	6145(96.95)	3481(98.56)
Cared for a Sick or Disabled Adult (at least once a month)				
Yes	302(2.67)	44(3.01)	171(2.70)	87(2.46)
No	11030(97.33)	1418(96.99)	6167(97.30)	3445(97.54)
Attending Educational Courses (at least once a month)				
Yes	71(0.63)	16(1.09)	48(0.76)	7(0.20)
No	11261(99.37)	1446(98.91)	6290(99.24)	3525(99.80)
Investment Activities				
Yes	61(0.54)	20(1.37)	37(0.58)	4(0.11)
No	11271(99.46)	1442(98.63)	6301(99.42)	3528(99.89)
Using the Internet (at least once a month)				
Yes	1225(10.81)	234(16.01)	778(12.28)	213(6.03)
No	10107(89.19)	1228(83.99)	5560(87.72)	3319(93.97)
Communicate by Social Media (at least once a month)				

Yes	769(62.78)	130(55.56)	499(64.14)	140(65.73)
No	456(37.22)	104(44.44)	279(35.86)	73(34.27)

Table 9 statistical Analysis from HRS

	HRS (7.323)				
Characteristics	n (%) / Mean ± SD	cognitive function (self-report)			P value
		Good	Fair	Bad	
Age					
60-70	3413(46.61)	2306(48.36)	940(43.82)	167(40.73)	< 0.001
70-80	2169(29.62)	1379(28.92)	667(31.10)	123(30.00)	
80 above	1741(23.77)	1083(22.71)	538(25.08)	120(29.27)	
Sex					
Male	2976(40.64)	1897(39.79)	900(41.96)	179(43.66)	0.104
Female	4347(59.36)	2871(60.21)	1245(58.04)	231(56.34)	
Martial Status					
Married	1112(64.69)	778(65.93)	294(63.64)	40(51.95)	< 0.001
Other Martal Status	607(35.31)	402(34.07)	168(36.36)	37(48.05)	
Educational Level					
Below High School	152(5.23)	120(6.27)	27(3.18)	5(3.47)	< 0.001
High School	170(5.85)	141(7.37)	27(3.18)	2(1.39)	
College or Above	2583(88.92)	1652(86.36)	794(93.63)	137(95.14)	
Delayed Memory	3.5(1.76)	4.47(±2.04)	3.71(1.94)	2.97(1.86)	< 0.001
Vigorous Physical Activity					
Often	2663(37.89)	1931(42.25)	646(31.24)	86(21.99)	< 0.001
Seldom	4366(62.11)	2639(57.75)	1422(68.76)	305(78.01)	

Moderate Physical Activity					
Often	4606(70.86)	3174(75.52)	1239(64.60)	191(50.80)	< 0.001
Seldom	1893(29.14)	1029(24.48)	679(35.40)	185(49.20)	
Light Physical Activity					
Often	5494(84.45)	3674(87.41)	1547(80.45)	273(71.84)	< 0.001
Seldom	1012(15.55)	529(12.59)	376(19.55)	107(28.16)	
Interacted with Friends (at least once a month)					
Yes	1648(57.42)	1131(59.68)	451(54.21)	66(46.15)	< 0.001
No	1222(42.58)	764(40.32)	381(45.79)	77(53.85)	
Playing Card Game Activity (at least once a month)					
Yes	736(10.05)	522(10.95)	185(8.62)	29(7.07)	< 0.001
No	6587(89.95)	4246(89.05)	1960(91.38)	381(92.93)	
Doing Voluntary or Charity Work (at least once a month)					
Yes	547(7.47)	432(9.06)	106(4.94)	9(2.02)	< 0.001
No	6776(92.53)	4336(90.94)	2039(95.06)	401(87.80)	
Going Sport Activity (at least once a month)					
Yes	581(7.93)	423(8.87)	138(6.43)	20(4.88)	< 0.001
No	6742(92.07)	4345(91.13)	2007(93.57)	390(95.12)	
Attending Community-related Activity (at least once a month)					
Yes	314(10.78)	231(12.07)	74(8.64)	9(6.29)	0.006
No	2599(89.22)	1683(87.93)	782(91.36)	134(93.71)	
Cared for a Sick or Disabled Adult (at least once a month)					
Yes	502(17.30)	323(16.93)	153(17.96)	26(18.31)	0.762
No	2400(82.70)	1585(83.07)	699(82.04)	116(81.69)	
Attending Educational Courses (at least once a month)					
Yes	152(2.08)	120(2.52)	27(1.26)	5(1.22)	0.001

No	7171(97.92)	4648(97.48)	2118(98.74)	405(98.78)	
Investment Activities					
Yes	6270(94.66)	4014(94.23)	1887(95.21)	369(96.60)	0.061
No	354(5.34)	246(5.77)	95(4.79)	13(3.40)	
Using the Internet (at least once a month)					
Yes	1876(25.65)	1366(28.65)	446(20.79)	64(15.61)	< 0.001
No	5447(74.38)	3402(71.35)	1699(79.21)	346(84.39)	
Communicate by Social Media (at least once a month)					
Yes	768(29.94)	546(31.67)	197(27.02)	25(22.32)	< 0.001
No	1797(70.06)	1178(68.33)	532(72.98)	87(77.68)	

And then, we conducted a descriptive statistical analysis of the participants' demographic and health characteristics to examine the overall impact of social activities on delayed memory in the mediating analysis, as shown in Table.10 . Multiple imputations were performed to address missing values, and the reliability of the data was confirmed. Although some missing values remain, they account for less than 5% of the total data, which, according to Rubin (1996), is considered acceptable and does not affect the reliability or validity of the analysis. The table presents the distribution of age, educational level, household location, gender, and health status across groups categorized by delayed memory scores.

The study results indicate that age, educational level, household location, and health status significantly impact delayed memory. Participants with lower delayed memory scores were older on average and had fewer years of education. In both urban and rural areas, individuals with higher delayed memory scores had significantly higher average scores compared to those with lower scores. Gender and health status also showed significant effects, with both male and female participants having higher delayed memory scores if they had higher overall scores. Notably, participants in good health had significantly higher delayed memory scores compared to those in poorer health. These descriptive statistical analysis results provide a detailed

understanding of the basic characteristics of the study sample. The data indicate that age, education level, household location, gender, and health status exhibit significant differences across different delayed memory score groups. The distribution of these variables provides background information for subsequent inferential analyses and helps in understanding the performance differences in delayed memory among different groups.

Table. 10Characteristics of participants for mediating effect analysis

Variable	**Category**	**Delayed memory<3 Obs**	**Delayed memory≥3 Obs**	**Delayed memory<3 Mean**	**Delayed memory≥3 Mean**
Age		4760	5545	68.14496	70.00757
education		4760	5545	3.339916	2.798016
Household	city	4760	3578	1.271639	1.21213
	rural	3923	4760	1.203671	1.259987
gender	male	2403	3301	1.481303	1.508025
	female	2357	2244	1.481303	1.508025
Health	unhealthy	4760	3578	3.078992	3.120458
	healthy	3403	4109	3.862768	3.981261

Variable	**Category**	**Std. Err.**	**95% CI of Diff**	**t**	**p-value**
Age		0.1361149	-2.129428 to -1.595805	-13.6841	0.0000***
education		0.0374829	0.468426 to 0.6153735	14.4573	0.0000***
Household	**city**	0.0108643	0.0382123 to 0.0808057	5.4775	0.0000***
	rural	0.0086769	-0.0229871 to	-0.689	0.4908

			0.0110298		
gender	**male**	0.0098767	-0.046083 to -0.0073625	-2.7056	0.0068**
	female	0.0098767	-0.046083 to -0.0073625	-2.7056	0.0068
Health	**unhealthy**	0.0223104	-0.0852008 to 0.0022672	-1.8586	0.0631
	healthy	0.0208077	-0.1592815 to -0.0777035	-5.6946	0.0000***

6.2 Effects of Social Activities on Cognitive Function: Regression Results from CHARLS and HRS

This study found that three specific types of social activities—voluntary or charity work, card game activities, and internet use—have significant positive effects on delayed memory in both the CHARLS and HRS datasets, as shown in table 11 and 12. In the CHARLS dataset, voluntary work demonstrated a coefficient of 0.100396 ($P < 0.001$, 95% CI: 0.0647673–0.1162046), while in the HRS dataset, the coefficient was 0.2419655 ($P = 0.002$, 95% CI: 0.0868756–0.3970554). Similarly, for card game activities, the CHARLS dataset showed a coefficient of 0.1959067 ($P < 0.001$, 95% CI: 0.1254285–0.0807066), whereas the HRS dataset reported a coefficient of 0.1070676 ($P = 0.004$, 95% CI: 0.0622047–0.3296086). Internet use presented a strong positive impact on delayed memory, with a coefficient of 0.0563635 in the CHARLS dataset ($P < 0.001$, 95% CI: 0.0513898–0.0613372) and 1.496366 in the HRS dataset ($P < 0.001$, 95% CI: 1.372331–1.620401).

Given that these three activities demonstrated consistent significance across both datasets, the following analysis will focus on these activities to explore their impact on delayed memory in more detail. However, the magnitude of these effects varies between the older adults populations in China and the United States. Voluntary or charity work and internet use show a stronger positive impact on delayed memory among American older adults, whereas card games activities

have a more pronounced positive effect on delayed memory among Chinese older adults. These findings emphasize the important role of social activities in enhancing cognitive function in the older adults and reveal significant differences in the types and frequencies of social activity participation across different cultures.

In general, card game activity and internet use, classified as leisure activities, along with volunteer or charity work, classified as volunteer service activities, have a significant positive impact on delayed memory in both databases, confirming Hypotheses 1 and 2. However, stock investment activity, classified as an income-generating activity, does not significantly impact delayed memory in either database, thus disconfirming Hypothesis 3. The significant differences in the impact of these specific activities on delayed memory between the two databases support Hypothesis 4 .

Table 11 Impact of social activities on delayed memory: regression results from CHARLS and HRS (Coeffient, std.err. and t value)

Delayed memory	**Coefficient**		**Robust Std. err.**		**t**	
Data base	**CHARLS**	**HRS**	**CHARLS**	**HRS**	**CHARLS**	**HRS**
Voluntary work	0.100396	0.2419655	0.0130753	0.0791035	6.91	3.06
Card games activities	0.1959067	0.1070676	0.0114081	0.0681946	9.03	2.87
Used the internet	0.0563635	1.496366	0.0025375	0.063264	22.21	23.65
Attending Educational Courses	0.0292976	0.433714	0.0265896	0.2139755	1.1	2.03
Communicate by Social Media	-0.0769542	-0.7995179	0.0774103	0.081601	-0.99	-9.80
Cared for a Sick or Disabled	0.0076564	0.1814009	0.030663	0.1318995	0.25	1.38

Adult						
Going Sport Activity	0.0655877	0.0167055	0.0245659	0.1242426	2.71	0.13
Attending Community-related Activity	0 .12112	0.1284835	0 .0185247	0.149628	6.54	0.86
Interacting with friends	0.1062593	-0.0295752	0.0781942	0.0238854	1.35	-1.24
Stock investment	0.1477002	0 .3610823	0.0227991	0.1123056	6.48	3.22
Marital status	-0.0305445	0.0100989	0.0336427	0.059075	-0.91	0.17
age	-0.335126	-0.0298346	0.072949	0.005197	-4.59	-5.74
_cons	3.671244	4.947803	0.0108438	0.5701954	124.57	49.74
CHARLS：R-squared: 0.4512; Adj R-squared: 0.4508; Prob > F: 0.0000; Root MSE: 0.1625;						
HRS：R-squared: 0.3462; Adj R-squared: 0.3449 Prob > F: 0.0000; Root MSE: 1.7781						

Table 12 Impact of social activities on delayed memory: regression results from CHARLS and HRS (P and 95% conf. interval value)

Delayed memory	**P>|t|**		**[95% conf. interval]**	
Data base	**CHARLS**	**HRS**	**CHARLS**	**HRS**
Voluntary work	<0.001	0.002	0.0647673, 0.1160246	0.0868756, 0.3970554
Card games activities	<0.001	0.004	0.0807066, 0.1254285	0.0622047, 0.3296086
Used the internet	<0.001	<0.001	0.0513898, 0.0613372	1.372331, 1.620401
Attending Educational Courses	0.271	0.043	-0.022869, 0.0814642	0.0139905, 0.8534375

Communicate by Social Media	0.320	<0.001	-0.2288271, 0.0749186	-0.6395075, 0.644893
Cared for a Sick or Disabled Adult	0.803	0.169	-0.0525875, 0.0679004	-0.0773265, 0.4401282
Going Sport Activity	0.007	0.893	0.0183913, 0.1147841	-0.2270025, 0.2604134
Attending Community-related Activity	<0.001	0.391	0.0848083, 0.1574316	-0.1650191, 0.4219861
Interacting with friends	0.178	0.216	-0.0485641, 0.2610827	-0.0764275, 0.0172771
Stock investment	0.105	0.071	0.10301, 0.1923904	0.1409273, 0.5812374
Marital status	0.362	0.864	-0.0965487, 0.0354597	-0.1057796, 0.1259775
age	<0.001	<0.001	-0.478247, 0.1920025	-0.0400288, -0.0196405
_cons	<0.001	<0.001	3.389467, 3.953021	3.829337, 6.066269

CHARLS：R-squared: 0.4512; Adj R-squared: 0.4508; Prob > F: 0.0000; Root MSE: 0.1625;

HRS：R-squared: 0.3462; Adj R-squared: 0.3449 Prob > F: 0.0000; Root MSE: 1.7781

Based on the quantitative analysis of data from the China Health and Retirement Longitudinal Study (CHARLS) and the U.S. Health and Retirement Study (HRS), this study finds that volunteer work, card-playing activities, and internet use significantly enhance delayed memory in older adults. These three social activities demonstrated consistent positive effects on cognitive function among older adults in both China and the U.S., highlighting the universal role of social engagement in promoting cognitive health. However, differences in participation rates and effects were observed across cultural contexts. Older adults in the U.S. are more inclined to engage in volunteer work, while card-playing activities are more prevalent among older adults in China.

The regression analysis showed that volunteer work significantly improved delayed memory in older adults in the U.S. (coefficient: 0.241, P<0.001), while card-playing activities had a stronger positive effect on delayed memory among older adults in China (coefficient: 0.195, P<0.001). Additionally, internet use demonstrated a significant and consistent impact on delayed memory in both countries, confirming the role of digital technology in supporting cognitive health in older adults.

These findings align with the framework of Social Support Theory, emphasizing the importance of emotional and informational support. Card-playing activities provide emotional support by offering psychological comfort and opportunities for social interaction, while volunteer work offers informational support by challenging cognitive abilities and fostering information exchange, both of which contribute to the enhancement of delayed memory.

Benefits of Volunteer Work for Cognitive Health

Volunteer service activities have shown a significant positive impact on delayed memory among older adults in both China and the United States. From a cross-cultural perspective, research indicates that the participation rate in volunteer service among older adults in the United States is significantly higher than in China. This can be attributed to the predominant eldercare models in each country. In the United States, community-based care is more prevalent, providing numerous opportunities for older adults to engage in volunteer service and community activities (Leopold et al., 2022). This well-established community care system fosters a broader social support network, enhancing social capital and delayed memory through volunteer service (Siette et al., 2020). Conversely, in East Asia, and particularly in China, the eldercare model is primarily family-based, with older adults relying more on family members for support (Lu et al., 2020), leading to lower participation rates. By increasing community resources and creating volunteer opportunities for older adults in such regions, cognitive health could be greatly enhanced.

Previous research has confirmed the overall positive effects of social activities on cognitive abilities and brain volume (Kazantseva et al., 2020). However, our findings reveal that not all social activities have an equal impact on delayed memory. Among the activities that showed

significant effects in both databases, volunteer work had the highest coefficient in the HRS, with a value of 0.2419655 ($P < 0.05$), while in CHARLS, it also demonstrated a significant effect with a coefficient of 0.100396 ($P < 0.05$). Furthermore, previous studies have often downplayed the role of social activities in improving language-related cognitive functions, such as fluency and processing (Kelly et al., 2017). Our findings suggest that volunteer work may offer a new perspective on this issue. Unlike other social activities, volunteer work requires complex communication and extensive language use (Comas-Quinn, 2019), which may explain its stronger impact on delayed memory. By engaging in language-intensive tasks, older adults are not only socially active but are also regularly practicing and enhancing their verbal and cognitive processing skills. This heightened demand on language-related cognitive resources could be a key reason why volunteer work has a more profound effect on cognition compared to other types of social engagement.

In addition to its cognitive benefits, older adults participating in volunteer service often act as active social actors (Morrow-Howell et al., 2014), playing significant roles in their communities. In countries like China, where family-based eldercare is dominant, volunteer service provides a rare opportunity for older adults to engage in structured, purposeful social activities outside the family unit. As social actors, they take on responsibilities, contribute to society, and find purpose in their activities (Wilson & Musick, 1999). This sense of purpose and responsibility may further enhance their cognitive engagement, as reflected in the data from both HRS and CHARLS, where volunteer work was associated with improved delayed memory. The significant impact of volunteer service on delayed memory in older adults not only pertains to their cognitive health but also reflects their continued participation and contribution to society. For countries in East Asia, where aging populations are rapidly increasing, expanding opportunities for volunteerism among older adults could be a crucial strategy for promoting cognitive health and encouraging social participation beyond the family sphere.

Cognitive stimulation through playing card games

Data show that card games have a significant positive impact on delayed memory in older adults, with a coefficient of 0.1959067 ($P < 0.001$) in CHARLS and 0.1070676 ($P = 0.004$) in HRS.

Unlike other activities, card games often rely on social environments such as community gatherings or clubs, where participants engage in both social and cognitive stimulation. These activities not only improve delayed memory but also provide emotional support through group interactions. Our research further indicates that older adults in China participate in card games at a higher frequency, with 18.72% of older Chinese adults reporting playing at least once a month, compared to only 10.05% in the United States (see Table1). This stark contrast highlights the cultural and social significance of card games, particularly in East Asia.

In China, card games like mahjong holds cultural significance as a traditional recreational activity often associated with social gatherings and festivals. Mahjong, a culturally significant activity, provides not only cognitive stimulation but also essential social support, especially for older adults. The emphasis on collective harmony and unity in Chinese culture aligns well with the social nature of mahjong, which fosters social bonds across various groups (Greene, 2016). This cultural backdrop helps explain the high frequency of card game participation among older Chinese adults. In contrast, in the United States, mahjong was introduced as a leisure marketing strategy (Gulliver, 2022), and card games are seen more as leisure activities with cognitive benefits, including their protective role against dementia (Narme, 2016).

The historical and cultural differences between China and the United States offer insight into why card games are more popular in China. However, in both countries, card games provide important cognitive stimulation. These activities require participants to use memory, strategy, and attention, all of which contribute to improved delayed memory. Given the popularity of card games in East Asia, particularly in China, and their role in promoting both cognitive and emotional well-being, this activity could be leveraged as a low-cost and accessible intervention for enhancing cognitive health in aging populations, especially in developing regions.

Internet Usage and Social Engagement in Older Adults

The results of this study indicate that internet use has a significant positive impact on delayed memory in older adults in both China and the United States. The participation rate in internet use among older adults is 25.65% in the United States, compared to 10.81% in China (see Table 1).

Unlike volunteer and card-playing activities that heavily rely on community groups, internet activities are highly flexible and form a crucial part of social resources. They not only provide continuous cognitive challenges but also help older adults maintain cognitive vitality by fostering social interaction.

From Social Support Theory perspective, internet-based interactions offer emotional support and opportunities for social connections, which in turn build social capital, indirectly enhancing delayed memory. In East Asia, particularly in China, family-based social support remains dominant, and older adults often rely on family members for emotional and informational support. However, internet use provides a supplementary form of social engagement, allowing older adults to expand their social networks beyond traditional family structures, potentially compensating for the decreasing frequency of in-person interactions in an increasingly urbanized society.

The difference in internet usage rates reflects the disparity between China and the United States in terms of social resource provision and technology diffusion. The internet infrastructure in the United States is more developed, and older adults have a higher acceptance and usage rate of the internet. Furthermore, the higher education system in the United States places greater emphasis on technology and information acquisition, encouraging older adults to actively use the internet. In contrast, although the internet penetration rate in China has rapidly increased in recent years, technical barriers and low usage rates still exist among older adults, especially in remote areas.

These findings highlight the universal benefits of internet use for enhancing delayed memory among older adults, while also illustrating the challenges faced in different cultural and infrastructural contexts. This provides crucial contextual support for developing global cognitive intervention strategies for older adults, particularly in regions where traditional social structures are being transformed by modernization and technology.

Cultural perspectives on the role of social support in maintaining cognitive function

Social support significantly improves cognitive health and mitigates cognitive decline in older adults (Wang et al., 2022). Our findings demonstrate that social participation, particularly through activities such as volunteering and community engagement, provides essential emotional and cognitive support to older adults, helping delayed memory decline. These activities not only offer emotional support through social interactions but also foster cognitive engagement, which is vital for maintaining cognitive function as individuals age.

Aging is a personalized and complex process (Dziechciaz et al., 2014), and the intervention of social support on cognitive aging varies across different social contexts. In East Asia, particularly in China, family-based social support remains the predominant form of emotional and practical assistance for older adults. Traditional filial piety, which emphasizes children's responsibility to care for their parents, continues to be a key element in the social support network of older Chinese adults. Family members' daily assistance with tasks and health management, as well as regular family gatherings and interactions with neighbors, form the main components of social participation for many older Chinese adults. In contrast, the United States has a highly developed community-based eldercare system, providing numerous participation opportunities for older adults. The community support system in the U.S. plays a vital role in the social support network of older adults, offering diverse social activities and volunteer opportunities that promote social participation and provide substantial cognitive stimulation.

To effectively enhance social support for older adults across different cultural contexts, it is crucial to integrate the strengths of both familial and community support systems. In China, there should be a stronger emphasis on developing community-based programs that complement traditional family support, while in the U.S., fostering stronger intergenerational connections within families can provide additional emotional support. By combining these approaches, a more comprehensive social support environment can be created, promoting cognitive health and facilitating active aging.

6.3 Mediation Analysis of the Impact of Educational Level and Social Activities on Delayed Memory

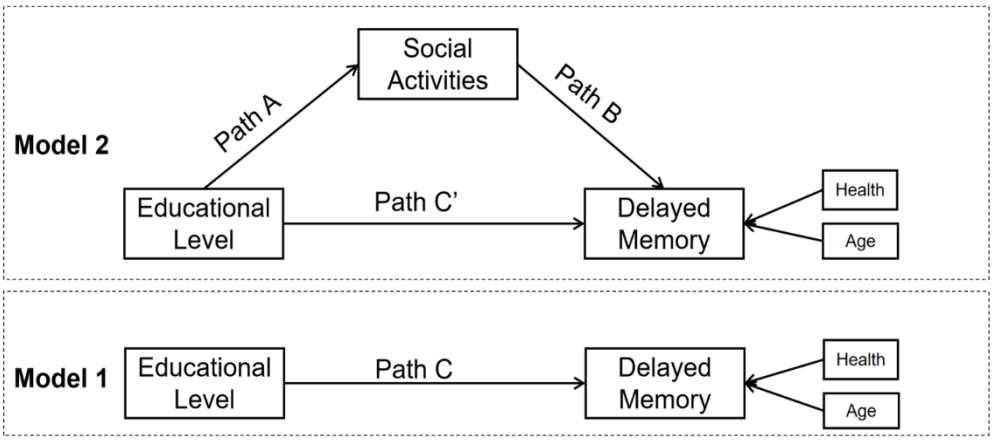


Fig. 25 Mediation Analysis of the Impact of Educational Level and Social Activities on Delayed Memory **(Source: Authors own work)**

This study examines the relationships between variables using two models (Fig. 24). Model 1 shows a direct pathway (Path C) from educational level to delayed memory, with health and age as control variables. Model 2 introduces social activities as a mediating variable, where educational level influences social activities (Path A), which in turn affects delayed memory (Path B). The direct effect of educational level on delayed memory in Model 2 is represented by Path C'. Both models account for health and age in their analysis.

The study results, as shown in Table 23 indicate that age, educational level, household location, and health status significantly impact delayed memory. Participants with lower delayed memory scores were older on average and had fewer years of education. In both urban and rural areas, individuals with higher delayed memory scores had significantly higher average scores compared to those with lower scores. Gender and health status also showed significant effects, with both male and female participants having higher delayed memory scores if they had higher overall scores. Notably, participants in good health had significantly higher delayed memory scores compared to those in poorer health. These descriptive statistical analysis results provide a detailed understanding of the basic characteristics of the study sample. The data indicate that age, education level, household location, gender, and health status exhibit significant differences

across different delayed memory score groups. The distribution of these variables provides background information for subsequent inferential analyses and helps in understanding the performance differences in delayed memory among different groups.

The results of the study indicate significant relationships between each path's variables. The direct effect of educational level on delayed memory is 0.8604, with a significance level of 0.000 ($\beta=0.8604, p<0.001$), demonstrating that higher educational levels significantly enhance delayed memory. This direct effect can be explained by the Neural Resource Enrichment Theory, which suggests that higher educational attainment enriches neural resources, providing a stronger cognitive reserve that benefits memory function (delayed memory).

The indirect effect of educational level on delayed memory through social activities is 0.1192 ($\beta=0.1192$), indicating that social activities play a significant mediating role between educational level and delayed memory. This is consistent with the Cognitive Social Capital Theory, which emphasizes the importance of social networks and participation in enhancing cognitive function. Higher educational levels may promote greater social engagement, which in turn enriches neural resources and enhances delayed memory.

The total effect of educational level on delayed memory is 0.9631 ($\beta=0.9631$), which includes both direct and indirect effects. This highlights the dual pathway through which education improves cognitive health: directly by enhancing neural resources and indirectly by fostering social engagement that further enriches neural resources.

Consequently, elderly individuals with higher educational levels not only have better delayed memory but are also more inclined to engage in social activities. Active participation in social activities further enhances their delayed memory. These findings suggest that higher educational levels improve delayed memory directly and indirectly by promoting social activity engagement. Therefore, improving educational level and encouraging social activities are crucial for enhancing cognitive health in the elderly.

Table 13. the Results of the Impact of Educational Level and Social Activities on Delayed Memory

Variable	Coefficient	Std. err.	t	P>|t|	95% conf. interval lower	95% conf. interval upper
MODEL 1(Path C)						
educational level	0.9630646	0.063327 3	15.21	P< .oo1	0.8389016	1.087228
health	-0.2673761	0.035895	-7.45	P< .oo1	-0.3377539	-0.1969983
age	-0.0513468	0.003972 3	-12.93	P< .oo1	-0.0591351	-0.0435586
_cons	6.571344	0.309364 1	21.24	P< .oo1	5.964787	7.1779
Dependent Variable: delayed memory; R-squared: 0.4272; Adj R-squared: 0.4265; Prob > F: 0.0000; Root MSE: 0.4209						
MODEL 2 （Path A)						
educational level	0.1568584	0.012474 9	12.57	P< .oo1	0.1324038	0.181313
_cons	0.2869224	0.014220 7	20.18	P< .oo1	0.2590453	0.3147994
Dependent Variable: social activities; R-squared: 0.2226; Adj R-squared: 0.2224; Prob > F: 0.0000; Root MSE: 0.33752						
MODEL 2 （Path B)						
social activities	0.9009038	0.062277 5	14.47	P< .oo1	0.7788113	1.022996
_cons	2.720202	0.037078 6	73.36	P< .oo1	2.647511	2.792893
Dependent Variable: delayed memory; R-squared: 0.2417; Adj R-squared: 0.2415; Prob > F: 0.0000; Root MSE: 0.4927						

MODEL 2 （Path C')

educational level	0.8604428	0.063248 9	13.6	P< .oo1	0.7364335	0.9844522
social activities	0.7062094	0.070154 9	10.07	P< .oo1	0.5686597	0.843759
health	-0.2446953	0.035453 5	-6.9	P< .oo1	-0.3142075	-0.1751831
age	-0.051726	0.003915 6	-13.21	P< .oo1	-0.0594032	-0.0440487
_cons	6.285967	0.306256 3	20.53	P< .oo1	5.685504	6.88643

Dependent Variable: delayed memory; R-squared: 0.2523; Adj R-squared: 0.2513; Prob > F: 0.0000; Root MSE: 0.4006

The elderly educational interventions

The research results indicate that increasing educational levels has a significant positive impact on delayed memory. Therefore, policymakers may prioritize educational interventions for the elderly, such as providing lifelong learning opportunities and adult education programs. In the CHARLS database, the participation rate of the elderly in educational activities is very low (less than 1%), indicating that future elderly education strategies need to vigorously promote and support educational activities for the elderly. Specific measures can include increasing the number of educational programs for the elderly, lowering the barriers to participation in education, and offering a diverse range of courses tailored to the needs and interests of the elderly. These initiatives can effectively enhance the educational levels of the elderly, thereby strengthening their cognitive reserve and improving delayed memory and overall cognitive health.

Cognitive Enhancement Framework in the Context of Social Gerontology

In the context of social gerontology, this study presents a framework (Fig.25) that reveals the complex relationships between educational level, social activities, and delayed memory, and explores how these factors contribute to active aging by enhancing neural resources and social capital. The findings indicate that higher educational levels directly enrich neural resources and promote brain plasticity, thereby enhancing delayed memory. Additionally, higher educational levels indirectly improve delayed memory by promoting social activities. Social activities are categorized as social actor and social engagement within this framework. Ultimately, these mechanisms work together to slow down brain deterioration and cognitive decline, promoting active aging in the elderly. Therefore, increasing educational levels and encouraging active participation in social activities are crucial for improving cognitive health in the elderly.

The results from Study 3 highlight the significant role of social factors in shaping the well-being and health of older adults. Drawing on data from the CHARLS and HRS datasets, the study reveals that educational level, social participation, health status, gender, and household location are key determinants of older adults' well-being. These social factors

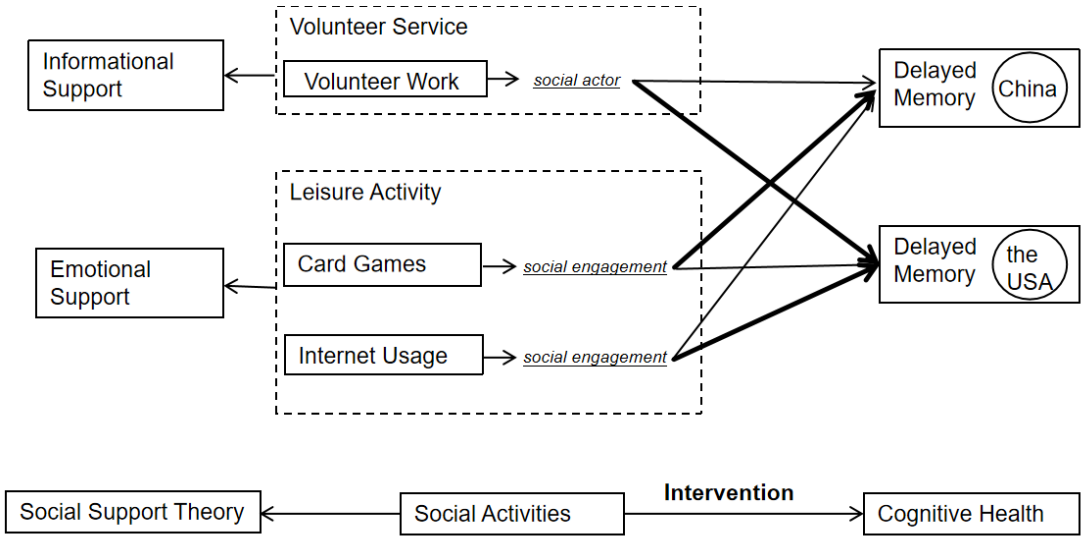


Fig 26 Theoretical Framework: to create social support environment in cultural context

(Source: Authors own work)

operate both directly and indirectly, with education playing a particularly influential role. Higher educational attainment directly enhances health outcomes by fostering cognitive resilience and indirectly promotes social engagement, which further contributes to overall well-being. This

dual-pathway effect reflects the principles of the Neural Resource Enrichment Theory and the Cognitive Social Capital Theory, emphasizing how cognitive resources and social capital collectively support the health and well-being of older adults.

The analysis identifies specific social participation activities—volunteer work, card games, and internet usage—as essential contributors to older adults' well-being. These activities not only promote cognitive engagement but also provide emotional and social support. The findings reveal cross-cultural differences in participation, with volunteer work being more prominent among older adults in the United States, while card game activities play a central role in China. Internet usage, however, demonstrates a universal positive impact on well-being, offering older adults a means of maintaining social connections and accessing information, particularly in regions where traditional support systems are evolving.

The mediating role of social activities is particularly noteworthy. Educational attainment is shown to indirectly promote older adults' well-being by encouraging greater participation in social activities, which, in turn, reinforces emotional, cognitive, and social health. This dual influence suggests that interventions aimed at increasing educational access for older adults could have a cascading positive effect on social engagement, cognitive health, and overall well-being. Furthermore, demographic factors such as age, gender, and health status shape the extent and type of social participation. Older age, poorer health, and lower educational attainment are associated with reduced participation in socially enriching activities, underscoring the need for targeted policies and support programs for vulnerable older populations.

6.4 Pathways of Service Innovation in Tourism on Delayed Memory and Brand Loyalty

Our study shows that social activity not only directly affects delayed memory but also plays a mediating role between educational level and delayed memory. Therefore, increasing opportunities for social engagement in older adult services is essential for enhancing cognitive function. Traditional services for older adults often emphasize care facilities and physical well-being. However, by improving services to include more opportunities for social participation—

such as volunteer work and community involvement—social capital can be effectively enriched. According to Cognitive Social Capital Theory, this increase in social capital not only strengthens social connections among older adults but also promotes mental health and cognitive functions.

Volunteer activities play a significant role in enhancing social participation among older adults. Through volunteering, older adults can build mutual support relationships, which foster a sense of accomplishment and belonging. This interaction not only expands their social support network but also strengthens cognitive abilities through positive social engagement. Volunteering promotes cooperation and enhances a sense of social responsibility and identity. Similarly, community involvement helps older adults connect with a broader social group, further expanding their social networks. By participating in community activities, they engage in social interactions, receive new cognitive stimulation, and stay mentally active, which supports cognitive health.

Therefore, increasing social participation opportunities through innovative service models in older adult care can help strengthen social capital and enhance cognitive health. Since cognitive function and memory retention are closely linked to overall well-being, service providers that foster these elements contribute positively to older adults' quality of life and well-being.
The data shows that educational level has a direct positive impact on delayed memory. Therefore, it is essential to enhance educational opportunities for older adults across various service sectors. Traditional service models can be adapted by integrating cultural and technological elements to provide rich, cognitively stimulating experiences. For instance, offering access to knowledge in areas such as history, art, and culture can engage older adults in learning activities, which provide cognitive stimulation and can improve memory retention. Additionally, using modern technology—such as smart guidance systems, online learning platforms, and virtual reality experiences—enables older adults to access information and participate in educational activities with ease. These technologies can offer personalized cognitive engagement, providing more opportunities for learning and social participation. Through these enriched service models, older adults are encouraged to remain mentally active, which helps to develop and sustain their cognitive abilities over time. The service model is represented in Fig. 26.

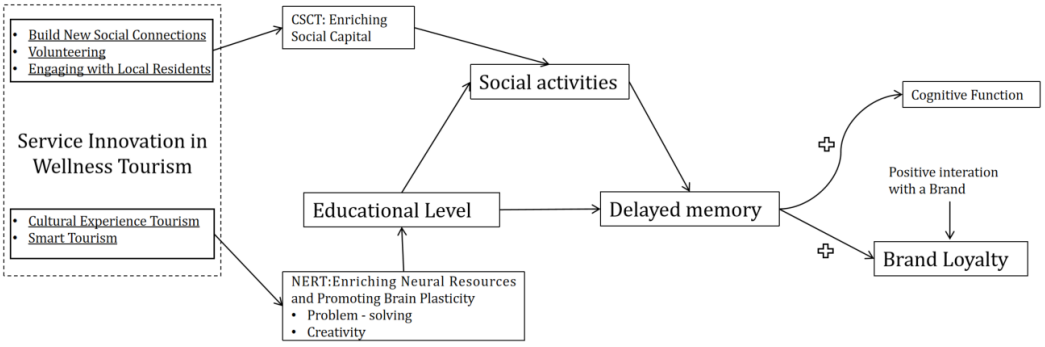


Fig. 27 service innovation on delayed memory and brand loyalty **(Source: Authors own work)**

These findings set the stage for a more comprehensive theoretical framework on the well-being of older adults in tourism. The next chapter will build on these insights from study 1, 2 and 3 to explore how technological, emotional, and social dimensions intersect to promote well-being in tourism contexts. Chapter 7 will integrate the key findings from Studies 1, 2, and 3 to propose a multi-dimensional model of older adults' well-being. This chapter will examine how mobile technologies (7.1), emotional engagement (7.2), and cultural perspectives on social support (7.3) interact to influence well-being. Finally, it will propose an integrated theoretical model (7.4) that synthesizes these pathways, offering a holistic perspective on the role of social factors, technological support, and emotional engagement in enhancing older adults' well-being during tourism activities.

Chapter 7

Discussion and Development of an Integrated Theoretical Model

7.1 Insights from Study 1: The Influence of Mobile Technologies on Older Adults' Well-being in Tourism

The integration of mobile technologies (MTs) into tourism for older adults has brought significant changes to their travel experiences, social participation, and overall well-being. This study highlights the multifaceted impacts of MTs on older adults, ranging from enhancing travel enjoyment and promoting social sharing to fostering intergenerational relationships and encouraging sustainable travel behavior. By examining how MTs influence the actions and perceptions of older travelers, the study provides insights into the complex role technology plays in the tourism experience for older adults.

The key findings of this study reveal that MTs serve as a catalyst for social interaction, family bonding, and lifelong learning, thereby supporting the mental health and well-being of older tourists. For many older adults, sharing travel experiences on social media platforms, such as WeChat Moments, offers emotional satisfaction and a sense of social participation, which helps to reduce loneliness. Simultaneously, the study underscores the impact of MTs on the concept of "traveling under social influence," where older adults are driven by the desire to replicate the popular travel experiences showcased online, sometimes at the expense of their personal enjoyment.

The role of MTs in enhancing the sense of responsibility among older adults is another critical finding. Older tourists, particularly those traveling with grandchildren, engage in "family care" tourism models, such as the "two seniors and one child" model, where MTs are used as practical

tools to ensure the safety and well-being of younger family members. This reflects the traditional family-centric values embedded in Chinese culture, wherein older adults often adopt dual roles as both caregivers and care recipients. By relying on MTs to track weather, book accommodations, and plan itineraries, older travelers play a proactive role in ensuring safety and comfort for themselves and their family members.

The study also highlights the minimal motivation of older adults to engage in post-travel reviews and ratings of services unless incentivized. This reluctance is rooted in traditional Confucian cultural values of modesty and restraint. However, social platforms like WeChat Moments promote interaction and engagement, thereby encouraging older adults to share their travel experiences with friends and family. The implications for service providers are clear—travel services targeting older adults should incorporate more interactive and socially stimulating elements to boost participation and post-travel engagement.

MTs are further found to support older adults' continuous learning and environmental consciousness during tourism. The historical context of limited environmental education for older generations in China is gradually being addressed through interactive mobile travel applications that promote sustainable practices. By using MTs, older travelers gain access to information about conservation initiatives and sustainable tourism practices, encouraging them to adopt environmentally responsible behaviors. This shift reflects the alignment of traditional Chinese values, such as frugality, with the principles of sustainability, ultimately contributing to active aging and lifelong learning for older adults.

Lastly, the study emphasizes the transformative impact of MTs on intergenerational relationships within tourism. Through the use of mobile applications, older adults maintain consistent communication with family members, enhancing both the travel experience and familial bonds. Interactions with children and grandchildren during travel underscore the importance of filial piety, a deeply rooted cultural value in Chinese society. MTs enable older adults to both provide and receive care during family trips, thus reinforcing intergenerational connections and contributing to older adults' overall well-being. The alternating roles of caregivers and care recipients highlight the cultural dynamic of elder care in Chinese society, where children are

expected to support their parents' needs, even as those parents actively engage in family responsibilities.

The study's structural model illustrates how MTs' influence on older adults' tourism experiences aligns with the objectives of Sustainable Development Goal (SDG) 3.4, which focuses on reducing non-communicable diseases and promoting mental well-being. The model identifies five key pathways through which MTs impact older adults' well-being:

MTs' Impact on Social Engagement: From Tourism Participation to Emotional Well-Being

The impact of social media extends beyond the travel period, as it helps sustain social engagement and motivates future travel. Discovering popular tourist spots through online platforms, such as "Internet celebrity check-in locations," was frequently mentioned as a key driver of curiosity and travel planning. One participant (M3) shared, "Seeing my friends' posts about famous places makes me want to visit them too." This reflects Totsune et al.'s (2021) observation that curiosity is a vital motivator for travel decisions and a contributor to emotional well-being. While older adults show enthusiasm for sharing trip highlights on WeChat Moments, they do so primarily to connect with peers and relive their journeys. However, they are far less active in writing online service reviews. Several participants admitted they only consider providing feedback if incentivized, suggesting a gap between personal enjoyment and the perceived value of formal evaluations. This contrast underscores both utilitarian and hedonic motivations: older adults derive intrinsic satisfaction from social sharing, yet they do not view official service feedback as equally beneficial unless tangible rewards are offered.

Such distinctions expand our understanding of how MTs meet both functional and hedonic needs, making them essential for promoting active aging and emotional well-being through tourism. Older adults take advantage of social media to sustain social bonds and discover new travel opportunities yet remain selective in-service evaluations. This perspective suggests that designing MT features aligned with both enjoyment and perceived benefit may further enhance older adults' long-term engagement in travel-related activities.

MTs' impact on enhancing the elderly's sense of responsibility: from self-care to family care

This study identified MTs' role in enhancing elderly tourists' sense of responsibility, particularly in terms of safety awareness. MTs comprise an effective tool that helps the elderly prevent and manage the risks encountered during travel. In our review of the literature, we noted that some elderly Chinese people have limited travel opportunities owing to family responsibilities, such as caring for grandchildren. However, our study indicates that as grandchildren grow older and become more self-sufficient, the elderly become inclined to travel with them, creating the new travel model of "two seniors and one child."

"My husband and I often take our granddaughter out; she is five years old and will start elementary school next year. We really enjoy traveling with her." (F1)

In this model, although the elderly continue to use MTs, they rely more on practical tools, such as weather forecasts and positioning systems, than on photography and social functions to ensure the safety and comfort in their journey.

"When taking children out, safety comes first. I always use my phone to check the local weather in advance, book hotels, and choose less exhausting itineraries." (M1)

This finding supports MTs' importance in supporting interactions between older adults and younger individuals, and highlights technology' adaptability in meeting the needs of different age groups. This shift from personal enjoyment to caring for descendants not only reflects the traditional Chinese values centered on family responsibilities (which are child-centric) but also demonstrates MTs' role in promoting intergenerational integration and enhancing familial bonding experiences. This study provides a new perspective on how MTs can support older adults' mental health and well-being. By actively participating in their grandchildren's travel experiences through MTs, elderly individuals expand their role and status within the family and find fulfillment and social recognition.

MTs' impact on post-travel assessment: incentives and internal motives for the elderly

Our survey indicated that elderly people do not actively rate or review travel services unless there is some type of reward. This can be explained from two perspectives. First, influenced by traditional Chinese culture, Confucian thought emphasizes subtlety and restraint, encouraging individuals to conceal their opinions. Second, according to U&R theory, individuals' choices to use specific media are driven by their expectations to meet certain needs (Levy & Windahl, 1985). Elderly people lack motivation to comment without clear incentives, thus reflecting their minimal social interaction and a lack of social stimulation. In contrast, social platforms such as WeChat Moments significantly increase social activity and engagement among the elderly, owing to their interactivity. Therefore, when designing travel services, it is important to consider introducing elements that can promote interaction among older adults, such as organizing social events and offering more interactive services targeted at them. This not only increases their participation, but also their overall well-being.

MTs' impact on post-travel experiences: a medium for elderly individuals' continued learning

This study examined how MTs enhance elderly people's awareness of environmental conservation and sustainable practices. Despite the historical lack of environmental education among the elderly in China—due to limited information access during their formative years—MTs have transformative potential in this regard. Today, through interactive travel applications that educate elderly travelers about local conservation policies and practices experienced during their travels, they are increasingly embracing environmental responsibilities. This shift is crucial, as traditional Chinese culture values such as frugality—which emphasizes making full use of resources and practicing thrift to manage household affairs, reflecting the cultural characteristics of China—align well with modern sustainable practices, even if originally not environmentally motivated.

MTs not only bridge the gap between traditional practices and contemporary environmental needs but also support the "live and learn" value—a cherished value in Chinese culture that significantly promotes active aging (Gao et al., 2023). Looking to the future, the service industry can further reinforce this connection by developing wellness tourism products that address the health needs of the elderly (Heung & Kucukusta, 2012), simultaneously raising environmental

awareness. Additionally, incorporating volunteer opportunities into ecotourism (Shirahada & Wilson, 2015) can improve social engagement and well-being among elderly travelers. To fully harness MTs' potential to promote environmental awareness among older adults, we propose the development of tailored mobile applications for continuous learning. Such applications could help the elderly stay connected with society and up-to-date on environmental issues, thus ensuring their active participation in sustainable development.

MTs' Impact on Inter-generational Relationships: Balancing Care-giving Roles, Filial Obligations and Subjective Well-Being

This study identifies a novel travel arrangement known as the "two seniors and one child" model, which allows grandparents to travel with a grandchild who is gaining independence. This finding contrasts with the traditional assumption that caregiving entirely restricts older adults' mobility (Albanese & Bocci, 2019; Wang et al., 2023). Quantitative analysis indicates that caring for grandchildren does not negatively affect tourism participation ($\beta = 0.0339$, $p < 0.001$), providing a foundation for this novel discovery. Such participation contributes to their overall subjective well-being, as they find a meaningful balance between personal leisure and care-giving responsibilities.

Besides, MTs not only enhance travel safety but also improve communication between elderly parents and their children. One participant mentioned: *"My daughter and I give each other likes for how many steps we walk and are registered on the app, and she always encourages me to walk more. This is one of our ways of sharing our lives."* (M5) This connection brings them a greater sense of safety and emotional fulfillment while helping them share insights and experiences with family members. Filial piety, a core element of Chinese family values, further shapes these digital interactions (Wang et al., 2023), since adult children often actively ensure their parents' well-being through technology. In this way, older adults feel their efforts in remaining active and healthy are acknowledged, reinforcing their subjective well-being through continuous family support and digital connection.

Additionally, we found that older adults alternated between the roles of caregivers and care recipients. In three-generation family travel, which includes younger adults, they often become

those who are looked after. *"During the Spring Festival, I went to see the ice lanterns in Harbin with my children and they arranged everything. My son often said, 'Dad, do not worry about it. I have booked everything online already'."* (M6) This pattern reflects cultural norms that children will care for aging parents, unlike societies that emphasize greater independence for the elderly (Kaplan & Bentwich, 2023). In China, older adults often seek happiness through their children's care, an important indicator of well-being (Shen & Yeatts, 2013). MT use reinforces this intergenerational bond by enabling children to care for their parents more effectively, while also offering older travelers' emotional satisfaction through their children's involvement.

Structural model

Figure 27 illustrates how MTs' impact on elderly Chinese tourism contributes to SDG 3.4. In this study, the deployment of MTs in elderly tourism exhibited a strong correlation with SDG 3.4. We identified two distinct aspects of this impact: direct contributions and lasting benefits that extend to seniors' daily lives. The five direct contributions are:

(1) MTs enhance the travel capabilities and social engagement of older adults, diminish feelings of isolation, and underpin their mental health;

(2) they provide elderly travelers with health management tools during their journeys, ensuring continued medication adherence and access to emergency services, thus aligning with the objective of mitigating premature mortality from noncommunicable diseases;

(3) technology enhances seniors' travel experiences by providing immersive cultural and educational encounters. This leads to cognitive stimulation and emotional satisfaction, thus enhancing overall quality of life and mental well-being;

(4) elderly tourists' environmental and safety consciousness is positively influenced by MTs, fostering eco-friendly behaviors and aligning with global sustainable tourism initiatives;

(5) MTs facilitate active engagement with local traditions and community interactions, fostering deeper satisfaction and connectivity, thereby enhancing mental health and well-being.

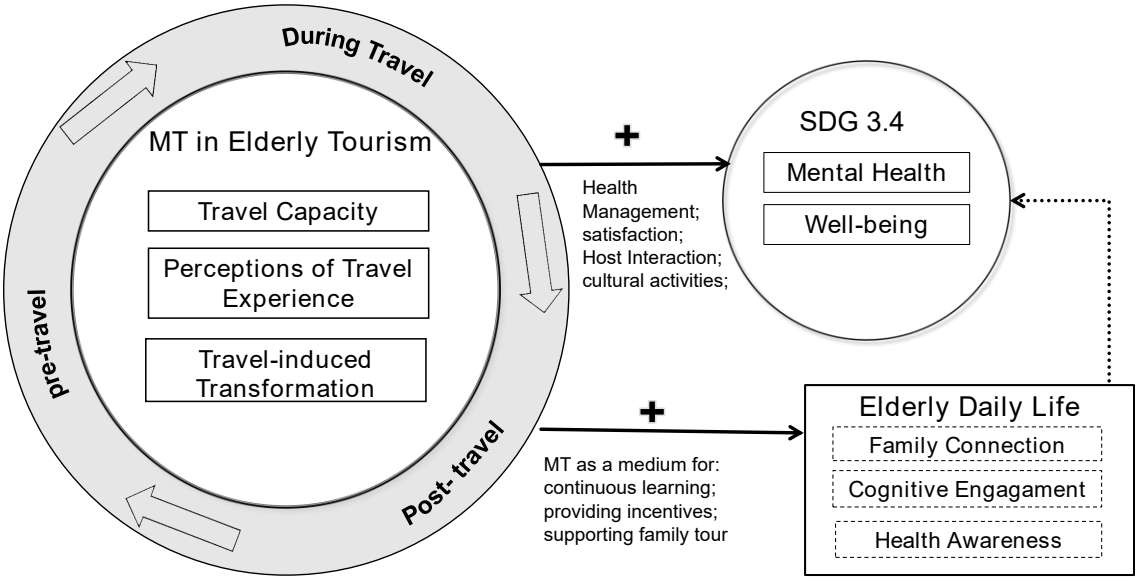


Fig.28 A model of MTs' impact on Chinese elderly tourism **(Source: Authors own work)**

7.2 Insights from Study 2: The Dominant Role of Emotional Engagement in Enhancing Older Adults' Tourism Experiences and Well-being

The results of this study support all the proposed hypotheses, confirming the significant role of tourism engagement in influencing both brand loyalty and well-being among elderly tourists. H5 and H6 demonstrate that deep engagement, specifically emotional engagement, have a stronger impact on both brand loyalty and well-being compared to surface engagement. This finding suggests that emotional engagement plays a critical role in fostering a deeper sense of loyalty and enhancing overall well-being, highlighting the importance of emotional involvement in tourism activities. This layered analysis provides new insights into the differential effects of engagement, an area that has not been fully explored in previous studies, especially within the context of elderly wellness tourism.

Additionally, the findings support H7, highlighting the significant influence of behavioral engagement on cognitive and emotional engagement. This indicates that active participation in tourism activities facilitates deeper emotional and cognitive connections with the experience. Likewise, the results confirm H8, demonstrating the positive relationship between action loyalty and social loyalty, further emphasizing the importance of sustained surface behaviors in building social connections and loyalty within the elderly tourism context.

By applying the SOR model, we highlight how surface level stimuli, specifically behavioral engagement, action loyalty, and hedonic pleasure, are processed through internal states (emotional engagement), ultimately influencing deeper outcomes, namely eudaimonic well-being and social loyalty. It provides a more comprehensive understanding of how different levels of engagement influence elderly tourists' loyalty and well-being in wellness tourism, areas that have been overlooked in prior research. There are five parts to discuss in the following:

The Role of Engagement Levels in Shaping Brand Loyalty and Well-Being in Wellness Tourism

Our findings reveal that engagement in elderly wellness tourism significantly enhances both brand loyalty and well-being, whether through surface-level behavioral engagement or deeper emotional and cognitive engagement. Notably, deep emotional and cognitive engagement exerts a greater influence on both brand loyalty and well-being than surface engagement, which is tested in H1 and H2. Previous research has shown that interaction with brands, through co-creation of tourism experience, strengthens brand loyalty. In our study, focusing on elderly wellness tourism, we further explore different types of engagement and find that emotional involvement has a particularly strong impact on brand loyalty and well-being. This can be attributed to the value co-creation mechanism in elderly wellness tourism, where value co-creation emphasizes the active involvement of both companies and customers in creating value. Unlike traditional models, where customers passively receive value, in value co-creation, they are contributors to value creation (Vargo & Lusch, 2004).

In our study, through emotional connections and active cognitive involvement, elderly tourists are not merely passive recipients of services but co-creators of the brand experience. This deeper engagement allows them to find personal meaning in their tourism experiences, enhancing emotional attachment and brand loyalty. Furthermore, the uniqueness of elderly wellness tourism lies in its community-based environment, where emotional support and social connections among tourists play a crucial role in enhancing well-being (Kang & Gretzel, 2012). The interaction between elderly tourists in wellness activities, such as spa retreats, strengthens their social support networks, while emotional exchanges foster a sense of belonging and psychological well-being. Through these deep emotional and cognitive engagements, elderly tourists not only strengthen their loyalty to the brand but also enhance their eudaimonic well-being by co-creating meaningful health experiences with the brand.

The Dominant Role of Emotional Engagement in Older Adults Wellness Tourism

In our analysis of the factors influencing eudaimonic well-being (EP), deep engagement by tourists had a substantial effect on EP ($\beta = 0.808$, $p < 0.001$), underscoring its dominant role in enhancing tourists' eudaimonic well-being. H1 and H2 further confirmed that deep engagement exerts a stronger influence on brand loyalty compared to surface-level engagement. Additionally, emotional engagement (EE) mediates the relationship between BE and EP. BE significantly influences EE ($\beta = 0.683$, $p < 0.001$), which directly impacts EP ($\beta = 0.808$, $p < 0.001$). Moreover, EE also bridges the relationship between BE and SL (indirect effect via EE: $\beta = 0.611$, $p < 0.01$), linking surface-level engagement with deeper dimensions of well-being and loyalty outcomes.

Whether considering the internal comparison of engagement's effects on well-being and loyalty, or the cross-factor comparison between brand loyalty, well-being, and engagement, it is evident that deep engagement holds a prominent position throughout wellness tourism. Emotional engagement not only directly influences EP but also serves as a bridge that connects surface-level engagement with deeper dimensions of well-being and brand loyalty. These findings suggest that future wellness tourism services should prioritize fostering deep engagement to effectively enhance tourists' long-term well-being and encourage positive word-of-mouth. By

cultivating meaningful emotional and cognitive connections, such services not only benefit individual travelers but also contribute to the sustainable growth and competitive differentiation of the wellness tourism industry.

Applying the SOR Framework to Explain Deep Engagement in Wellness Tourism

This study employs the SOR (Stimulus-Organism-Response) framework to explain the mechanisms through which external stimuli are processed via internal psychological states to produce meaningful outcomes in the context of wellness tourism. External stimuli, including behavioral engagement, action loyalty, and hedonic pleasure, serve as surface-level triggers that initiate the engagement process. These external factors are mediated by internal states which represent the organism stage of the framework. These internal states transform surface level behaviors into deeper outcomes emphasizing the importance of emotional engagement as a key bridge between surface-level behaviors and long-term well-being.

What distinguishes this study is its focus on the different level of engagement in wellness tourism, integrating surface-level and deep-level dimensions into the SOR framework. Unlike traditional applications of SOR in marketing and digital environments, this research highlights the specific pathways through which surface-level behaviors interact with deep-level psychological states to produce sustained well-being and brand loyalty. These findings reveal that emotional engagement acts not only as a bridge between external stimuli and deeper outcomes but also as a central mechanism for transforming transient, surface-level experiences into long-term satisfaction and loyalty. This novel application of the SOR framework expands its relevance by incorporating the unique needs of older adults in wellness tourism, where long-term well-being and meaningful engagement are paramount.

Service Design for Transforming Surface Engagement into Deep Engagement

We tested the impact of surface level factors on deep level of brand loyalty, engagement, and well-being (H3 and H4). These findings highlight the importance of adopting a multi-dimensional service design approach in wellness tourism, which gradually transitions older

tourists from surface-level behaviors to deeper emotional and social connections, ultimately enhancing their long-term well-being and brand loyalty.

Designing additional social activities specifically tailored to older adults, building upon foundational wellness services like hot spring therapy and yoga sessions, has become crucial for enhancing the quality and effectiveness of wellness tourism. Establishing social spaces like chat rooms, game rooms, and other communal facilities in hot spring resorts enables older adults to naturally transition from behavioral engagement to social interaction, thereby increasing opportunities for deeper involvement. As the wellness tourism industry continues to evolve, incorporating multi-dimensional service designs that blend social interaction will become an innovative approach to enhancing the overall experience of elderly tourists. By blending physical recovery, social interaction, and emotional engagement, multi-dimensional service design provides a transformative framework for improving the overall wellness tourism experience for older adults. The service can not only benefit their physical recovery but also improve their mental health through social support, thereby achieving a dual improvement in well-being and brand loyalty.

The Impact of Emotional Engagement on Eudaimonic Well-Being: A Regenerative Perspective on Wellness Tourism

H1 confirms that wellness tourism serves as long-term well-being development, while H2 and H3 align with transformative experience theory (Mezirow, 1991), suggesting that deeper emotional engagement leads to lasting psychological and behavioral change. While traditional wellness tourism primarily focuses on short-term relaxation and physical rejuvenation, emerging perspectives suggest that integrating regenerative principles can enhance its long-term impact on well-being. Originally developed in sustainable tourism, regenerative tourism extends beyond the concept of sustainability by emphasizing active participation in the renewal and enhancement of both personal and social well-being (Hes & Du Plessis, 2015). This concept, when applied to wellness tourism, suggests that travel experiences should not only restore well-being but also contribute to ongoing psychological and social transformation.

Tourists develop a deeper sense of meaning in their experiences, often reflecting on personal values and aspirations. Social connections are strengthened through shared wellness activities, cultural immersion, and intergenerational interactions, which help older travelers reduce loneliness and maintain emotional well-being. Additionally, travelers who engage deeply in wellness experiences are more likely to adopt health-conscious behaviors beyond their trips, integrating wellness practices into their everyday lives rather than viewing them as isolated events. By shifting from temporary recovery to long-term regeneration, wellness tourism has the potential to create deep and lasting psychological benefits. However, for this transformation to occur, the tourism environment must be carefully designed to support deep emotional engagement.

Emotion-Friendly Environments (EFE) as a Driver of Deep Engagement

In this study, we verified emotional engagement's key role in edumonic well-being in wellness tourism. Based on this, we propose "Emotion-Friendly Environments" (EFE) EFE aims to enhance emotional engage ment, EFE supports deeper engagement and long-term satisfaction. Emotional engagement is essential in shaping well-being and brand attachment, yet traditional wellness tourism often focuses primarily on physical health interventions, neglecting the emotional dimension (Jiang & Tu, 2022). EFE-based service models address this gap by incorporating personalized wellness services that integrate emotional responsiveness, ensuring that service providers offer not only medical expertise but also empathetic interactions (Mogaji et al., 2022). Additionally, creating psychologically safe environments allows tourists to feel comfortable expressing their needs and preferences, reducing stress and enhancing their overall experience. By implementing real-time feedback loops, wellness services can enable tourists to engage dynamically with their experiences, fostering a sense of autonomy and participation.

Social connection further enhances emotional well-being in wellness tourism, as structured engagement opportunities encourage tourists to build meaningful relationships rather than relying on random social encounters (Lin et al., 2019). Emotionally supportive spaces such as community lounges, wellness circles, and interactive group therapy sessions provide inclusive environments where tourists can share experiences and support one another (Lehto & Lehto,

2019). Scenario-based social interaction design, including cultural storytelling, group meditation, and peer wellness mentoring, further strengthens social bonds and emotional support (McCabe et al., 2012). In addition, technology-assisted engagement allows older tourists with mobility constraints to participate in virtual wellness communities, extending the benefits of wellness tourism beyond the physical travel experience (Ponsignon & Derbais, 2020; Kohtala et al., 2020). Interactive virtual spaces and digital platforms facilitate continuous engagement, ensuring that wellness tourism fosters long-term well-being even after the trip has ended.

By embedding EFE principles into wellness tourism, tourists experience greater emotional engagement, stronger social bonds, and increased long-term satisfaction. Rather than viewing wellness tourism as a temporary retreat, EFE supports a continuous transformation in well-being by providing emotionally supportive environments where tourists feel safe, valued, and connected. The encouragement of active social participation reduces feelings of isolation and fosters meaningful relationships, while sustained engagement beyond the travel experience allows tourists to integrate wellness practices into their daily lives. Prioritizing EFE in service design ensures that wellness tourism moves beyond conventional health interventions, creating deep emotional experiences that contribute to lasting improvements in well-being (Rasul, 2021).

The integrated framework

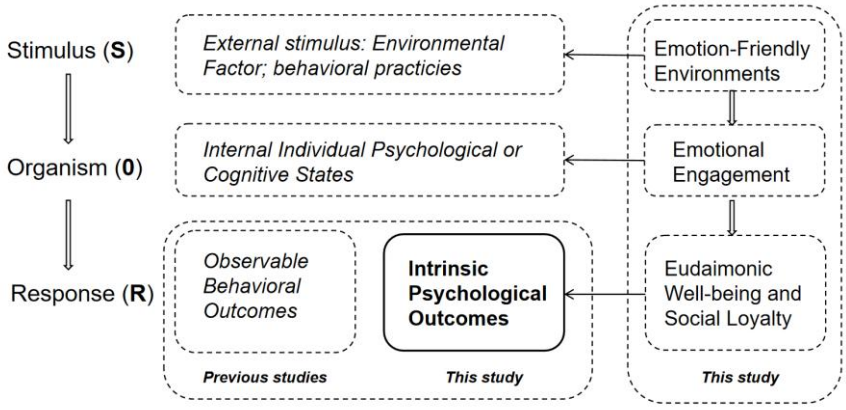


Fig. 29 Redefine R in SOR

The integration of quantitative and qualitative findings provides a robust understanding of how deep emotional engagement can be achieved through value co-creation:

- Quantitative analysis highlights that emotional engagement pathways significantly influence personal growth, happiness, and brand loyalty. Social and therapeutic activities play crucial roles in driving these outcomes.
- Qualitative insights reveal that fostering personalized social interactions and interactive group experiences are essential mechanisms for enabling value co-creation.

By addressing both individual needs and collective experiences, this multi-dimensional service design approach aligns emotional engagement with positive psychological outcomes (e.g., mental recovery, psychological compensation) and social well-being.

7.3 Insights from Study 3: Cultural perspectives on social support in maintaining Older Adults' Well-being

Based on the quantitative analysis of data from the China Health and Retirement Longitudinal Study (CHARLS) and the U.S. Health and Retirement Study (HRS), this study finds that volunteer work, card-playing activities, and internet use significantly enhance delayed memory in older adults. These three social activities demonstrated consistent positive effects on cognitive function among older adults in both China and the U.S., highlighting the universal role of social engagement in promoting cognitive health. However, differences in participation rates and effects were observed across cultural contexts. Older adults in the U.S. are more inclined to engage in volunteer work, while card-playing activities are more prevalent among older adults in China.

The regression analysis showed that volunteer work significantly improved delayed memory in older adults in the U.S. (coefficient: 0.241, $P<0.001$), while card-playing activities had a stronger positive effect on delayed memory among older adults in China (coefficient: 0.195, $P<0.001$). Additionally, internet use demonstrated a significant and consistent impact on delayed memory in both countries, confirming the role of digital technology in supporting cognitive health in older adults.

These findings align with the framework of Social Support Theory, emphasizing the importance of emotional and informational support. Card-playing activities provide emotional support by offering psychological comfort and opportunities for social interaction, while volunteer work offers informational support by challenging cognitive abilities and fostering information exchange, both of which contribute to the enhancement of delayed memory.

Benefits of Volunteer Work for Cognitive Health

Volunteer service activities have shown a significant positive impact on delayed memory among the elderly in both China and the United States. This finding further confirms the dual-pathway through which volunteer service enhances cognitive function through both internal and external mechanisms. Firstly, from the internal mechanism perspective (Neural Resource Enrichment Theory), volunteer service involves cooperation and task execution among individuals. These activities provide rich cognitive stimulation, thereby enriching neural resources and promoting brain plasticity, which directly enhances delayed memory.

Secondly, from the external mechanism perspective (Cognitive Social Capital Theory), during volunteer service, the elderly interact with others, expand their social circles, help others, and establish trust relationships with fellow volunteers. These positive social engagement behaviors promote social interaction, increase social capital, and provide learning opportunities and cognitive stimulation, which indirectly enhance delayed memory.

From a cross-cultural perspective, research indicates that the participation rate in volunteer service among the elderly in the United States is significantly higher than in China. This can be attributed to the predominant eldercare models in each country. In the United States, community-based care is more prevalent, providing numerous opportunities for the elderly to engage in volunteer service and community activities (Leopold et al., 2022). This well-established community care system fosters a broader social support network, enhancing social capital and cognitive health through volunteer service (Siette et al., 2020). Conversely, in China, the eldercare model is primarily family-based, with the elderly relying more on family members for support (Lu, Zhang, & Zhang, 2020). This reliance on family reduces opportunities for

community engagement and volunteer service, leading to lower participation rates. In China, providing volunteer opportunities for the elderly, increasing community resources, and improving the environment can enhance the engagement of the elderly in volunteer activities, thereby promoting cognitive health.

Besides, previous research has found that while social activities enhance overall cognitive abilities and brain volume, they do not improve key cognitive functions such as attention, verbal fluency, and processing speed (Kelly et al., 2017). Our study suggests that volunteer activities positively impact elderly cognition, indicating that social activities can enhance language processing and use (Kazantseva et al., 2020). Unlike general social activities, volunteer activities require extensive language communication to accomplish complex tasks (Comas-Quinn, 2019), which demands higher levels of fluency and cognitive processing, thereby promoting the development of language communication skills. Additionally, the elderly engaging in volunteer service often act as active social actors (Morrow-Howell et al., 2014), playing significant roles in their communities. As social actors, they take on responsibilities, contribute to society, and find purpose in their activities (Wilson & Musick, 1999). This sense of purpose and responsibility further boosts their cognitive engagement and overall mental health. The significant impact of volunteer service on elderly cognition not only pertains to the health of the elderly but also reflects their participation and contribution to society.

Cognitive stimulation through playing card games

Data show that card games have a significant positive impact on delayed memory in elderly individuals in both China and the United States. Similar to volunteer service, card games enhance cognitive function through both internal and external mechanisms. Unlike other activities, card games rely more on social environments such as communities or clubs. These activities not only improve cognitive function but also provide emotional support to the elderly. Our research indicates that the frequency of participation in card games among elderly Chinese is four times that of their American counterparts.

In China, mahjong, a traditional recreational activity, has a long history and symbolizes cross-class entertainment (Greene, 2016). Mahjong is often associated with gatherings and festivals, serving as a means of maintaining social relationships. Additionally, the Chinese cultural emphasis on the concept of "harmony" makes collective card game activities align well with traditional values, emphasizing collective harmony and unity. In contrast, in the United States, mahjong was introduced as a leisure marketing strategy (Gulliver, 2022). Card games, including mahjong, are considered protective factors against dementia (Narme, 2016). The historical and cultural differences explain why card games are particularly popular in China, especially among the elderly. These findings indicate that card game activities, particularly in China, have a significant positive effect on the cognitive function of the elderly. These leisure games do not require significant physical effort, making them more suitable for the elderly. Overall, card games, a popular activity in China, have a universal impact on enhancing elderly cognition in both countries, though participation rates differ. This finding provides contextual support and scientific evidence for developing cognitive interventions for the elderly.

Internet usage and social engagement in the elderly

The results of this study indicate that internet use has a significant positive impact on delayed memory in the elderly in both China and the United States. The participation rate in internet use among the elderly is 21.7% in the United States, compared to 13.45% in China. From the perspective of the Neural Resource Enrichment Theory, the elderly gain rich cognitive stimulation through information searching, reading, watching short videos, and social activities while using the internet. These activities require cognitive engagement and mental effort, which help to stimulate brain neuroplasticity, thereby directly enhancing delayed memory. Unlike volunteer and card-playing activities that heavily rely on community groups, internet activities are highly flexible and constitute a crucial part of social resources. They not only provide continuous cognitive challenges but also help the elderly maintain cognitive vitality.

From the perspective of the Cognitive Social Capital Theory, the elderly increase their social participation through online activities. Online interactions provide emotional support and social connections, which enhance social capital, thereby indirectly improving delayed memory. The

difference in internet usage rates reflects the disparity between China and the United States in terms of social resource provision and technology diffusion. The internet infrastructure in the United States is more developed, and the elderly have a higher acceptance and usage rate of the internet. Furthermore, the higher education system in the United States places greater emphasis on technology and information acquisition, encouraging the elderly to actively use the internet. In contrast, although the internet penetration rate in China has rapidly increased in recent years, technical barriers and low usage rates still exist among the elderly, especially in remote areas.

These findings demonstrate the universal benefits of internet use for enhancing cognitive function in the elderly while highlighting the differences in social resource provision and technology diffusion between China and the United States. This provides crucial contextual support and scientific evidence for developing global cognitive intervention strategies for the elderly and emphasizes the importance of promoting internet use among the elderly.

Cultural perspectives on the role of social support in maintaining cognitive function

Social support significantly improves cognitive health and mitigates cognitive decline in the elderly (Wang et al., 2022). Our data show that the elderly with higher educational levels have greater social participation, suggesting that they are more likely to access and utilize opportunities and avenues for social support. This increased participation helps the elderly maintain and strengthen their roles as volunteers, thereby promoting engagement in social activities. These volunteer roles not only provide emotional support to others but also enhance the elderly's social identity and self-efficacy, contributing to a positive psychological state. The social interaction and cognitive stimulation offered by these activities help delay cognitive decline.

Aging is a personalized and complex process (Dziechciaz et al., 2014), and the intervention of social support on cognitive aging varies across different social contexts. Despite the trend toward more equal and open intergenerational relationships in Chinese families, traditional filial piety remains prevalent, where children’s obedience to their parents is considered a virtue. Family members’care is the primary emotional support for elderly Chinese individuals. Children’s daily

assistance and health management form a crucial part of the elderly's social support system. Family gatherings and neighborhood interactions are the main elements of social participation for Chinese elderly. In contrast, the United States has a highly developed community-based elderly care system, providing numerous participation opportunities for the elderly. The community support system in the U.S. plays a vital role in the social support network of the elderly, offering diverse social activities and volunteer opportunities that promote social participation and provide substantial cognitive stimulation. Our study confirms this, showing that volunteer service participation among the American elderly is significantly higher than in China.

To enhance social support for the elderly across different cultural contexts, it is essential to integrate the strengths of both familial and community support systems. In China, there should be an increased emphasis on developing community-based programs that complement traditional family support, while in the U.S., fostering stronger intergenerational connections within families can provide additional emotional support. Combining these approaches can create a more comprehensive social support environment that promotes cognitive health and active aging.

Contributions to knowledge science

This research contributes to knowledge science by examining how social and educational factors influence the cognitive well-being of the elderly, emphasizing the transformative application of knowledge to enhance human well-being. By integrating Neural Resource Enrichment Theory (NRET) and Cognitive Social Capital Theory (CSCT), this study provides insights into cognitive aging and demonstrates how knowledge can be shared and applied across different cultures to foster societal well-being. The findings highlight the role of transformative knowledge as a resource in promoting cognitive health, supporting a more inclusive and well-being-oriented approach to knowledge management.

This study constructs a framework for understanding how education and social activities enhance cognitive health in the elderly, comparing data from China and the United States to explore the influence of cultural backgrounds on the effectiveness of these interventions. The findings underscore the critical role of lifelong education and inclusive social participation in improving

cognitive health among the elderly. They also highlight the necessity of community interventions and multi-sector collaboration to achieve cognitive health. Despite global aging trends, countries need to tailor their strategies to specific cultural contexts. In China, enhancing community-based programs to complement traditional family support is crucial, while in the United States, fostering stronger intergenerational connections within families can provide additional emotional support. Creating an elderly-friendly society can effectively address aging challenges, fully utilize the potential and experience of the elderly, and promote social harmony and progress.

7.4 Proposing an Integrated Theoretical Model for Enhancing Older Adults' Tourism Well-being

Objective of the Integrated Model

The primary objective of this section is to consolidate the findings from the three prior studies into a unified theoretical model. This integrated model is designed to serve as a conceptual framework that illustrates the key pathways and mechanisms through which mobile technologies (MTs), emotional engagement (EE), and social support collectively influence older adults' well-being in the context of tourism. By synthesizing quantitative and qualitative data from multiple studies, this model provides an evidence-based approach to the development of a service model tailored for older adults' tourism experiences.

The ultimate goal of this model is to promote active aging by enhancing the health, well-being, and overall quality of life for older adults through tourism participation. Active aging, as a critical concept in gerontology, emphasizes the importance of social engagement, lifelong learning, and well-being, all of which are facilitated by tourism. The proposed model highlights the multi-dimensional interactions that contribute to older adults' well-being, encompassing the roles of technology use, emotional experiences, and social participation.

Specifically, this model aims to:

1. Bridge Theory and Practice: Provide an evidence-based theoretical foundation for the design of tourism services that cater to the specific needs of older adults, thereby offering practical guidance to tourism operators, policy makers, and service providers.
2. Promote Multi-Dimensional Service Design: Propose a framework that moves beyond one-dimensional tourism experiences to a comprehensive design approach that fosters emotional, cognitive, and social engagement for older tourists.
3. Encourage Value Co-Creation: Emphasize the active role of older adults as co-creators of their own tourism experiences. Through interactions with service providers, family members, and other tourists, older adults contribute to the value of their travel experiences, thereby strengthening their emotional bonds, brand loyalty, and personal well-being.
4. Facilitate Active Aging: Demonstrate how tourism participation can serve as a pathway to active aging, as it enables older adults to stay socially, cognitively, and emotionally engaged. This is achieved through exposure to new environments, cultural experiences, and social interactions, all of which support cognitive health and emotional well-being.
5. Achieve Sustainable Development Goals (SDGs): Align the model with the objectives of SDG 3.4 (Good Health and Well-Being) by showcasing how tourism participation can enhance older adults' mental well-being, reduce non-communicable diseases, and promote sustainable development through responsible tourism practices.

Implications of the Integrated Model

The theoretical model illustrated in Fig.28 consolidates the findings from the prior studies into a cohesive framework that elucidates the dynamic pathways through which mobile technologies (MTs), emotional engagement (EE), and social activities influence subjective well-being (SWB) for older adults within the context of tourism. Anchored in the concept of active aging, this model highlights how these interrelated factors facilitate the health, well-being, and overall quality of life for older tourists.

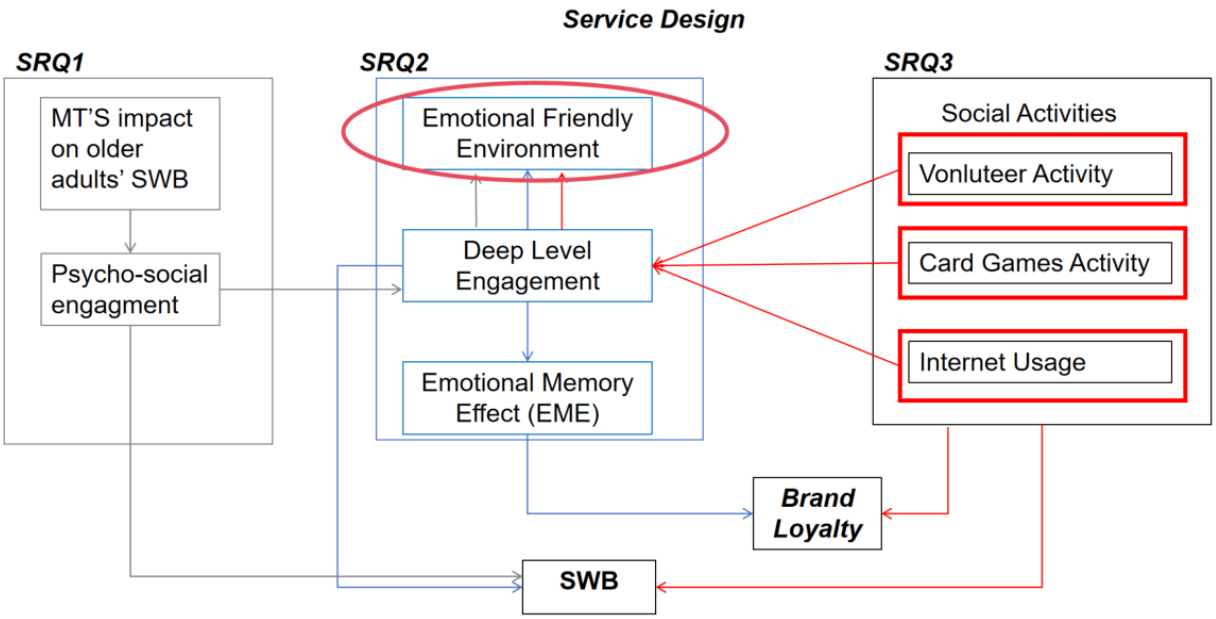


Fig. 30 The Integrated Model **(Source: Authors own work)**

These pathways collectively feed into subjective well-being, which is conceptualized as a multi-dimensional construct encompassing life satisfaction, eudaimonic pleasure, and cognitive health. The diagram further incorporates service innovation as an enabler, emphasizing its role in enhancing the delivery of tourism experiences tailored to older adults' needs. Moreover, cultural context is introduced as a moderating factor, reflecting the variability in how different cultural settings influence the relationships within the model.

By aligning with the objectives outlined above, the model demonstrates the following:

1. It bridges theoretical insights with practical applications, guiding the design of tourism services that address older adults' emotional, cognitive, and social needs.
2. It emphasizes multi-dimensional service design, moving beyond traditional tourism experiences to foster comprehensive engagement.
3. It highlights the co-creative role of older tourists, showing how their active participation enhances personal well-being and contributes to the broader tourism ecosystem.
4. It positions tourism as a pathway to active aging, integrating lifelong learning, emotional growth, and social connection into older adults' lives.
5. Lastly, it aligns with SDG 3.4, showing how tourism can be a driver for improving health and well-being, while also supporting responsible and sustainable tourism practices.

7.5 Emotion-Friendly Design

Based on the findings of this study, a set of practice-oriented design recommendations is proposed (see Figure 31). These recommendations are grounded in the core concept of building an Emotion-Friendly Environment, which emerged as a critical facilitator of emotional engagement and subjective well-being in senior tourism.

For travel agencies, designing family-friendly tourism experiences can enhance emotional security and intergenerational connection. Involving local older adults as tourism volunteers can also increase participants' sense of purpose and social belonging, while fostering community interaction.

For hotels and tourism service providers, attention should be paid to spatial design—specifically, creating scenario-based rest areas within attractions that promote socialization through shared spaces, such as story-sharing corners, and board or card game zones. Additionally, interactive features, like a voice-based chat application linked to scenic spots, can help reduce digital fatigue and promote meaningful engagement without overwhelming users.

For policymakers and government agencies, the integration of mobile technologies into elderly tourism requires cross-sector collaboration between the tourism and technology industries. As Stankov and Gretzel (2021) argue, such partnerships are essential to promote well-being through tourism innovation. Recent national initiatives, such as China's 2023 5G tourism program—which includes projects like the *Forbidden City mini-program* (Ministry of Culture and Tourism, 2023)—demonstrate the government's increasing role in enabling smart, accessible tourism services. These examples suggest that public policies should focus on expanding digital infrastructure, offering incentives for tourism operators to adopt age-inclusive mobile tools, and developing certification schemes for "emotion-friendly" tourism environments tailored to older adults.

This chapter has consolidated the findings from the three prior studies and synthesized them into an integrated theoretical model that highlights the mechanisms through which mobile technologies, emotional engagement, and social interaction collectively influence the subjective well-being of older adults in the context of tourism. By situating this framework within the

broader concept of active aging, it demonstrates how tourism participation serves as a catalyst for enhancing older adults' cognitive, emotional, and social well-being, while also aligning with the Sustainable Development Goals (SDGs).

As we transition to the final chapter, Conclusion and Future Directions, the focus shifts from the theoretical and practical contributions of the integrated framework to a whole reflection on the research. Chapter 8 will revisit the research objectives and questions, summarize the key findings, and highlight the theoretical contributions to the fields of gerontology and tourism. It will also explore practical implications for tourism management and social gerontology, emphasizing the transformative role of service design in enhancing older adults' well-being. Additionally, the chapter will address the limitations of the study and propose future research directions, ultimately underscoring how this dissertation contributes to advancing the understanding of older adults' tourism and its potential to promote active aging and align with sustainable development goals.

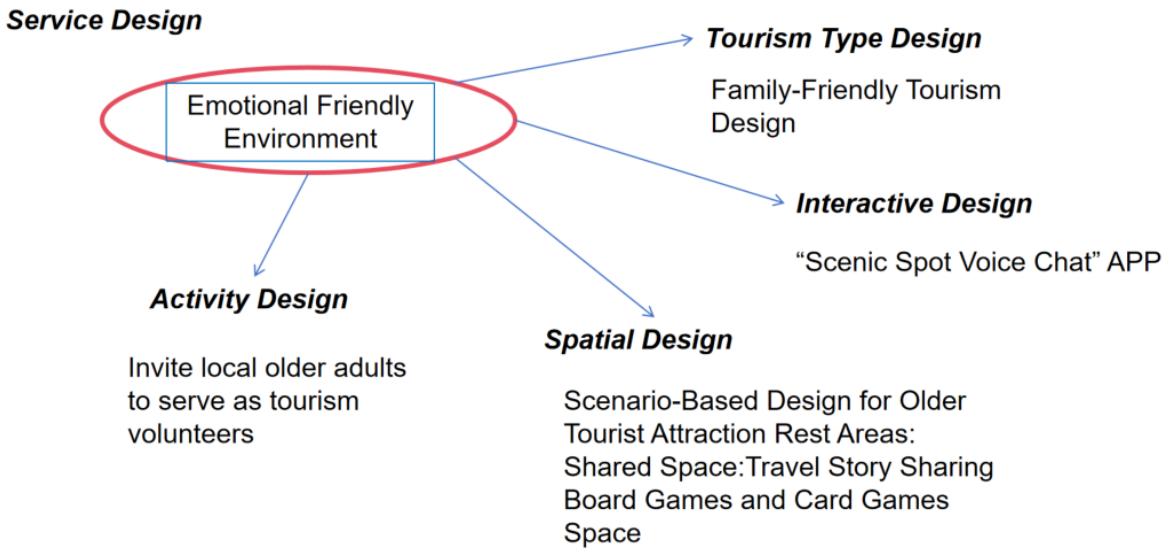


Fig. 31 Emotion-Friendly Environment **(Source: Authors own work)**

Chapter Eight

Conclusion and Future Directions

8.1 Revisiting the Research Objectives and Questions

This dissertation investigates the dynamic factors influencing subjective well-being (SWB) among older adults in tourism contexts, focusing on the roles of mobile technologies (MTs), emotional engagement (EE), and social interaction. The primary objective is to understand how these dimensions contribute to enhancing SWB and promoting active aging through tourism participation. Below, the revised research objectives and questions are outlined in alignment with this focus.

Research Objectives

To examine the role of mobile technologies (MTs) in enhancing older adults' subjective well-being in tourism contexts, study 1 explored how MTs contribute to improving mental health, fostering social engagement, and addressing emotional well-being among older Chinese adults, even under caregiving responsibilities. It aimed to understand the broader psychosocial benefits of MTs in tourism;

To investigate the impact of emotional engagement (EE) on subjective well-being and brand loyalty in wellness tourism, study 2 analyzed different levels and types of engagement, distinguishing surface-level from deep emotional connections. It aimed to reveal how emotional engagement influences SWB and the sustainability of wellness tourism programs for older adults;

To analyze the role of social interaction in promoting cognitive health and subjective well-being across cultural contexts, study 3 focused on the relationship between social interaction and delayed memory, a key component of cognitive health, through a cross-cultural comparison of older adults in China and the United States. It aimed to uncover how cultural norms shape the role of social activities in fostering SWB.

Research Questions

Based on these objectives, the following research questions guided this dissertation:

Mobile Technologies and SWB (Study 1):

- How do mobile technologies enhance older adults' mental health, social engagement, and emotional well-being in tourism contexts?
- In what ways can MTs support subjective well-being for older adults balancing caregiving responsibilities and logistical challenges during travel?

Emotional Engagement and SWB in Wellness Tourism (Study 2):

- What are the different levels and types of emotional engagement in wellness tourism, and how do they influence subjective well-being among older adults?
- How do deep emotional connections contribute to long-term brand loyalty and the sustainability of wellness tourism programs?

Social Interaction and Cognitive Health (Study 3):

- How do social interactions impact cognitive health and subjective well-being among older adults?
- What are the cross-cultural differences in the role of social interaction in fostering cognitive health between older adults in China and the United States?

8.2 Summary of Key Findings and Theoretical Contributions

This dissertation provides a comprehensive exploration of the factors influencing older adults' subjective well-being (SWB) in tourism contexts, addressing gaps in understanding the roles of mobile technologies, emotional engagement, and social participation. Through three interconnected studies, the research presents novel insights into how tourism can serve as a pathway to active aging and subjective well-being. Below is a summary of the key findings and their theoretical contributions.

Key Findings

- The Role of Mobile Technologies in Tourism (Study 1): This study advances our understanding of how mobile technologies (MTs) support older adults' psycho-social needs during tourism. The findings reveal that older Chinese adults use MTs not only for functional purposes, such as navigation or booking, but also for maintaining intergenerational relationships, balancing family obligations with personal leisure, and proactively managing cognitive and physical health while traveling. Additionally, MTs play a hedonic role, fostering curiosity, cultural discovery, and emotional fulfillment in

tourism experiences, particularly within the context of traditional Chinese family values and caregiving responsibilities.

- Deep Emotional Engagement and Value Co-Creation in Wellness Tourism (Study 2): The second study demonstrates that deep-level engagement—characterized by meaningful emotional and cognitive interactions—has a significantly stronger impact on eudaimonic well-being and brand loyalty than surface-level engagement in wellness tourism; The research emphasizes the importance of designing tourism services that prioritize personalized and meaningful interactions, moving beyond superficial experiences to foster deeper connections; By promoting value co-creation, where older adults actively participate in shaping their tourism experiences, service providers can enhance emotional bonds, strengthen social connections, and maximize tourists' well-being.
- Social Participation and Cross-Cultural Differences in Cognitive Health (Study 3): The third study highlights the pivotal role of specific social activities, including volunteer work, card games, and internet usage, in improving delayed memory, a key component of cognitive health, among older adults; The findings demonstrate that social participation contributes to both cognitive health and social well-being, while also helping older adults maintain their roles and identities, which are critical to their overall well-being; Cross-cultural comparisons reveal significant differences: volunteer work and internet usage are more prevalent in the United States, while card games are more prominent in China. These cultural contexts shape how social participation supports cognitive health, underscoring the need for tailored interventions in different regions.

Theoretical Contributions

Extension of Technology Acceptance Frameworks (Study 1):

This study significantly extends established technology acceptance frameworks, including TAM, TAM2, and UTAUT, by integrating social and hedonic motivations to address the unique needs and behaviors of older adults in tourism contexts. TAM2, introduced by Venkatesh and Davis (2000), incorporates social factors like subjective norm and cognitive instrumental processes, such as job relevance and result demonstrability, to better capture the influence of contextual variables on technology adoption. This expansion is particularly relevant to older adults, as

subjective norm—the expectations of significant others like family members—plays a crucial role in shaping their behavioral intentions (Zhang et al., 2023). In tourism, family encouragement often motivates older adults to adopt mobile technologies for trip planning, navigation, and sharing travel experiences, reinforcing their intention to use these technologies (Marler & Hargittai, 2022). Furthermore, hedonic motivations, such as the enjoyment derived from social sharing and emotional connection, are essential for sustaining technology engagement during travel (Wong et al., 2024). These factors are particularly significant in the context of older adults' tourism, where emotional well-being and social engagement are key components of subjective well-being.

By integrating these dimensions, this study expands TAM2's applicability, demonstrating that older adults' perceived usefulness of mobile technologies goes beyond functional gains, such as convenience and task efficiency, to include emotional and hedonic benefits. For example, mobile technologies facilitate cultural discovery and provide opportunities for older adults to engage socially, enhancing both emotional well-being and overall tourism satisfaction. This theoretical contribution emphasizes the dual role of mobile technologies in addressing practical travel needs while fostering emotional fulfillment and deeper social connections.

Moreover, recent advancements in TAM-related research, such as the inclusion of constructs like "accessibility" and "digital sociality" (Tuomi et al., 2023), further inform this study's findings. Accessibility ensures that older adults can easily use mobile technologies regardless of physical or cognitive constraints, while digital sociality highlights the importance of virtual interactions in promoting engagement and connection. These aspects align with the cognitive instrumental processes introduced in TAM2, such as output quality and result demonstrability, which explain how older adults evaluate the usefulness of mobile technologies based on their ability to deliver meaningful tourism experiences (Doo & Bonk, 2021).

Advancement in Understanding Value Co-creation (Study 2):

This study contributes to the theoretical understanding of value co-creation by integrating the concept into multi-dimensional service design for older adults in wellness tourism. By

emphasizing deep emotional engagement, the research expands existing theories of value co-creation, particularly in the context of wellness tourism, where both social interactions between tourists and service providers and social engagement among tourists play crucial roles in enhancing subjective well-being. Traditional theories of value co-creation, such as those proposed by Vargo and Lusch (2004), often focus on functional and transactional aspects of interactions. This study extends these frameworks by highlighting the relational and hedonic dimensions of co-creation, emphasizing the role of emotional engagement in fostering meaningful tourism experiences. Through advanced technologies like AI, the research introduces the concept of emotional co-design, where service providers collaborate with older adults to create personalized wellness services that not only address health needs but also establish ongoing emotional connections (Mogaji et al., 2022). This dynamic feedback-driven process reframes personalized services as emotionally targeted interactions, enriching the theoretical understanding of co-creation in the wellness tourism domain.

The study also advances the understanding of social engagement among tourists by proposing that these interactions can be intentionally designed rather than left to chance. Unlike prior theories that emphasize incidental social encounters (McCabe et al., 2012), this research introduces the concept of scenario-based social engagement, where structured interactions among tourists are carefully crafted to foster shared emotional experiences and social bonds. Furthermore, the integration of interactive technologies and virtual tourism expands the theoretical scope of value co-creation by demonstrating how virtual co-creation can facilitate engagement and well-being for older tourists, particularly those with mobility constraints (Ponsignon & Derbais, 2020; Kohtala et al., 2020). These findings not only extend value co-creation theory to virtual and hybrid tourism contexts but also highlight the potential of active technologies to enhance emotional engagement and peer-to-peer collaboration.

By synthesizing these perspectives, the study develops a comprehensive multi-dimensional service design framework that integrates emotional, cognitive, and social dimensions of well-being. This framework demonstrates that deep emotional engagement is a critical driver of meaningful and co-created tourism experiences, especially for older adults in wellness tourism. In doing so, the research challenges the traditional focus on surface-level satisfaction, proposing

instead that deeper engagement leads to sustained brand loyalty, emotional fulfillment, and eudaimonic well-being (Lin et al., 2019; Jiang & Tu, 2022). This theoretical contribution lays the groundwork for future studies on value co-creation, wellness tourism, and service design, particularly in contexts where older adults' well-being is a priority.

Cross-Cultural Perspectives in Social Support Theory (Study 3):

This study makes a significant theoretical contribution by examining the cross-cultural impact of social participation on cognitive health, offering valuable insights into the intersection of cultural norms and social support frameworks. By integrating findings from China and the United States, the research extends the theoretical understanding of social support theory in the context of cognitive health, highlighting how familial and community-based support systems operate in distinct cultural environments to influence delayed memory and subjective well-being (SWB).

This study challenges the traditional one-size-fits-all approach to social support by demonstrating that aging is a personalized and culturally embedded process (Dziechciaz et al., 2014). In East Asian societies like China, social support predominantly stems from family networks, underpinned by the values of filial piety. Older Chinese adults benefit from family-centered assistance, including daily caregiving, health management, and emotional connection through regular family gatherings and neighborly interactions. These family-based support structures foster cognitive engagement and mitigate cognitive decline through intimate and sustained social interactions. In contrast, in Western societies like the United States, where individualism and institutional frameworks dominate, community-based programs play a central role in providing older adults with opportunities for social participation, such as volunteering and organized group activities. These community-driven models offer diverse avenues for cognitive stimulation and emotional engagement, underscoring the importance of structured social activities in supporting cognitive health (Wang et al., 2022). This cross-cultural lens enriches the theoretical framework by showing that the mechanisms through which social support influences cognitive health are not universally applicable but instead shaped by cultural values and societal structures.

Furthermore, the findings contribute to the theoretical discourse on social participation as a form of active aging by integrating the strengths of familial and community support systems. The research suggests that in China, enhancing community-based programs can complement traditional family support, creating a more balanced and inclusive social support network. Conversely, in the U.S., fostering stronger intergenerational connections within families can provide older adults with additional emotional support, bridging gaps left by community programs. This integrated approach expands the theoretical foundation of social support by advocating for a dual-framework model that synergizes familial and community contributions to cognitive health.

8.3 Practical Implications for Tourism Management and Social Gerontology

The practical implications of this dissertation emphasize actionable insights for tourism management and social gerontology. These insights aim to inform tourism service providers, policymakers, and social gerontologists on how to design and implement strategies that enhance the subjective well-being of older adults through tourism participation.

For Tourism Management

Enhancing Service Design through Emotional Engagement

The findings highlight the importance of deep emotional engagement in tourism experiences, particularly in wellness tourism. Tourism service providers should focus on designing services that go beyond functional benefits to address the emotional and cognitive needs of older tourists. For instance, scenario-based interactions and personalized wellness programs can strengthen tourists' emotional connection to the experience and improve satisfaction and loyalty. Integrating advanced technologies like AI-driven personalization can also enable service providers to anticipate the needs of older tourists, fostering deeper engagement and co-creation opportunities.

Incentivizing Post-Travel Feedback and Social Interaction

This research reveals that older adults are generally reluctant to provide feedback on travel services unless incentivized, a behavior influenced by traditional cultural norms such as Confucian values that emphasize subtlety and restraint, as well as a lack of intrinsic motivation to engage in such activities without clear rewards. For tourism managers, this highlights the importance of designing reward-based feedback systems that effectively encourage older adults to share their travel experiences. Incentive programs, such as offering discounts, loyalty points, or exclusive benefits for submitting reviews, can serve as a strong motivator for older travelers to actively participate in post-travel assessments. Additionally, integrating social sharing features into feedback platforms, such as those on WeChat Moments, can increase engagement by enabling older adults to share their travel experiences within their social circles, fostering a sense of connection and pride in their journeys. Organizing socially oriented events, including post-travel reunions or virtual forums, can further enhance participation by creating opportunities for older adults to discuss their experiences in a community setting. These initiatives not only generate valuable feedback for tourism operators but also promote a sense of belonging and social interaction, contributing to the overall well-being of older travelers.

For Social Gerontology

Strengthening Intergenerational Tourism Experiences Through Social Gerontology Applications

The study highlights the importance of intergenerational relationships in shaping older adults' technology use and travel behaviors. One notable finding is the emergence of the "two seniors and one child" travel model, where grandparents accompany their grandchild on trips. This arrangement reflects a novel balance between caregiving responsibilities and personal leisure, contrasting with traditional assumptions that caregiving restricts older adults' mobility (Albanese & Bocci, 2019; Wang et al., 2023). Quantitative analysis further supports this finding, showing that caregiving for grandchildren does not negatively affect older adults' tourism participation ($\beta = 0.0339,\ p < 0.001$). Instead, such arrangements provide opportunities for older adults to

fulfill caregiving roles while engaging in meaningful travel, thereby enhancing their subjective well-being.

Another significant pattern observed is the alternation between caregiving and care-receiving roles during intergenerational travel. In three-generation family trips, older adults often shift from being caregivers to becoming care recipients. For instance, one participant shared: "During the Spring Festival, I went to see the ice lanterns in Harbin with my children and they arranged everything. My son often said, 'Dad, do not worry about it. I have booked everything online already.'" (M6) This dynamic reflects cultural norms in China, where children are expected to care for their aging parents, aligning with traditional values that associate well-being with the care provided by offspring (Shen & Yeatts, 2013). Unlike societies emphasizing greater independence for older adults (Kaplan & Bentwich, 2023), this intergenerational caregiving approach fosters emotional satisfaction and enhances well-being through familial involvement.

The findings suggest practical applications for tourism management and policy design. Family-centered tourism packages, which include activities promoting intergenerational bonding, can help older adults maintain strong family connections while benefiting from travel. Social gerontologists can work with travel companies to design activities that encourage shared learning, storytelling, and emotional support between generations. From a social gerontology perspective, these findings highlight the importance of designing tourism experiences that integrate caregiving and care-receiving dynamics, align with cultural expectations, and provide meaningful participation opportunities for all family members. This approach not only promotes active aging but also reinforces the emotional and social foundations that contribute to older adults' quality of life.

Promoting Meaningful Participation for Active Aging Across Cultural Contexts

Promoting meaningful participation is essential for enhancing the well-being of older adults. (WHO, 2023) This research verified the transformative role of volunteering in promoting cognitive health and a sense of purpose, making it an indispensable component of active aging. Volunteer activities address not only the social needs of older adults but also their psychological

and cognitive requirements, demonstrating their universal applicability across cultural contexts. In the United States, where community-based eldercare is prevalent, older adults have greater access to organized volunteer opportunities and community activities (Leopold et al., 2022). This well-established community care system fosters a robust social support network, enhancing social capital and cognitive health through regular engagement in volunteer service (Siette et al., 2020). In contrast, China's eldercare model remains predominantly family-based, with older adults relying heavily on family members for support (Lu et al., 2020). This reliance contributes to lower participation rates in community-based volunteer activities, suggesting that expanding community resources and creating structured volunteer opportunities in such regions could significantly improve cognitive outcomes for older adults.

One possible explanation for the superior cognitive benefits of volunteer work lies in its language-intensive nature. Unlike other social activities, volunteer service often involves complex communication, extensive language use, and problem-solving tasks (Comas-Quinn, 2019). These activities require older adults to engage in verbal interactions, organize thoughts, and process information, which helps maintain and enhance language-related cognitive functions such as fluency and verbal memory (Kelly et al., 2017). By placing heightened demands on these cognitive resources, volunteer work provides regular and meaningful practice that supports both verbal and cognitive processing, potentially explaining its more profound impact on well-being compared to other forms of social engagement.

Policymakers and social gerontologists can leverage these insights to design and implement volunteer programs that address cultural influence while retaining a universal focus on improving older adults' well-being. In China, efforts should focus on establishing community-driven volunteer networks that supplement traditional familial support. In the U.S., enhancing intergenerational volunteering initiatives can provide older adults with additional emotional support and opportunities for meaningful engagement. Moreover, integrating volunteer activities into tourism contexts, such as volunteer tourism, offers a unique way to combine travel experiences with community contribution, further enriching the well-being of older adults.

8.4 Limitations of the Study and Future Research Directions

This study contributes valuable insights into the intersection of mobile technologies, intergenerational dynamics, and social participation in shaping older adults' well-being in tourism contexts. However, several limitations should be acknowledged, providing directions for future research to expand and refine these findings.

First, while this research included a broad sample of older adult travelers, it did not specifically control whether participants engaged in caregiving responsibilities, such as providing grandchild care. This limitation restricts the ability to isolate the effects of caregiving roles on travel behaviors and mobile technology use. Future studies could refine participant selection by comparing older adults who do and do not engage in childcare, enabling deeper exploration of how caregiving responsibilities interact with travel behaviors, technology use, and subjective well-being. Additionally, this research primarily focused on mobile technologies, excluding emerging tools such as IoT, AI, and VR. Exploring these advanced technologies in diverse cultural contexts may reveal novel pathways through which digital innovation influences older adults' caregiving roles, tourism participation, and well-being.

Second, the limited sample size of qualitative study and geographic focus may affect the generalizability of the results. Future research could address this by expanding both the sample size and regional diversity to capture broader perspectives. Additionally, the integration of emerging technologies, such as AI and mobile health tools, within the context of wellness tourism could provide actionable insights into enhancing emotional and cognitive engagement among older adults.

Third, the cross-sectional nature of this study limits the ability to infer causality, particularly regarding the relationship between social participation and cognitive health, such as delayed memory. Future longitudinal studies are needed to better understand the dynamic effects of social activities on cognitive health over time. While this research offered a comparative analysis between older adults in China and the United States, the inclusion of additional countries could provide a more comprehensive understanding of how cultural contexts influence cognitive health

and social participation. Moreover, reliance on self-reported data for cognitive function introduces the possibility of response bias. Future studies should incorporate objective measures, such as standardized cognitive tests or neuroimaging techniques, to improve data accuracy and reliability.

Future research should also continue to advance the field of social gerontology by exploring how social roles, cultural practices, and community engagement shape cognitive health and well-being in older adults. Integrating familial and community support systems offers an opportunity to develop culturally appropriate interventions that delay cognitive decline and improve subjective well-being. For instance, combining family-based caregiving with structured community programs could create comprehensive strategies to promote cognitive health while aligning with cultural values. Additionally, exploring specific cultural practices in cognitive health interventions will be critical for refining strategies aimed at achieving active aging.

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Appendix 1: Situation Statement for Participants in Quantitative and Qualitative Study

Quantitative Study: Chinese Version

尊敬的参与者：

感谢您考虑参与本次问卷调查。本问卷是学术研究的一部分，旨在探讨以下主题：

- 老年群体在旅游活动中的参与情况;
- 影响旅游品牌忠诚度的因素;
- 旅游过程中技术的使用及其作用。

研究目的
本研究的目标是更好地了解老年群体的旅游参与行为、对特定品牌的偏好，以及在旅游中使用技术的情况。研究结果将用于学术探讨，并为提升老年群体的旅游服务质量提供参考。

保密性和数据用途
您的参与完全是自愿的，所有回答将仅用于学术研究，绝不会用于其他用途。您的个人信息将严格保密，且不会透露给任何第三方。所有数据均会以匿名形式存储和分析，确保无法通过您的回答识别您的身份。

时间安排
本问卷包含约30道问题，预计需要10-
15分钟完成。您可以随时选择退出，无需提供任何理由。

伦理保障
本研究遵循严格的伦理规范：

- 参与完全基于自愿原则;
- 不会收集任何可识别的个人信息;
- 所有数据将以整体形式安全存储和分析。

联系方式
如果您对本次研究或问卷有任何疑问，请随时联系：
LIU YUCHI

86-137XXXXXXXX

当您继续填写问卷时，即表示您已了解本研究的目的，并自愿参与。

感谢您为本研究贡献宝贵的时间和意见！

此致
敬礼
LIU YUCHI

Quantitative Study: English Version

Dear Participant,

Thank you for considering participating in this survey. This questionnaire is part of a scholarly research project aiming to explore the following topics:

- Older adults' participation in tourism activities;
- Factors influencing brand loyalty in tourism;
- The role and usage of technology during travel.

Purpose of the Study
The goal of this study is to gain a better understanding of how older adults engage in tourism, their preferences for specific brands, and how they utilize technology while traveling. The results of this research will contribute to academic discussions and insights into improving travel services for older adults.

Confidentiality and Data Usage
Your participation in this survey is completely voluntary. All responses will be used strictly for academic purposes and will not be applied to any other uses. Your personal information will remain confidential and will not be disclosed to any third party. All data collected will be anonymized to ensure your identity cannot be traced back to your responses.

Time Commitment
The questionnaire contains approximately 30 questions and will take around 10-15 minutes to complete. You may choose to stop participating at any time without providing any reason.

Ethical Assurance
This survey adheres to strict ethical guidelines:

- Participation is voluntary.
- No identifiable personal data will be collected.
- Responses will be securely stored and analyzed in aggregate.

Contact Information
If you have any questions about this study or the survey, please feel free to contact:
LIU Yuchi

86-137XXXXXXXX

By proceeding with the questionnaire, you acknowledge that you understand the purpose of the study and agree to participate voluntarily.

Thank you for your valuable time and contribution to this research!

Sincerely,
LIU YUCHI

Qualitative Study: Chinese Version

尊敬的参与者:

感谢您同意参与本次访谈。本访谈是学术研究的一部分，旨在探讨以下主题:

- 老年人在康养旅游（以下简称“康旅”）中的参与经历;
- 康旅中的品牌了解情况。

研究目的

本研究旨在更好地理解有康旅经验的老年人在旅游中的感受、偏好和行为。研究结果将为学术研究提供支持，并为康旅及相关服务的优化提供参考。

参与者要求

本次访谈的目标受访者需满足以下条件:

1. 至少有多次康旅经历;
2. 曾经参与过品牌相关的康旅项目或服务。

访谈形式和时长

访谈预计时长为 **90 分钟**，可以通过面对面或电话、视频等形式进行。如果访谈过程中您感到不适或不愿继续，您可以随时终止访谈，无需提供任何理由。

保密性和数据用途

您的参与完全是自愿的，访谈内容仅用于学术研究，绝不会用于其他用途。您的个人信息将严格保密，所有数据将匿名化处理，确保无法通过访谈内容识别您的身份。

伦理保障

1. 参与完全基于自愿原则;
2. 您可以随时选择退出访谈;
3. 所有数据将仅用于本次学术研究，且以匿名形式存储和分析。

联系方式

如果您对本次研究或访谈有任何疑问，请随时联系:

LIU YUCHI

86-137XXXXXXXX

当您同意接受访谈时，即表示您已了解本研究的目的，并自愿参与。

感谢您为本研究贡献宝贵的时间和意见！

此致
敬礼
LIU YUCHI

Qualitative Study: English Version

Dear Participant,

Thank you for agreeing to participate in this interview. This interview is part of a scholarly research project aimed at exploring the following topics:

- Older adults' experiences in wellness tourism;
- Physical and mental well-being during wellness tourism.

Purpose of the Study
The goal of this study is to better understand the experiences, preferences, and behaviors of older adults with health tourism experience. The findings will contribute to academic research and provide insights for improving wellness tourism services.

Eligibility Criteria
Participants for this interview must meet the following criteria:

1. Have multiple experiences with wellness tourism;
2. Have participated in health tourism projects or services associated with specific brands.

Interview Format and Duration
The interview is expected to last 90 minutes and can be conducted in person, over the phone, or via video call. If at any point during the interview you feel uncomfortable or wish to withdraw, you may do so without providing any reason.

Confidentiality and Data Usage
Your participation is completely voluntary, and all information will be used solely for academic purposes. Your personal information will be kept strictly confidential, and all data will be anonymized to ensure that no one can identify you based on your responses.

Ethical Assurance

1. Participation is entirely voluntary;
2. You may withdraw from the interview at any time;
3. All data will be stored securely and used only for this academic research.

Contact Information
If you have any questions about this study or the interview process, please feel free to contact:
LIU YUCHI
86-137XXXXXXXX

By agreeing to participate in this interview, you acknowledge that you understand the purpose of this study and agree to participate voluntarily.

Thank you for your valuable time and input!

Sincerely,
LIU YUCHI