

Exploring the implementation of gerontechnology in long-term care services: Community-based day and night care units in Taiwan

Yi-Fen WANG

Department of Senior Citizen Services, National Tainan Junior College of Nursing
Tainan City, 700007, Taiwan

Ya-Hui LEE

Department of Adult and Continuing Education, National Chung Cheng University
Chiayi County, 621301, Taiwan

ABSTRACT

The objective of this study was to explore the utilization of gerontechnology in the context of community-based long-term care services in Taiwan, with a focus on the user experience, striving to achieve the goal of enhancing effectiveness in caregiving service endeavors. This study adopted a qualitative research method, conducting data collection through semi-structured one-on-one interviews. The subjects included eight professionals employed in community-based long-term care institutions who possessed a minimum of one year of experience in utilizing smart technology products. The findings of this study were: (a) Utilizing functional smart technology products can reduce data input time, effectively monitor the elderly's activities, and provide real-time updates to family members. Additionally, entertainment-oriented smart technology products can encourage the elderly's participation in activities. (b) Challenges encountered during the application process include the insufficient information literacy of middle to old-age caregivers. A significant amount of time was spent on in the initial setup of products; connectivity issues affected stability; there is the need to improve maturity and scalability. (c) Community-based long-term care institutions address these challenges internally through educational training and peer learning to enhance caregivers' familiarity with technological products. Externally, they strengthen communication and collaboration with manufacturers to enhance the effectiveness of service products. The results of this study can serve as a valuable reference for caregiving service institutions and research and development entities engaged in the advancement of gerontechnology products.

Keywords: Gerontechnology, User experience, Community-based services, Long-term care institution.

1. INTRODUCTION

The rapidly aging population has led to an increase in the demand for care that far exceeds the supply of the workforce. Technological care has become a common strategy for countries to cope with the aging trend, aiming to shift from manpower-based to technology-based care services. This not only meets the care needs of the elderly but also addresses the shortage of workforce [1], improving service efficiency and reducing care costs [2][3]. Taiwan's elderly population ratio has experienced a rapid growth. While the transition from an aging society to an aged society took 25 years, projections suggest that moving from an aged society to a super-aged society will occur within just 7 years [4]. Alarming, one in every 5.7 elderly individuals is expected to lose their ability to self-care, necessitating an average of 7.3 years of long-term care over their lifetime [5]. This

indicates an urgent need to respond to the significantly expanding demand for elderly care. To address this, the Taiwanese government is gradually emphasizing the application of technology in medical care environments, aiming to provide more user-friendly and efficient care tools.

Care technology should take into account the specific needs of the elderly in terms of physical and psychological requirements. However, research indicates significant differences in the thinking between users and developers of care technology products [6][7], leading to various service disparities in application scenarios [8]. This highlights the importance of exploring user experiences to provide individualized care. Therefore, the purposes of this research were to: (a) Understand the benefits of applying smart technology to community-based long-term care institutes. (b) Explore the challenges of applying smart technology to community-based long-term care institutes. (c) Analyze the strategies that community-based long-term care institutes adopt to address challenges in the use of smart technology.

2. LITERATURE REVIEW

The concept of aging in place is a fundamental principle in elderly care policies globally. In Taiwan, the approval of the Long-Term Care 2.0 program in 2016 marked a significant step towards community-based services. This initiative aims to provide diverse and continuous care, encompassing support from home to community and residential facilities [9]. Community-based services, characterized by deinstitutionalization, effectively bridge the gap between home and institutional care. They not only cater to the physical needs of care recipients but also attend to their psychological well-being [10], embodying a person-centric ethos.

The integration of smart technology in long-term care services addresses challenges posed by the silver tsunami resulting from aging and the impending shortage of caregiving labor, or the caregiving cliff. Research suggests that using technology for repetitive and labor-intensive care, such as assisting elders in bathing, ensuring safety, and frequently monitoring physiological signals, can relieve caregivers' burdens and improve service efficiency. This not only enables professionals to accurately and promptly assess the physical conditions of the elderly but also enhances the sense of security for both family members and the elderly themselves [11][12]. Innovative technology-based care also cultivates emotional connections and social relationships to varying degrees. Chen's research indicates that information and communication technology can integrate into the lives of elderly individuals by facilitating communication

with distant family members, sharing information, and enhancing social support and interactions [13]. This promotes improved cognitive functioning and a higher sense of vitality in the elderly [14][15], helping to alleviate feelings of loneliness and isolation. Additionally, it contributes to mitigating symptoms associated with dementia and depression, extending the duration seniors spend in familiar homes and communities, ultimately enhancing their overall quality of life.

However, for users, the acceptance of technology within the long-term care industry and its alignment with the actual needs of the elderly and caregivers in practical settings present substantial challenges. Many caregivers or care recipients have limited understanding of smart care aids, resulting in low acceptance rates. Concerns encompass difficulties in learning and operating technological products, inconvenient post-sales service support, and high market prices [16]. Apprehension about new technology, inadequate information literacy [17], and worries regarding privacy protection [18][19] can significantly impact the willingness to adopt such technology. Additionally, in the application of services, mismatches between product design and the characteristics of the service domain and user needs can lead to suboptimal practical use. Issues may include overcrowded interface layouts, users' limited color recognition [6], large and complex volumes, high costs, product functionality not meeting human capabilities, insufficient education and training [20], and incongruent service space and workflow configurations [8].

In considering these challenges, the implementation of technological products in service domains should prioritize a need-driven approach over a technology-centric one. Design considerations must encompass shifts in the physiological and psychological aspects of caregivers and the elderly, economic and social conditions, as well as cultural and social differences [21]. Utilizing graphic interfaces, simplified operation modes, and voice guidance can significantly boost user acceptance and willingness to engage with the technology [22][23]. Furthermore, the factors of education, training, and pricing should be noticed [24]. Consistent practice to enhance user adaptability and the adoption of personalized designs, coupled with multiple explanations and training sessions [20], can effectively minimize frustrations and difficulties encountered during the usage process.

In summary, long-term care service units employ care technology products to alleviate caregiver burdens and elevate service efficiency and quality. However, acknowledging the disparity in the thinking between product users and developers, it is necessary to grasp practical field experiences as a reference when implementing diverse long-term care service models.

3. METHOD

This research adopted a qualitative method with semi-structured interviews to explore the usage experiences of care technology products in community-based long-term care institutes in Taiwan.

Participants

Initially, the researchers selected institutes within the geographic information map of long-term care provided by the Taiwan Ministry of Health and Welfare, using purposive sampling to select participants. The criteria for interviewees included (a) having achieved various forms of support for elderly care through the application of smart technology and (b) having work experience of at least one year and being willing to participate in the interview. Ultimately, a total of 8 participants were selected, comprising 6 supervisors and 4 caregiving service staff. Participants' characteristics included: all 10 were female; ages ranged from 25 to 58 with an average age of 46.1; years of service in long-term care ranged from 1 to 20 with an average of 8.4 years.

Procedures

Between September and November 2023, the researcher contacted and informed the participants about the research purposes and obtained their consent with consent forms signed. Each interview lasted approximately 40 to 60 minutes. Throughout the interview process, the researcher maintained a flexible and open approach, allowing participants to fully describe their experiences with the use of care technology to obtain rich and comprehensive data [25][26]. The interview topics included: (a) What care technology products have you used and for how long? (b) How has the use of care technology products assisted in caregiving work? (c) Have you encountered any difficulties in the process of using care technology products? (d) How have you coped with difficulties encountered during the use?

After the interviews, the audio recordings were transcribed for review and comparison, ensuring the completeness of interview data to explore the truth of the issues [27]. To protect the privacy of research participants, each participant was represented by a code, with the first digit indicating the participant's job title and the second digit indicating the order of the interview. For example, 1-D represents the first interviewed supervisor, and 4-C represents the fourth interviewed caregiving service staff.

Data Analysis

The analysis of research data follows the constant comparative method, involving multi-level comparisons of emerging themes to achieve reliable data interpretation [28]. Beyond comparing responses to the same question from different participants, the method also involves comparing the content provided by the same individual throughout the interview process [29]. Consequently, upon transcribing each interview, the researcher reads the text to gain an overall understanding. Subsequent steps involve analysis and coding to form concepts with corresponding labels, leading to the development of four hierarchical levels: summarized meaning, meaning unit, sub-theme, and theme (see Table 1).

Table 1. Example of data analysis

Theme	Sub-theme	Meaningful units	Summary of Meaning
The benefits of applying smart technology	Functional products	Enhancing safety through monitoring elderly movements	The toilet is equipped with detection alarms, allowing for immediate awareness of the elderly's condition.
		Time saving in data entry and enhanced accuracy	The system can detect whether the elderly need to get out of bed, enabling prompt identification and timely response. Efficiently saving time by directly importing data through data connections. Leveraging AI eliminates the need for excessive manpower, sparing individuals from the laborious task of manual registration.

4. RESULTS

Theme 1. The benefits of the application of gerontechnology in community-based long-term care institutions

The advantages derived from the utilization of technological products in community-based long-term care institutions encompass the reduction of data transcription time, the effective monitoring of the elderly's movements, the facilitation of family comprehension of the elderly's conditions, and the fostering of interactive engagement.

1.1 Streamlining data transcription time and enhancing precision

Three respondents mentioned that technology instruments designed for measuring vital signs, utilizing Bluetooth connectivity, possess the capability to seamlessly transmit data to computer systems. This not only diminishes the need for manual record-keeping and transcription time but also augments the precision of the recorded information, e.g.

"At present, our team comprises 60 individuals, but we anticipate expanding it to 120 in the future. Leveraging AI will mitigate the necessity for extensive manpower... otherwise, managing registrations manually for such a significant number of elderly individuals would prove to be quite arduous." (4-C)

"In the routine tasks of measuring body temperature and blood pressure, the direct incorporation of data through connectivity has already resulted in significant time savings." (5-D)

"Connecting directly to the system after measurements helps to reduce omissions. In contrast, at the adult day care center where I used to work, we used to write everything by hand and then input it into the system, leading to occasional forgetfulness and missed records." (8-D)

1.2 Effectively monitoring the movements of the elderly enhances safety

Nine respondents mentioned that utilizing smart technology enables real-time tracking of the elderly's movements and behaviors, allowing prompt responses to unforeseen circumstances and enhancing safety, e.g.

"The sensors can detect whether the elderly need to get out of bed... enabling the timely identification and handling of

any unusual behaviors to prevent unfortunate incidents from occurring." (1-D)

"In the morning, vital signs are routinely measured... and through the analysis of data, we can discern whether the readings are within the normal range. Comparing the data with previous records helps identify any significant differences, and if there is a substantial variance, inquiries are made to ascertain if any discomfort is experienced." (8-D)

"The detection alarms for falls and prolonged stays in the bathroom provide us with a sense of reassurance. It allows us to gain insights into the well-being of the elderly while using the restroom." (10-C)

1.3 Family members can promptly comprehend the conditions of the elderly

Three respondents conveyed that through the connectivity and transmission features of technological products, the physiological data, activities, and mobility status of the elderly can be synchronized daily and shared with family members, fostering understanding and reassurance, e.g.

"An advantage lies in its user-friendly operation, facilitating the sign-in process... the information can seamlessly synchronize to the family members' mobile phones." (3-D)

"Utilizing satellite tracking, we can acquire real-time information about the vehicle, providing family members with insights and offering substantial assistance in route planning." (4-C)

"Family members can access daily updates on the elderly's information through our electronic communication log, enabling them to stay informed about the elderly's well-being at the center for the day." (5-D)

1.4 Facilitating the engagement and fostering interaction among the elderly

Seven respondents mentioned that entertaining smart technology products can captivate the attention and interest of the elderly. This enables them to engage in interactive games, enhancing cognitive abilities or providing a source of joyful emotions, e.g.

"I will bring the companion robot for a stroll around the daycare center, and it tends to attract attention. Everyone finds it quite fascinating." (3-D)

"Once, during a senior's birthday celebration, we had the disinfection robot, Ah Fu, sing the birthday song, bring out items, and even speak a few words. The experience deeply moved the seniors." (6-C)

"The seniors had a delightful time engaging in interactive activities, such as cutting fruits together. They found such interactive games quite new and enjoyable." (9-D)

Theme 2. The challenges of applying gerontechnology in community-based long-term care institutions

The challenges of implementing smart technology products in community-based long-term care institutions include insufficient information literacy among middle-aged and elderly caregivers, the impact of connection quality on stability, significant time required for setup, and inadequate maturity and expansiveness of the products.

2.1 Insufficient information literacy among middle-aged and elderly caregivers

Four respondents indicated that middle-aged and elderly care service providers possess lower information literacy, learning agility, and memory compared to younger individuals, necessitating an extended period for learning and adaptation, e.g.

"Younger individuals indeed excel in information reception and memory retention... for instance, even for basic typing speed or messages conveyed by supervisors, I often find myself needing to deliberate, whereas they recall with clarity." (2-C)

"As the apparatus is mobile, involving sensors, projection, and wiring, various challenges must be overcome. Typically, it is the younger care providers who handle these tasks, with a fixed group of individuals responsible for the operations." (4-C)

"At times, the system data may not transmit smoothly, necessitating a period of waiting... some colleagues face challenges in operation as they are less adept at using electronic devices." (6-C)

2.2 The stability of the product is susceptible to the quality of the connection

Eight respondents expressed that smart technology products are prone to dysfunction or operational lag due to poor connectivity, adversely affecting caregiving tasks, e.g.

"The subpar network connectivity hinders our ability to achieve the desired outcomes we anticipated." (2-C)

"When encountering connectivity issues with the computer, the data from measurements cannot be uploaded. As a workaround, we switch to using a tablet to input data, causing delays in other tasks." (6-C)

"The system requires Wi-Fi, and initially, there was no network in the room. Although it was later installed, sometimes the Wi-Fi connection is unstable, leading to a failure in sensing." (7-D)

2.3 During the initial stages of use, considerable time is spent on configuration settings

Four respondents indicated that technological products need to align with the institutional environment and users' needs or habits. Therefore, during the initial stages of utilization, a significant amount of time and human resources are invested in adjusting functionalities or parameters, e.g.

"Apart from myself, no one is willing to undertake the task, primarily due to the initial exhaustion. Matching sounds, responses, or dialogues requires extensive effort... it's not merely a matter of pressing a button and having the device follow; all these elements need to be carefully paired." (3-D)

"Initial communication proved challenging; the manufacturers lacked a genuine understanding of seniors with cognitive impairments. Consequently, comprehension was challenging during the communication process." (1-D)

"The high accuracy is attributed to our careful backend setup, wherein photo files, featuring subjects both with and without masks, are carefully configured.... This careful preparation involves building an extensive collection of photos on the cloud." (5-D)

2.4 The product's maturity and scalability are areas that require enhancement

Six respondents indicated that there are still numerous issues requiring correction in the application of technological products. The maturity of the products is yet to be optimized, and there is an expectation for the functionality to expand in response to on-site service needs, aiming to achieve the anticipated benefits, e.g.

"The false reporting rate is relatively high, including the actions of staff and instances where the elderly's sitting posture is suboptimal. Therefore, ongoing efforts are being made to optimize these aspects." (1-D)

"Some discrepancies are significant compared to our expectations. For example, detecting an improper sitting posture might be mistakenly identified as a fall." (2-C)

"The devices were frequently damaged by dementia patients, resulting in nearly half of them needing repairs.... Subsequently, we switched to infrared detection but encountered difficulties in integrating it with the original system." (7-D)

Theme 3. Community-based long-term care facilities have implemented coping strategies

Community-based long-term care facilities employ strategies to address challenges, including conducting internal educational training and fostering peer collaboration. Externally, they emphasize strengthening communication with vendors, among other measures

3.1 Internally, the institution conducts educational training sessions and fosters collaborative efforts among peers

Seven respondents expressed that within the service institution, they address challenges in the use of technological products through the implementation of educational training courses or collaborative efforts among peers, e.g.

"When caregivers encounter difficulties in usage, they typically resort to direct inquiries among themselves for a quicker resolution." (9-D)

"As we follow a shift schedule, it's not practical to have everyone gathered together, so the practice is one person teaching another." (2-C)

"We ensure that team members have a shared vision, providing them with educational training... we encourage team members to collectively engage with the vendors, and they are all willing to cooperate in the usage." (1-D)

3.2 Externally, we enhance communication with the vendors and prioritize post-sales services

Nine respondents expressed that, for issues not addressable internally, they establish contact through customer service and post-sales service channels, thereby reinforcing communication and connections with vendors, e.g.

"If encountering a problem that none of us are familiar with, it's easier to seek assistance from customer service directly." (8-D)

"We directly reach out to the manufacturer; each product has a corresponding contact with the respective vendor." (10-C)

"The vendors have conducted several instructional sessions for us because ongoing maintenance and updates are necessary for the products." (7-D)

"The facial recognition check-in system has not been widely implemented yet. Training sessions will be conducted in the future, and typically, individuals can grasp its usage after a single training session." (4-C)

5. DISCUSSION

Taiwan's community-based long-term care services encompass four types: day care, family care, small-size multifunctional services, and group homes [30]. The first three involve elderly individuals receiving care during the day at service units and returning home to family care at night, while the latter provides round-the-clock, small-scale, and home-style living environments for seniors with dementia. With the increasingly aging population, diverse service recipients, varying levels of impairment, and chronic illnesses, coupled with the aging average age of caregivers and the phenomenon of insufficient manpower, some long-term care institutions are gradually integrating gerontechnology into service domains to alleviate the burden of and pressure on care staff [1][2][3].

Interviewees' experiences indicate that functional smart technology products, such as facial recognition, prolonged toilet occupancy alerts, or bed-exit detection, can effectively monitor the movements of the elderly while respecting their privacy [18][19]. Immediate responses to abnormal behaviors enhance safety, especially for caregivers dealing with dementia patients, easing their caregiving stress. The widely employed wireless physiological measurement not only automatically uploads seniors' physiological data to computer systems, replacing traditional pen-and-paper tasks, but also reduces the time spent on data transcription and improves accuracy. At the same time, it facilitates family members' understanding of the seniors' conditions within the service institutions [11][12]. Moreover, entertainment-oriented smart technology products like robots and interactive cognitive games easily capture the attention of the elderly and promote cognitive functions and interpersonal interactions through gaming [14][15].

While the conceptualization of developing and applying smart technology is commendable, there are still numerous challenges in their field application. Notably, the stability of care technology products is affected by connection quality, and many long-term care institutions did not consider network system deployment during construction, resulting in issues such as unstable or slow networks after product implementation. Some interviewees also indicated that to achieve expected benefits; many smart products need parameter adjustments during the initial setup to adapt to environments, user needs, and service recipient characteristics [8][21]. This requires internal staff to provide relevant data and assist in resolving false reporting situations outside their regular duties. This highlights the potential for improvement in the maturity and functional expansiveness of technology products [20]. Additionally, the information literacy of care workers is a contributing factor, especially considering the impact of the gradual reduction in the caregiving workforce and the increasing average age of caregivers. Their acceptance and adaptability to smart technology products are less pronounced than in younger individuals, necessitating longer learning times [17].

Community-based long-term care institutions, in response to challenges in the application of technology products, adopt a comprehensive approach involving internal resources and external connections as coping strategies. Internally, although educational training courses are conducted during the initial use of products [24], more emphasis is placed on peer-to-peer mutual teaching and learning [20], enhancing familiarity for care technology products. Externally, the establishment of communication channels with vendors, such as online group chats, contributes to the real-time resolution of product issues, achieving an optimal effectiveness in the service field.

6. CONCLUSION

The study results encompass: (a) Advantages of applying smart technology in community-based long-term care institutions, including the reduction of data entry time and effective monitoring of the elderly's movements through functional smart products, enabling immediate awareness of the elderly's condition for family members. Entertainment-oriented smart products also promote the elderly's engagement in activities. (b) Challenges of applying smart technology in community-based long-term care institutions include insufficient information literacy among middle-aged and elderly caregivers, significant time spent on initial product setup, connection quality affects stability, and the need for improvement in maturity and expandability. (c) Coping strategies adopted by community-based long-term care institutions, involving internal measures such as education and training courses and peer-to-peer learning to enhance familiarity with technological products. Externally, reinforcing communication with vendors to enhance the efficiency of product utilization in service domains.

The study suggests that community-based long-term care institutions should adopt the strategy of combining internal training and external communication to minimize problems and adaptation time during the smart technology implementation phase, ultimately achieving the effective support of caregiving services. The results of the research can serve as a reference for the development of gerontechnology products.

7. REFERENCE

- [1] R. Rieland, **How will artificial intelligence help the aging?**, Retrieved from <https://www.smithsonianmag.com/innovation/how-will-artificial-intelligence-help-aging-180962682/>, 2017.
- [2] R. M. Wachter, **Making IT work: harnessing the power of health information technology to improve care in England**, Retrieved from https://assets.publishing.service.gov.uk/media/5a8091afe5274a2e87dba8f2/Wachter_Review_Accessible.pdf, 2016.
- [3] J. Wright, "Tactile care, mechanical Hugs: Japanese caregivers and robotic lifting devices", **Asian Anthropology**, Vol. 17, No. 1, 2018, 24-39.
- [4] National Development Council, **Population Projections for the Republic of China (Taiwan): 2018-2065**. Taipei: National Development Council, 2018.
- [5] Ministry of Health and Welfare, **The improvement of long term care services capacity (2015-2018)**. Taipei: Ministry of Health and Welfare, 2015.
- [6] Y. H. Chou, S. Y. Wang, "Dual Nature of Surveillance Technology: Exploratory Study on the Application of an Infrared Thermal Image Sensing Module on Elderly Care", **Taiwanese Journal of Social Welfare**, Vol. 16, No. 1, 2020, 1-52.
- [7] Y. H. Lee, H. T. Cha, Y. F. Wang, **How to develop assistive technology for elderly care: designers' perspectives**. Proceedings ICSIT, International Conference on Society and Information Technologies, 2023, 51-56.
- [8] M. M. Lai, S. Y. Su, Y. S. Chang, "Application of intelligent technology in long-term care services", **Journal of Information and Communications Technology**, Vol. 178, 2019, 6-8.
- [9] S. C. Wu, "A new turning point of long-term care policy in Taiwan", **The Journal of Long-Term Care**, Vol. 21, No. 1, 2017, 1-7.
- [10] L. H. Chuang, Y. S. Hwang, "Reviewing a community-based care model: perspective of network governance", **NTU Social Work Review**, Vol. 44, 2021, 133-173.
- [11] J. Pols, **Care at a distance: On the closeness of technology**. Amsterdam: Amsterdam University Press, 2012.
- [12] J. Pols, I. Moser, "Cold technologies versus warm care? On affective and social relations with and through care technologies", **Alter**, Vol. 3, No. 2, 2009, 159-178.
- [13] L. K. Chen, "Gerontechnology and artificial intelligence: Better care for older people", **Archives of Gerontology and Geriatrics**, Vol. 91, 2020, 104252.
- [14] R. Abbott, N. Orr, P. McGill, R. Whear, A. Bethel, R. Garside, K. Stein, J. Thompson-Coon, "How do "robotpets" impact the health and well-being of residents in care homes? A systematic review of qualitative and quantitative evidence", **International Journal of Older People Nursing**, Vo. 14, No. 3, 2019, e12239.
- [15] S. C. Chen, C. Jones, W. Moyle, "Social robots for depression in older adults: a systematic review", **Journal of Nursing Scholarship**, Vol. 50, No. 6, 2018, 612-622.
- [16] T. H. Chang, M. C. Yeh, M. L. Lou, L. F. Liu, L. C. Hung, "Comparison perception regarding telehome care between home caregiver and home nurse", **Cheng Vhing Medical Journal**, Vol. 3, No. 1, 2007, 27-34.
- [17] M. C. Hsu, "E-learning for the elderly in major countries", **Pulse of Education**, Vol. 1, 2015, 147-155.
- [18] C. Y. Fu, J. T. Li, "The status and development of care services and smart healthcare in the aged society", **Public Governance Quarterly**, Vol. 4, No. 1, 2016, 84-91.
- [19] F. H. Tsai, "Application development of AIoT smart healthcare in chronic diseases", **Economic Outlook Bimonthly**, 182, 2019, 116-120.
- [20] K. Iijima, "Assistive technology in elderly care: Japanese perspectives and current situation", **Journal of Gerontechnology and Service Management**, Vol. 6, No. 2, 2018, 179-192.
- [21] A. D. Fisk, S. J. Czaja, W. A. Rogers, N. Charness, S. J. Czaja, J. Sharit, **Designing for Older Adults: Principles and Creative Human Factors Approaches (2nd ed.)**. CRC Press, 2009.
- [22] C. Y. Chen, "Probing the technology acceptance for older adults: a case study on southern part of Taiwan", **Journal of Kun Shan University**, Vol. 10, 2015, 132-144.
- [23] B. Loureiro, R. Rodrigues, **Multi-touch as a natural user interface for elders: a survey**. In 6th Iberian conference on information systems and technologies (CISTI 2011), IEEE, 2011, 1-6.
- [24] M. F. Li, M. H. Hu, M. R. Lee, M. H. Lee, "Development of holistic-care technology: from the perspectives of late-middle-aged and older adults in the community", **The Journal of Long-Term Care**, Vol. 12, No. 1, 2008, 17-31.
- [25] S. B. Merriam, "Assessing and evaluating qualitative research" In S. B. Merriam (Ed.), **Qualitative research in practice: Examples for discussion and analysis**, San Francisco, CA: Jossey-Bass, 2002, 18-33.
- [26] M. Packer, **The science of qualitative research**. New York, NY: Cambridge, 2011.
- [27] C. Marshall, G. B. Rossman, **Designing qualitative research (5th ed.)**. Thousand Oaks, CA: SAGE, 2011.
- [28] B. G. Glaser, A. L. Strauss, **Discovery of grounded theory**. New York, NY: Rouledge, 1999.
- [29] K. Charmaz, **Constructing grounded theory: a practical guide through qualitative analysis**, London: Sage, 2006.
- [30] Ministry of Health and Welfare Taiwan, **Instructions for administrative operations of the Ministry of Health and Welfare's Community Care Service System Project**. Retrieved from <https://1966.gov.tw/LTC/cp-4006-42523-201.html>, 2019.