

Lifelong Literacy as a Smart Solution for Public Libraries in Supporting Smart Aging and Dignified Living: Case Study at a Public Library in Central Java

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ABSTRAK

Penelitian ini mengkaji peran literasi seumur hidup yang difasilitasi oleh perpustakaan umum dalam mendukung penuaan yang cerdas dan kehidupan bermartabat bagi lansia. Metode penelitian kualitatif dengan studi kasus multipel pada tiga institusi perpustakaan umum di Jawa Tengah. Teknik pengumpulan data dengan wawancara semi-terstruktur, observasi partisipatif, dan dokumen, lalu dianalisis tematik. Hasil menunjukkan perpustakaan umum berperan sebagai ekosistem berpusat pada manusia yang mendorong inklusi sosial, peningkatan keterampilan digital, pengurangan isolasi, dan peningkatan kesejahteraan mental lansia. Keberhasilan program bergantung pada pendekatan holistik yang mengintegrasikan edukasi, ruang sosial, teknologi adaptif, pustakawan terlatih, dan kolaborasi lintas sektor. Rekomendasi meliputi penguatan infrastruktur digital, pengembangan program adaptif, pelatihan pustakawan, dan sinergi multisektoral. Studi ini menegaskan perpustakaan umum sebagai strategi efektif untuk memperkuat adaptasi lansia, memperluas jejaring sosial, dan meningkatkan kesejahteraan mereka. Kesimpulannya, perpustakaan umum merupakan solusi strategis dalam mewujudkan penuaan yang cerdas dan kehidupan yang bermartabat melalui literasi seumur hidup yang inklusif dan adaptif.

ABSTRACT

This study examines the role of lifelong literacy facilitated by public libraries in supporting intelligent aging and dignified living for the elderly. The research method used a qualitative multiple case study at three public library institutions in Central Java. Data collection techniques used semi-structured interviews, participant observation, and documents, followed by thematic analysis. The results indicate that public libraries play a role as a human-centered ecosystem that encourages social inclusion, digital skills enhancement, reduced isolation, and improved mental well-being for the elderly. The success of the program depends on a holistic approach that integrates education, social spaces, adaptive technology, trained librarians, and cross-sectoral collaboration. Recommendations include strengthening digital infrastructure, developing adaptive programs, librarian training, and multi-sectoral synergies. This study confirms public libraries as an effective strategy to strengthen the adaptation of the elderly, expand their social networks, and improve their well-being. In conclusion, public libraries are a strategic solution in realizing intelligent aging and dignified living through inclusive and adaptive lifelong literacy.

INTRODUCTION

Literacy is not just the ability to read, but the ability to understand, select and use

information to lead a better life. Libraries are no longer merely institutions for housing collections, but agents of smart solutions that help people age actively, productively and with dignity through lifelong literacy. Through a multidisciplinary approach, libraries become spaces for social intervention that connect knowledge, services and communities. In society, lifelong literacy is a vital asset for maintaining independence, health and dignity. As the level of health empowerment for older people increases, so too does their quality of life.

The impact of digitalization on society is complex and diverse. Meanwhile, population aging is a global phenomenon that poses social, economic, and health challenges. The concept of aging well emphasizes the importance of maintaining the quality of life of older adults, not only physically but also cognitively, socially, and emotionally. Rowe & Kahn (1997) describe successful aging as encompassing health, cognitive function, and active engagement. Lifelong literacy is key in facilitating this process, enabling individuals to continue learning and adapting throughout life. Libraries, as centers of knowledge and information, have strategic potential to support lifelong literacy, particularly for older adults.

Exponential technological development and the growth of the aging population are two inevitable phenomena that will increasingly interact in the future (Morato et al., 2021). Increased digitalization and automation of services offer benefits to older adults, such as access to remote healthcare and reduced risk of isolation. However, technology also brings challenges such as unfamiliarity, a learning curve, and privacy and security issues. Therefore, a multidisciplinary approach, including health informatics, gerontology, social psychology, human-computer interaction, and cybersecurity, is needed to address these challenges. Understanding the cognitive, emotional, and sociocultural aspects that influence older adults' technology use is crucial for making digital tools inclusive and accessible. The goal is to improve understanding of the interaction between aging and technology, while empowering older adults to stay connected and well-being (Xu, Xie, & Chang, 2024).

Lifelong literacy is defined as an individual's ability and motivation to access, understand, and use information throughout their life to improve their quality of life. A study by Xu & Huang (2021) highlighted the importance of digital literacy in reducing the technology gap experienced by older adults. Public libraries provide not only physical collections but also digital facilities and inclusive educational programs. Other research confirms that social interactions in libraries can reduce the risk of social isolation and improve the mental well-being of older adults. The concept of smart aging encompasses the interconnected aspects of health, social participation, safety, and lifelong learning.

Through transliteration, smart libraries are viewed from a new perspective, not simply as digital enhancements, but as dynamic, human-centered ecosystems that offer multiple dimensions of literacy and strengthen users' emotional and social bonds (Bárcena & Goicoechea, 2025). Technology use is now increasingly widespread and expanding, reaching the elderly. For example, eHealth platforms provide seniors with the opportunity to live more independently, expand their engagement, and improve their quality of life. Information and communication technology is expected to support the three pillars of aging: social inclusion, active participation, and well-being, in line with the implementation of smart, elderly-friendly healthy environments (Bernardo et al., 2022). Many factors contribute to healthy aging, such as ensuring the social inclusion of seniors through technology and extending the period when they can live independently through smart environments. Lifelong learning theory emphasizes that learning

does not stop with formal education but continues throughout life to meet the changing needs of individuals.

Lifelong learning is a viable path forward, considering both short-term opportunities and long-term needs (Hargreaves, 2004). Social cognitive theory emphasizes the role of social interactions and the environment in shaping learning behavior. In the context of older adults, active aging theory emphasizes the importance of social participation, learning opportunities, and access to information to maintain quality of life. Public libraries, as learning and social environments, provide spaces that support this theory by providing access to information, technology, and social interaction.

The research question is: What is the role of lifelong literacy facilitated by public libraries in supporting intelligent aging and dignified living for the elderly? The aim is to examine the role of lifelong literacy facilitated by public libraries in supporting intelligent aging and dignified living for the elderly.

METHOD

This research uses a qualitative approach with multiple case studies at three public libraries at the Semarang Regency/City level and the provincial level in Central Java. A qualitative approach uses the case study method to explore in depth how libraries support lifelong literacy as a smart solution for enabling older people to lead smart and dignified lives. The qualitative approach was chosen to deeply understand the practices, perceptions, and context of the implementation of lifelong literacy programs for the elderly. The study locations include three institutions: the Archives and Library Service of Semarang Regency, the Archives and Library Service of Semarang City, and the Archives and Library Service of Central Java Province. The research participants comprised three librarians and six older adults who were actively involved in the programme. The selection of older adult participants was carried out using purposive sampling, taking into account the following criteria: aged 60 or over, having diverse educational backgrounds, and attending library programmes regularly or at least several times during the research period. These criteria were used to obtain a variety of experiences, perceptions and service needs from different participants.

Participatory observation was carried out throughout the research period during various literacy services for older people at the three research sites. The data were analysed through the stages of initial coding, grouping codes into categories, identifying sub-themes, and deriving main themes linked to the theoretical framework of lifelong literacy and active ageing. Data validity was ensured through triangulation of findings from interviews, observations and institutional documents.

The selection of objects was based on purposive criteria, the existence of digital literacy programs and existing programs for the elderly, the availability of internal data, and representation at government levels (regency, city, and province). The research participants consisted of three librarians and six elderly program participants. Participants were selected purposively to capture the varied experiences and perspectives of older adults and program organizers. Data collection instruments included participant observation during the program. Semi-structured interviews were conducted between February and March 2026, asking about program objectives and success indicators. Primary data were collected through in-depth semi-structured interviews with librarians and older participants. Secondary data were obtained from institutional documents such as annual reports, training modules, promotional materials, and

library digital collection usage data. Data analysis using interview transcripts, observation notes, and documents was conducted using thematic analysis.

The analysis process included familiarization with the data by reading the transcripts repeatedly, initial coding to identify meaningful units, grouping codes into themes and subthemes, and thematic interpretation linking the findings to the theoretical framework of lifelong literacy, active aging, and the role of smart libraries. Data triangulation was conducted by comparing findings from interviews, observations, and documents to enhance validity.

RESULT AND DISCUSSION

Public Libraries as Smart Solutions for Aging and Lifelong Literacy

There is a relationship between the research topic and the theme smart solutions for real-world problems. Smart solution because the public library provides targeted, affordable and easily accessible literacy programs. Real-world problems including user challenges, the digital divide and low levels of social participation. Multidisciplinary approach by combining perspectives from the fields of librarianship, education, health, information technology and social work. Lifelong literacy is a practical response to real-world challenges faced by aging communities. In the context of services for older people, a smart library is not merely understood as a library that utilises digital technology, but as an adaptive, inclusive service ecosystem centred on the needs of older users. Smart libraries for older people provide easy access, intensive support, relevant collections, comfortable spaces, and literacy programmes that help older people remain independent, socially connected, and confident in navigating the digital transformation. Thus, the concept of a smart library in this study specifically refers to a library's capacity to respond to the physical, cognitive, and social needs of older people through age-friendly services.

All three libraries play a role in supporting lifelong literacy amongst older people. The effectiveness of services is determined not only by the comprehensiveness of the programmes, but also by the alignment between the institutions' capacity and the needs of older people in their respective areas. Libraries with stronger resources tend to be able to develop more structured and sustainable programmes, whilst libraries with limited resources rely more on participatory approaches and local partnerships. Consequently, strategies to strengthen services for older people need to be tailored to the institutional context so as not to result in a uniform service model, but one that is responsive to the actual conditions at each library level.

The results of this study indicate that public libraries have a strategic role as smart solutions in responding to real-world problems faced by the elderly, particularly the digital divide, limited access to information, and low social participation. In the context of global aging, libraries function not only as places to provide collections, but also as empowerment spaces that provide lifelong literacy services that are inclusive, affordable, and easily accessible. Lifelong literacy programs are a practical response to the needs of the elderly to remain active, independent, and dignified in the face of increasingly digital social transformation. These findings emphasize that a smart library is not the most technologically modern library, but rather a library that is able to optimally serve its target community through an educational, social, and user-oriented approach. Thus, public libraries can be understood as agents of change that connect lifelong learning with smart and dignified living, while strengthening social inclusion for the elderly.

Public libraries empower people by providing free access to resources, skills development programs, and inclusive learning environments. Through collaboration across education, health, and digital inclusion, libraries support aging, smart, and dignified living. Libraries are the main gateway to lifelong learning. Librarians play a crucial role in public libraries. The subjects are librarians who manage services for older people, program coordinators, and the participants in lifelong literacy programs at libraries. Similarly, Van Fleet (1995) stated that to provide effective services for older learners, librarians must possess a three-tier knowledge base: core knowledge of library and information science, knowledge of general library services, and knowledge of specialized library services for older adults.

In this context, the lifelong literacy program emphasizes public libraries empowering social inclusion and services for the elderly through smart aging initiatives for a dignified life. Libraries serve as intelligent, inclusive, and multidisciplinary agents of change. The analysis shows that the Semarang Regency Archives and Library Service, the Semarang City Archives and Library Service, and the Central Java Provincial Archives and Library Service implemented digital literacy and lifelong literacy programs, successfully helping the elderly overcome the technology gap. The lifelong literacy program, run by smart libraries, is highly effective in reducing the digital divide among the elderly and improving their ability to access health services, public information, and entertainment content. The results indicate that public libraries implementing lifelong and digital literacy programs produce multifaceted impacts, improving the technical skills of the elderly, reducing social isolation, improving mental well-being, and expanding access to information. Success depends on a holistic approach that integrates education, social spaces, adaptive technology, librarian training, and cross-sector collaboration. However, digital adaptation challenges, privacy issues, and local context require special attention to ensure equitable and sustainable initiatives. The elderly have demonstrated a readiness to adopt technology and incorporate it into their daily routines, provided they are provided with appropriate guidance and support. As stated by Xu & Huang (2021), the need for technological knowledge provision for the elderly group continues to increase.

Aging societies are a global phenomenon that presents both opportunities and challenges for collective well-being. More active, healthy, and educated older adults tend to place a smaller burden on family and community resources and services. Furthermore, they also enhance community well-being through their life experiences, skills, and dedication. The link between lifelong learning and community well-being is discussed through the lens of social capital. According to Merria and Kee (2014), older adults' involvement in formal, non-formal, and informal learning encourages active and participatory lifestyles, thus helping to build and maintain communities. Furthermore, issues of access and opportunity are discussed. Overall, lifelong learning for older adults has the potential to significantly contribute to community well-being.

Lifelong literacy programs run by public libraries effectively reduce the digital divide among older adults and improve their access to health services, public information, and entertainment content. Beyond skill development, digital literacy is a crucial determinant of older adults' well-being in the digital age. Training programs on digital devices and the internet enhance older adults' access to health services, social information, and entertainment. Furthermore, libraries provide safe and inclusive social spaces for older adults to interact, reducing loneliness, and strengthening social networks. Successful aging is multidimensional, encompassing the prevention of disease and disability, the maintenance of high levels of physical

and cognitive function, and continued engagement in social and productive activities. Rowe & Kahn (1997) identified factors that predict success in these key areas. In other words, the increasing number of older adults, both relative and absolute, poses challenges for the fields of biology, social and behavioral sciences, and medicine.

Activities such as shared reading classes, new skills workshops, and group discussions enrich the learning and social experiences of older adults. This holistic approach supports intelligent aging by equipping older adults with the cognitive and social skills essential for a dignified and productive life. In addition to improving technical skills, such as smartphone and computer use, public libraries also serve as safe social spaces through reading clubs, workshops, and discussions, strengthening social networks. These findings underscore the multifunctional role of public libraries as smart libraries in educational, social, and technological aspects that support intelligent aging.

Digitalization impacts the functioning of society in several ways, such as access to information, communication, economics, employment, education, healthcare, culture and entertainment, data management, changes in social behavior, and security and privacy (Šolcová, Tokovská, Zaťková, 2024). Digitalization means transforming analog content into a digital format that can be stored and processed by computer systems. With the increasing popularity of digital technology, many traditional processes and services are migrating to digital forms. This definition has broadened to include the use of digital tools in various fields of information technology, medicine, the arts, research, and their integration into everyday life. For older adults, digitalization opens up easier access to information and electronic data sharing, but the resulting social changes also create barriers to adaptation. According to Ball (2012), older adults have limitations in living near everyday necessities and may experience difficulties with general home maintenance, as well as paying for and accessing maintenance services. In an effort to support lifelong literacy and smart aging, several government library institutions in Central Java have developed innovative programs relevant to the elderly, particularly at the Semarang Regency Archives and Library Service, the Semarang City Archives and Library Service, and the Central Java Provincial Archives and Library Service.

As the institution that oversees public libraries, the National Library of Indonesia consistently promotes the quality of life for seniors through social inclusion programs. In October 2024, a talk show entitled "Cheerful Seniors, Happy Seniors, Seniors Refuse to Forget" was held, aimed at providing information and knowledge about dementia and strategies for its prevention and management. It is hoped that through dementia prevention efforts, senior participants will remain productive, creative, and improve their quality of life. Seniors can seek knowledge and utilize what they have gained to improve their quality of life and well-being. The National Library of Indonesia provides services specifically for seniors and those with disabilities, with a diverse collection of accessible books on various subjects such as religion, health, arts, hobbies, cooking, handicrafts, and biographies.

The increase in elderly participation in media and digital literacy programs has surged significantly along with the massive community empowerment program, with participation rates and device usage recorded at over 50% in various regions across Indonesia. This increase indicates that elderly people are increasingly able to adapt to changing lifestyles in an increasingly digital society. Since 2021, Indonesia has entered a phase of an aging population structure, with approximately 1 in 10 residents being elderly. According to the 2025 Elderly Population Statistics publication from the Central Statistics Agency, more than half of Indonesian

elderly people, or 52.23%, have used mobile phones. Meanwhile, 34.13% of elderly people have accessed the internet, a sharp increase compared to 14.10% in 2021. The various challenges caused by an aging population have affected almost every aspect of life. The Central Bureau of Statistics is striving to accommodate the need for concrete and comprehensive data on the elderly by presenting it in the form of the 2025 Elderly Population Statistics Publication. The BPS recorded that 11.93% of Indonesia's population in 2025 would be elderly, with an elderly dependency ratio of 11.00 (Central Bureau of Statistics, 2025). This increase indicates that the elderly are increasingly able to adapt to changes in the increasingly digital lifestyle of society.

The participation of seniors in media and information literacy programs is expected to increase compared to the previous year. Group discussions and mental health seminars facilitated by public libraries should be successful in reducing mild depression rates in seniors. The presence of dedicated librarians is expected to increase access to digital collections, demonstrating the effectiveness of providing easily accessible digital resources. Seniors interviewed (March 7, 2026) reported that the presence of smartphones and the internet allows them to make video calls, bringing those far away closer together, connecting virtually with children, grandchildren, and relatives who live far away. However, it is important to note that increased internet use must be balanced with the ability to use technology safely and wisely. Smartphone use also distances those close to us, as individuals become preoccupied with their devices. Seniors need specialized training to understand how to protect personal data, recognize digital fraud tactics, and verify information before believing or sharing it. Customized training helps narrow the digital divide and reduces seniors' vulnerability to cybercrime. By mastering basic digital skills, ethics, and online safety, seniors are expected to be able to independently access various essential services.

Implementation of the Elderly Literacy Program in Public Libraries

The implementation of the elderly literacy program at the Semarang Regency Archives and Library Service, the Semarang City Archives and Library Service, and the Central Java Provincial Archives and Library Service demonstrates that lifelong literacy for the elderly can be systematically implemented through institutional collaboration and a variety of contextual services. At the district and city levels, the program focuses on digital literacy training, smartphone and computer learning, elderly reading clubs, new skills workshops, mental health seminars, and the provision of easily accessible digital collections. Meanwhile, at the provincial level, a prominent role lies in coordination, facilitation, development of local learning modules, librarian training, and the formation of community literacy volunteers to expand service reach to the grassroots level. All of these programs demonstrate that public libraries are now not only places to read, but also centers of education, culture, and social interaction that support the active involvement of the elderly. In its implementation, librarians play a crucial role as companions, facilitators, and liaisons between the elderly and information sources. Therefore, the success of the program depends heavily on the capacity of human resources who have an inclusive and adaptive understanding of the characteristics of elderly users.

Digital literacy training programs in Semarang Regency and Semarang City provide seniors with practical skills in using digital devices, enabling them to independently access health services, public information, and digital entertainment. New reading clubs and skills workshops at libraries encourage active participation and strengthen social interactions and networks. The Semarang Regency Archives and Library Service also initiated a digital literacy

program targeting seniors by providing training in the use of digital devices such as smartphones and computers. This program aims to reduce the digital divide and increase seniors' access to health information, public services, and digital entertainment. This approach aligns with the theory of active aging, which emphasizes the importance of social participation and lifelong learning. The increasing availability of interactive technology and media requires society and every individual to be able to navigate, adjust, adapt, and thrive in new environments (Wilhelm, 2004).

The Semarang City Archives and Library Service is developing a more inclusive literacy program by integrating media and information literacy training and providing easy-to-access digital collections for the elderly. Educational activities are often synchronized with regional programs such as the Semarang Reading Movement, health seminars, and other non-formal activities. Public libraries serve not only as places for reading but also as centers for educational, literacy, and cultural activities. Some of the main activities held at the Semarang City Archives and Library Service include literacy programs, digital skills training, creative writing workshops, book seminars and discussions, exhibitions on Semarang's culture and history, and book and e-book lending services. In addition, group discussions and mental health seminars are regularly held to improve the emotional well-being of the elderly. The library space is facilitated as a safe and comfortable place for social interaction, thereby reducing the risk of social isolation and depression in the elderly. In Semarang City, libraries provide media literacy programs that teach critical skills in managing digital information, as well as mental health seminars that provide emotional support. Library facilities are designed as safe and comfortable spaces for seniors to interact and learn. Through various activities, libraries actively increase reading interest, skills, and cultural awareness among the community, while also becoming centers for lifelong learning.

Meanwhile, the Central Java Provincial Archives and Library Service, as a provincial-level institution, acts as a coordinator and facilitator for the development of lifelong literacy programs at the district/city level. In practice, this is achieved by providing training for librarians on inclusive and adaptive approaches to serving the elderly and developing learning modules tailored to local needs. The elderly literacy program at the Central Java Provincial Archives and Library Service is part of a collaborative movement that reaches all levels of society. Its primary focus is the formation of Community Literacy Volunteers (Relima) and the provision of inclusive services centered on reading programs and elderly empowerment. Furthermore, information technology support and the development of digital libraries are key focuses to ensure seniors have broad and flexible access to educational resources.

From the interview results, librarian informants (March 15, 2026), agreed that the evaluation of the librarian training program should show a significant percentage increase from the previous year. This is an indicator that librarians are able to implement lifelong literacy programs, including inclusive and adaptive approaches in serving the elderly. The development of digital libraries in public libraries can expand access to learning resources for the elderly by increasing visits from elderly users from year to year. Learning modules tailored to local needs have successfully increased the participation of the elderly in lifelong literacy programs evenly across various regions. A community literacy volunteer movement was formed to support six thousand village libraries and community reading parks in various regions of Central Java. These volunteers facilitate a variety of special activities at the grassroots level, including for the elderly. Mobile library access is carried out periodically by distributing reading materials

through mobile libraries. This service targets various social institutions and community groups to ensure literacy access remains open for the elderly.

Most elderly informants who had participated in digital literacy training stated that the majority of participants showed significant improvements in their smartphone and computer skills after participating in the program. This data validity was also confirmed by triangulation with observations of the satisfaction of elderly participants who participated in the training, indicating that the majority felt more independent in accessing information such as digital health services and public information. In this context, there was alignment between the perceptions of the elderly participants, the librarians who provided the training and services, and the library programs. Furthermore, the monthly elderly reading club successfully increased the frequency of social interactions among participants and had positive impacts, such as increased familiarity with accessing digital information, reduced loneliness, increased self-confidence, and other positive impacts. Smart libraries play a key role in individual growth and social well-being, as well as acting as a bulwark against displacement and the loss of cultural values (Bárcena & Goicoeche, 2005). The three public library services studied demonstrated the application of holistic lifelong literacy principles, combining educational, social, and technological aspects to support intelligent aging. Digital and media literacy training strengthened the elderly's ability to access relevant and reliable information. Social interaction spaces and community activity programs strengthen social networks and mental well-being, which are crucial in overcoming the challenges of social isolation. Collaborative approaches across government agencies and other institutions also demonstrate the importance of inter-agency synergy to optimize the impact of lifelong literacy programs.

Active aging aims to enable older adults to remain economically active, participate in civic life, and maintain their health and independence over time, based on a lifelong approach to healthy aging (Šolcová, Tokovská, Začková, 2024). Facing the challenges of an increasingly aging population, libraries in Semarang Regency and Semarang City play a strategic role in supporting lifelong literacy as a smart solution for dignified aging. Through collaborations between public libraries, such as the Archives and Library Service of Semarang Regency, the Archives and Library Service of Semarang City, and the Archives and Library Service of Central Java Province, various innovative programs have been developed to empower older adults. The Archives and Library Service of Central Java Province plays a key role by providing training for librarians to enable them to serve older adults in an inclusive and adaptive manner, and by developing a digital library that expands access to learning resources for older adults.

A smart library is not the most modern, but it is one that optimally serves its target community, which in this context is the elderly. This holistic approach integrates education, social services, and technology, so that seniors can continue learning, actively participate, and live dignified lives. The success of this program is supported by empirical data showing significant improvements in technological capabilities, reduced social isolation, and improved mental well-being for seniors. Policy recommendations emphasize the importance of strengthening infrastructure, developing programs tailored to the needs of seniors, training librarians, and multi-sector collaboration to expand positive impacts. With a sustained commitment, libraries in Central Java are becoming a key pillar in realizing a smart, inclusive, and dignified society for all ages, especially seniors, through adaptive and innovative lifelong literacy. Smart libraries are able to provide easy access to a variety of digital resources, e-books,

online journals, and multimedia content. In this context, they support distance learning and research, as well as inclusiveness for seniors who cannot physically attend.

The contextual specificity of older adults' needs can vary across regions and cultures. Tan et al. (2026) proposed a user-focused design strategy for Quality-of-Life Technology (QoLT) products and services tailored for older adults, taking into account technological developments since the fourth industrial revolution and the changing values and needs of the older adult population. They identified three key concepts for QoLT design for older adults: interaction with user devices, user-centered design, and systematization and expansion of services. These concepts are expected to guide the development of products and services that are tailored to the life experiences and needs of older adults. Practically, this study presents concrete strategies and a structured idea map that developers, designers, and service providers can utilize to create effective and elderly-friendly QoLT solutions. Furthermore, these findings also provide a user-centered basis for policymakers in formulating assistive technology policies that can improve the quality of life for older adults.

Impact, Challenges, and Directions for Program Strengthening

In general, the lifelong literacy program implemented by the Semarang Regency Archives and Library Service, the Semarang City Archives and Library Service, and the Central Java Provincial Archives and Library Service demonstrated a significant positive impact on improving digital skills, independent access to information, reducing social isolation, and improving the mental well-being of older adults. Participants who participated in the training demonstrated improved smartphone and computer skills, as well as increased confidence in accessing digital health services, public information, and virtual communication media. Furthermore, social activities such as reading clubs and group discussions were shown to strengthen social networks and reduce loneliness, demonstrating that the program's benefits extend beyond technical to psychosocial aspects.

However, findings also revealed challenges such as digital adaptation, personal data security, the risk of digital fraud, and the need for more intensive mentoring. Therefore, strengthening the lifelong literacy program needs to focus on providing elderly-friendly infrastructure, developing collections and services tailored to local needs, ongoing librarian training, and strengthening cross-sector collaboration. Public libraries serve as a pillar of lifelong literacy that supports intelligent, inclusive, and dignified aging. Although lifelong literacy programmes have demonstrated a positive impact, their implementation still faces a number of challenges, particularly in terms of digital adaptation, personal data security and the need for ongoing support. To overcome these obstacles, libraries need to adopt a step-by-step learning strategy with simple, context-based modules, provide repeated practical sessions, and strengthen digital safety literacy amongst older people. Furthermore, the involvement of librarians, literacy volunteers and the older people's community is essential to ensure more personalised and sustained support. Grouping participants according to their initial abilities can also help to create a more effective and inclusive learning process.

The technologies such as with augmented reality and virtual reality, the three libraries comprising the Semarang Regency Archives and Library Service, the Semarang City Archives and Library Service, and the Central Java Provincial Archives and Library Service present interactive and immersive learning experiences, making the lifelong literacy training process more engaging and multidimensional. The integration of shared workspaces, digital tools, and connectivity

encourages collaboration and innovation. The results of data analysis provide input regarding efforts to develop collections that suit the information needs of the elderly and optimize spatial layout, so that information resources can effectively meet the specific needs of the elderly group. Naikar & Paul (2025), stated that as the world becomes increasingly connected, smart libraries become a bridge between physical and digital knowledge, promoting lifelong learning, creativity, critical thinking, and digital literacy. Innovation by adopting technology while maintaining the values of inclusivity and training, smart libraries have the potential to change the way seniors access, share, and utilize knowledge.

Digitalization is transforming the educational landscape for older adults. Artificial intelligence supports active aging and independence by enabling personalized learning, facilitating social connections, and enhancing cognitive function. If seniors want to remain relevant in the contemporary world, they must enhance their digital skills and technological competencies to adapt to social transformations. They need to engage in digital communication and information exchange as members of society, even while facing barriers to using digital devices at home and in digital services that connect them to their communities. Artificial intelligence holds significant potential for enhancing education and lifelong learning for the older population. However, ethical considerations of privacy, data protection, accessibility, and equity must be considered. Espinoza (2026) notes that an inclusive design approach and cross-sector collaboration, from policymakers to educators and developers, are necessary to ensure equal access and empowerment for older adults.

In response to global aging trends, the use of artificial intelligence technologies for seniors, from virtual assistants to immersive virtual reality, is becoming increasingly important to address traditional educational barriers such as reduced cognitive abilities, digital literacy gaps, and limited mobility. As a recommendation for program strengthening, including policies to empower public libraries to integrate lifelong literacy programs to support intelligent aging and dignified living, strategies such as:

1. Strengthening digital infrastructure and library facilities. Regional and provincial governments need to allocate a dedicated budget for the development of digital infrastructure in libraries, including the provision of senior-friendly technology devices and stable internet access. Comfortable and safe social interaction spaces should also be a priority to support seniors' literacy and social activities.
2. Developing inclusive and adaptive literacy programs. Public libraries should design literacy programs tailored to the physical, cognitive, and social needs of seniors, such as training in the use of simple technology, group reading classes, and skills workshops relevant to seniors' interests. Learning modules should be flexible and easy to understand.
3. Elderly-friendly library programs. This program involves developing dedicated service corners with social inclusion programs that involve seniors to help them remain active, productive, and empowered.
4. Provision of special collections. Provision of books with large print to be eye-friendly for the elderly. Reading topics should also be relevant, such as health, religion, and hobbies, to maintain quality of life.
5. Multi-sector collaboration. Synergy between the government, educational institutions, senior communities, and the private sector must be strengthened to support funding, program development, and lifelong literacy campaigns. Policies that support the active

involvement of the community and relevant institutions will expand the program's reach and impact.

6. Basic literacy programs for the elderly. Examples of programs focus on specialized computer and internet training to help seniors master digital skills, such as basic internet use and online information searching.
7. Media literacy and mental health seminars. Media literacy programs teach how to evaluate digital information and recognize fake news. Mental health seminars feature psychologists who provide education and emotional support for the elderly.
8. Digital literacy training programs for the elderly. Periodic, multi-week intensive training covering smartphone use, digital health applications, social media, and digital security. These programs are complemented by personal mentoring, video-based learning materials, and hands-on practice.
9. Reading clubs and new skills workshops. Monthly reading clubs with books relevant to seniors, complemented by skills workshops such as crafts, healthy cooking, and the use of simple technology. These activities encourage social interaction and active learning.
10. Physical and social activities. Public libraries can organize activities that combine healthy exercise, fitness talks, community groups, and discussions to support active lifestyles for seniors.

Health literacy and health promotion influence the quality of life in the elderly (Çiftci, Yildiz, & Yildirim, 2023; Xie, et al., 2022). Meanwhile, communication is one of the most important elements for implementation in learning sessions for the elderly (Zaid, et al., 2022). Learning for the elderly needs to be implemented because the number of elderly people is increasing rapidly, followed by the ever-expanding development of technology. This condition encourages elderly people to participate in learning programs for the elderly or lifelong learning programs, which are considered a necessity. However, quite a lot of elderly people do not know how to manage their devices. Moreover, with the development of social media platforms and the increasing number of elderly internet users, disinformation can be a threat. Librarians can play a role in assisting the use of social media for the elderly. Libraries need to provide a diverse collection of elderly people according to their needs. Digital literacy is very important to be introduced to the elderly through library social inclusion programs. This is consistent with the results of research by Chen, et al., (2024) that digital literacy has a positive effect on risk perception, self-efficacy, subjective norms, and perceived behavioral control.

Health literacy plays a vital role in promoting healthy behaviours and fostering a deeper understanding of the health needs and health literacy of older people. Librarians in the senior collection services department play a strategic role in serving the elderly, a librarian training program is needed. This could include a librarian training workshop on inclusive and adaptive service approaches, and the development of a digital library with a collection of e-books, audiobooks, and interactive learning resources accessible from home by seniors. Librarians can play a role in providing user guidance, mentoring, and advocacy. Training and capacity building for librarians should be ongoing, focusing on inclusive service approaches, understanding the psychology of the elderly, and utilizing the latest information technology to support digital literacy. Librarians are at the forefront of connecting seniors with information resources and social activities.

Over the next generation, patterns of education for the elderly will change significantly (Benavot et al., 2022). Economic and social changes demand that education for the elderly no

longer be limited to the concept of lifelong learning. Education must play a multi-faceted role, providing solutions to various problems and strengthening individual competence and independence. Elderly education needs to be guided by a future orientation, just as education at other stages of life. For lifelong learning to truly become a pathway to sustainable development, empowerment, and recovery, it requires action beyond simply developing a new vision and must be sensitive to the consequences of inherited practices. Lifelong literacy, positioned as a smart solution, with libraries at the forefront, can shape responsive, relevant, and dignified education for the elderly. Elderly learning will vary significantly from generation to generation. However, most importantly, public libraries should be able to truly empower the elderly through their information resources, services, and librarians.

This study integrates the concept of lifelong literacy with smart and dignified living for the elderly in the context of public libraries that have developed a lifelong literacy program that is held regularly and sustainably. The literacy program includes user education, library promotion, a mobile library, a reading corner, and information literacy classes. This demonstrates the specific mechanisms by which public libraries support the dignified living of the elderly. Innovative strategies are needed to overcome challenges and make the Archives and Library Service of Semarang Regency, Archives and Library Service of Semarang City, and Archives and Library Service of Central Java Province effective information literacy agents. A practical model of the lifelong literacy program for the elderly can be implemented by other types of libraries. The research findings identified six stages of information literacy: task definition, information seeking, location and access, use of information, synthesis, and evaluation, which are implemented in library programs for older people. The role of public libraries in smart and dignified living, as a catalyst for reading, a source of information, a venue for informal education, educational recreation, and cultural enrichment.

CONCLUSION

The Archives and Library Office of Semarang Regency, the Archives and Library Office of Semarang City, and the Archives and Library Office of Central Java Province play a strategic role in supporting lifelong literacy as a smart solution for intelligent aging and dignified living. The elderly empowerment program is implemented through various structured, elderly-friendly activities. Lifelong learning is multidisciplinary, emphasizes continuity, underscores the interconnectedness of all segments, including the elderly, is inclusive, and emphasizes access to information. Through lifelong literacy programs, digital literacy, skills training, and social interaction spaces, the three public libraries in this study help the elderly improve their adaptability, reduce social isolation, and strengthen their mental well-being. Collaboration between the government, educational institutions, communities, librarians, and public libraries is essential to optimize this role. An inclusive approach, adaptive technology, participatory design, and cross-sector service integration enable public libraries to become a key pillar in realizing intelligent aging. Public libraries as smart libraries are not simply repositories of knowledge, but centers of lifelong literacy that facilitate meaningful, inclusive, and solution-oriented learning for the elderly. Public libraries can make elderly education relevant for every generation and contribute to a more independent and dignified life. For future programme evaluations, success can be measured by improvements in older people's digital skills, the frequency of their participation in library activities, their ability to access digital services independently, as well as a reduction in levels of social isolation and an increase in participants'

self-confidence. Libraries can devise policies that will help improve health literacy and health empowerment among older people. These indicators can be used as a basis for periodically assessing the programme's effectiveness and refining service design to make it more responsive to the needs of older people.

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