

Digital Literacy On Ai Apps For The Older Adults: A Systematic Review

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Abstract:

Background: Promoting digital literacy among older adults is crucial for their engagement in today's digital society. Targeted efforts, accessible technology, and AI applications can help overcome barriers and enable active participation. The aim is studying the effect of AI application that are utilized to support and enhance the digital literacy skills of older adults by quantitative research.

Methods: The conducted of this study is the various existing studies on the effect the AI application contribute to the development of digital literacy for older adults to standardize the results and clarify the effect of each method and indicator. The systematic literature review flow of PRISMA were used on original, peer-reviewed studies published from January 2020 to April 2024. The databases are SCOPUS, Education Research Complete, and ERIC. The search words were derived by combining keywords including PICO (Population: older adults aged ≥ 60 years; Intervention: AI application; Comparison: comparison group; Outcome: digital literacy). For any study, if one condition among subjects, intervention, comparison, or study design was different from those indicated, the study was excluded from the literature review.

Results: In total, 2 studies were selected for the systematics review. Publication bias was examined using the contour-enhanced funnel plot method to confirm the reliability and validity of the 2 studies.

Discussion: An AI application, organizations and developers can follow 10 steps to create innovative solutions that address the digital literacy gap among older adults' population, empowering them to fully participate in the digital world and stay connected with their communities.

Conclusions: AI application empower elderly individuals to navigate technology confidently, fostering social inclusion.

Keywords: Artificial intelligence, Apps, Older adults, Digital literacy, Systematic review.

1. INTRODUCTION

Population aging emerges as a paramount trend of the 21st century, carrying profound implications across societal domains. Globally, the frequency of individuals reaching their sixtieth birthday stands at two per second, cumulating to nearly 58 million annual celebrations of this milestone. As the demographic landscape evolves, with one in every nine individuals worldwide aged 60 years or older, a projection expects this ratio to escalate to one in five by the year 2050. Consequently, population aging emerges as an undeniable phenomenon demanding attention and proactive responses (United Nations Population Fund, 2012). United Nation (2015) defines "older person" as an individual, regardless of gender, aged 60 years or above. It further categorizes the societal integration of older individuals into three levels: (1) An "aged society" denotes a community where the population aged 60 years and above constitutes over 10% of the total population. (2) A "complete aged society" signifies a society wherein the population aged 60 years and above accounts for more than 20% of the total population, and (3) A "super aged society" characterizes a community in which the population aged 60 years and above surpasses 28% of the total population. In nations undergoing an early transition phase characterized by swiftly expanding and youthful populations, there exists a strategic interest in prioritizing investments in healthcare, particularly in areas pertaining to reproductive health and family planning, alongside initiatives in education and employment generation. Such endeavours aim to optimize the advantages arising from the forthcoming demographic dividend. Meanwhile, countries in mid-transition stages, marked by a sustained decline in fertility rates leading to the onset of a demographic dividend period, are advised to proactively fortify their social protection and healthcare frameworks in anticipation of impending population aging. Conversely, late-transition countries experiencing a surge in older demographics are urged to concentrate efforts on bridging gaps within their social protection systems

to ensure comprehensive coverage and equitable inclusion, thereby preventing any segments of the population from being marginalized (United Nations, 2023).

According to Simon Kemp's report, the current global internet user population stands at 4.57 billion individuals, representing a growth of over 7% compared to the previous year. Notably, the expansion of social media users has outpaced this rate, increasing by more than 8% since April 2019, reaching a total of 3.81 billion users. Although global social media usage has not yet reached the 50% penetration threshold, recent trends indicate that this significant milestone is likely to be surpassed before the conclusion of 2020. Additionally, there has been a notable rise in the number of individuals using mobile phones, with global user figures increasing by 128 million in the past twelve months (Simon Kemp, 2018). Keya Sen (2022) studied reveals that credibility in Internet information, knowledge, and experience are adaptable factors influencing the efficacy of technology. Engaging older adults at the community level, while adhering to best practices from the Community-Based Participatory Research model, is identified as a favourable approach. Furthermore, given the technological advancements over time, there is a need for thorough examination of the effectiveness of interventions utilizing instant messaging applications such as iMessage, WhatsApp, Instagram Direct, or Google Hangouts in addressing social isolation (SI) issues. The findings from such research endeavours have the potential to inform innovative and effective practices in technology-based interventions aimed at mitigating social isolation among elderly populations.

Artificial Intelligence technology or AI is increasingly employed to streamline daily routines, enhancing user experiences. These AI-powered virtual assistants facilitate various tasks, including calendar management, appointment scheduling, reminder setting, and organization of to-do lists. Leveraging natural language processing and machine learning, these assistants comprehend user preferences and dynamically adjust to meet individual needs, thereby facilitating seamless task management and ensuring efficient productivity (BriA'anna Lawson, 2023). Currently, artificial intelligence (AI) is being utilized to assist a wide range of individuals, including older adults and those with physical or mental disabilities. For instance, AI-powered assistive technologies employing deep learning are employed to recognize and process user images, aiding in the assessment of suitable assistive devices or adjusting settings according to user preferences. Robotics are also used to aid in daily activities such as household chores and basic tasks. Additionally, personalized communication and teaching technologies enable efficient communication and learning for older adults or those with communication impairments. Furthermore, sensor and Internet of Things (IoT) technologies are deployed to control and adjust household devices conveniently and securely. These applications aim to enhance the convenience, comfort, and independence of older adults and individuals with disabilities in their daily lives (National Academies Press (US), 2019).

The transition from analogue to digital technologies poses significant challenges, particularly for older adults. Encouraging elderly individuals to engage with technology is crucial for their independence and well-being. This necessity stems from societal shifts such as rising rates of living alone, migration for employment, and the separation of families, which contribute to increased isolation among older adults. Embracing technology can help bridge the generational gap and strengthen familial bonds. Digital literacy, the ability to effectively use digital tools and platforms, is essential for all individuals, including older adults, as it facilitates staying informed, safeguarding privacy, and ensuring online safety. Developing digital literacy empowers individuals to navigate the digital landscape adeptly, leveraging information creatively and responsibly for their benefit. Phnom Kleechaya (2023) studied revealed that the utilization of technology for the well-being of older adults, encompassing physical, mental, and social aspects, is lower compared to other age groups transitioning into old age. Deep analysis indicated that technology adoption among older adults is predominantly observed in work-related tasks, accessing welfare services and government assistance online, banking through mobile applications, online shopping, leisure activities, and fostering relationships with peers and younger family members. This aligns with findings from Danai Chaladkid (2020) studied which concluded that many elderly individuals do not use passcodes or lock screens on their phones due to perceived complexity, as they are still not fully accustomed to using smartphones in sophisticated ways. Additionally, elderly individuals find it convenient to have mobile phones accessible at all times, falling into the habit of constantly being within reach of their mobile devices. Moreover, elderly individuals may lack the knowledge of how to verify products before making online purchases, indicating a need for assistance in accessing accurate information to enhance

their digital literacy levels concerning rights, responsibilities, and cybersecurity in the digital age for older adults moving forward.

Based on the aforementioned discussion, researchers recognize the importance and necessity of synthesizing research on the effects of digital literacy using AI applications for older adults through a systematic review. This approach aims to summarize research findings and propose a conceptual framework for promoting digital literacy with AI technology. This framework will serve as a guideline for future research endeavours to enhance digital literacy among older adults through the utilization of AI applications.

2. METHOD

The first step involved conducting a preliminary literature review to determine definitions and get an overview of the research procedures being used. Second stage, involved undertaking a systematic literature review from the SCOPUS, Education Research Complete, and ERIC to identify papers with sufficient information for the research synthesis. To ensure standardization in the data collection, we use JBI Critical Appraisal Checklist for Quasi-Experimental Studies (Tufanaru C et al., 2017) to assess the methodological quality of a study and to determine the extent to which a study has addressed the possibility of bias in its design, conduct and analysis. Finally, a preliminary data analysis was performed to calculate descriptive statistics by analysing the variables related to a) the research papers b) the researchers and c) the research methodologies. To ensure a rigorous approach to reporting the procedure the PRISMA (Page MJ et al., 2020) guidance was followed.

2.1 Search Strategy

The researcher conducted a systematic search across the SCOPUS, Education Research Complete, and ERIC databases to identify articles published between January 2020 and April 2024. Search terms were formulated through a combination of keywords, utilizing the PICO framework (Population, Intervention, Comparison, Outcome). The specified population included adults aged 60 years and above, with the intervention focusing on AI application. Comparison was made with a control or comparison group, while the outcome of interest was digital literacy.

The search strategy incorporated the following terms: Population terms such as "older," "elderly," "older adult," "older people," "senior," "aging," and "aged"; Intervention terms encompassing "Artificial Intelligence" and "AI"; and Outcome term "digital literacy."

Studies were excluded from the literature review if any of the conditions pertaining to subjects, intervention, comparison, or study design deviated from the specified criteria.

2.2 Selection Criteria

The selection criteria for the research encompassed studies published in peer-reviewed journals written in English and readily accessible. These studies were required to incorporate experimental designs. Digital literacy, for the purposes of this investigation, was delineated as the proficient utilization of digital technologies for information retrieval, evaluation, comprehension, creation, and communication, alongside the possession of critical thinking abilities for the appraisal of digital content. Additionally, a comprehension of ethical considerations pertaining to digital conduct, privacy, and security was essential. Furthermore, the inclusion criteria stipulated a quantitative evaluation of the efficacy of digital literacy interventions utilizing artificial intelligence, with a focus on relevance to older adult's demographic.

2.3 Data collection and analysis

Quantitative research articles were selected for inclusion in the study. The researchers prioritized the examination of various outcome measures rather than the detailed statistical data analysis. The primary focus of the investigation pertained to two aspects: the utilization of AI applications and the attitudes of elderly individuals towards such technologies, with a view to potentially augmenting digital literacy. Within the results section, the articles were succinctly summarized based on their objectives, and further organized according to their principal findings.

3. RESULTS

Researcher identified 440 publications in the SCOPUS, Education Research Complete, and ERIC databases to identify articles published between January 2020 and April 2024. Following this, the titles and abstracts with duplicates were removed, 217 articles were identified as being potentially eligible for inclusion. From these, were removed because they were found to have non-Peer review, Proceeding paper, Wrong age group,

non-English publications, and not Digital literacy intervention. This left 11 articles potentially eligible for inclusion. Finally, 9 were removed because they were found to be not included in AI application intervention and non-Statistical. Therefore, 2 articles were included in the synthesis.

All of the selected papers reported experimental research that studied independent variables related to AI application interventions and dependent variables including Digital literacy in elderly as given in Figure 1.

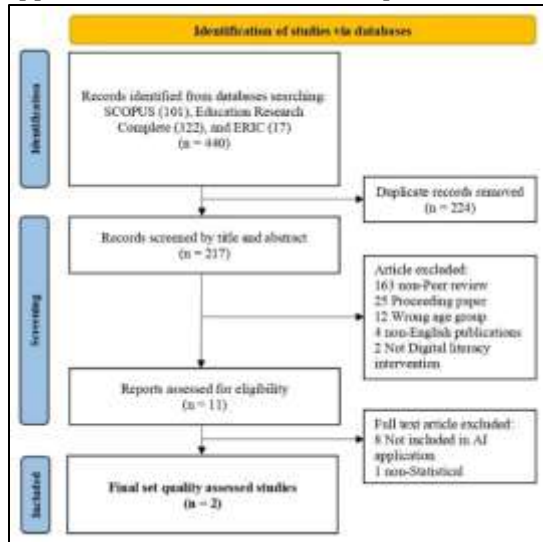


Figure 1. Flow diagram of article selection (This figure is adapted from Page MJ et al., 2020)

3.1 Characteristics of included studies

The characteristics of the 2 studies, including the population, intervention, and outcomes are described in Table 1. The selected studies were conducted between January 2020 and April 2024, and they evaluated the effectiveness of AI application on Digital literacy improvement in elderly aged ≥ 60 years. Two quantitative research articles were conducted, one in Thailand and the other in Korea. The combined population sample encompassed 445 individuals, consisting of 178 males, 266 females, and 1 transgender participant. Both studies investigated the application of artificial intelligence (AI) in distinct designs: the first study employed a chatbot, while the second utilized a Decision Tree Education Program as interventions. The findings from both studies indicate a notable improvement in digital literacy among older adults following the implementation of the respective interventions. The quality assessment of the studies, conducted using the Joanna Briggs Institute (JBI) critical appraisal checklist, yielded ratings ranging from high to medium quality.

Table 1: The characteristics of the studies

Author s (year)	Count ry of origin	Study design	Objective	Pop u- lation (N)	Gender and Age	Intervent ion	Outcome	Results of Digital literacy	Quali ty Asses s- ment
Kanyar at Sriwisat hi- yakun (2022)	Thaila nd	Quantita tive	to enhance the digital literacy skills with an intelligent conversati onal agent.	422	Gender; Male=165, Female=25 6, Transgend er=1 Age; 60-69=401, 70-79=19	AI apps; “Senior See Net” chatbot	The developme nt of learning content and media must consider the target audience's needs. This study used survey data and	Senior citizens showed strong digital literacy in accessing digital media (mean score 3.78) using smartpho	High

Author s (year)	Count ry of origin	Study design	Objective	Pop u- latio n (N)	Gender and Age	Intervent ion	Outcome	Results of Digital literacy	Quali ty Asses s- ment
							literature to design the Senior See Net demonstr chatbot, ated enhancing moderate seniors' skills in digital analyzing literacy news, through evaluating self-paced, values, autonomo participati us learning. ng in Findings social indicated agendas, seniors and using preferred technolog features y for social like image- change based (mean description scores s, large ranging fonts, and from 3.10 interactive to 3.46). education. This aligns with principles advocating simplicity and avoiding visual clutter. Additionall y, simpler chatbots elicited more positive user responses compared to complex animated avatars, reinforcing	nes or tablets, but demonstr moderate skills in analyzing news, evaluating values, participati ng in social agendas, and using technolog y for social change (mean scores ranging from 3.10 to 3.46).	

Author s (year)	Count ry of origin	Study design	Objective	Pop u- latio n (N)	Gender and Age	Intervent ion	Outcome	Results of Digital literacy	Quali ty Asses s- ment
Eunsun Choi (2022)	Korea	Quantita tive	an educationa l program that combines IT and humanitie s to improve digital literacy in the elderly.	23	Gender; Male=13, Female=10 Age; 60- 65=12, 65- 79=11	AI apps; Decision Tree Educatio n Program	the need for straightfor ward design The outcome of the IT Humanitie s Education Program to Improve Digital Literacy of the Elderly research focuses on the effectivenes s of a specific educational interventio n aimed at enhancing digital literacy among older adults. The research likely evaluates the impact of the program on participant s' knowledge, skills, and confidence in using digital technologie s. It may also assess any	The experimen tal group exhibited a statisticall y significant improvem ent in digital literacy capabilitie s ($p < .05$), whereas the comparati ve group showed improvem ent that was not statisticall y significant ($p > .05$), indicating the effectiven ess of the interventi on in enhancing digital literacy skills.	High

Author s (year)	Count ry of origin	Study design	Objective	Pop u- latio n (N)	Gender and Age	Intervent ion	Outcome	Results of Digital literacy	Quali ty Asses s- ment
							changes in participant s' attitudes towards technology and their overall engagement with digital platforms. Additionally, the research might explore the feasibility and scalability of the program, considering factors such as resource requirements and participant satisfaction . Overall, the outcome of the research aims to provide insights into the efficacy of IT humanities education in addressing the digital divide among older		

Author s (year)	Count ry of origin	Study design	Objective	Pop u- latio n (N)	Gender and Age	Intervent ion	Outcome	Results of Digital literacy	Quali ty Asses s- ment
							population s and inform future initiatives in this area.		

3.2 The ten steps of AI application development are to determine outcomes

To create an AI application for assessing digital literacy in elderly individuals, based on research from studies by Kanyarat Sriwisathiyakun (2022) and Eunsun Choi (2022), follow the ten steps outlined in Figure 2.

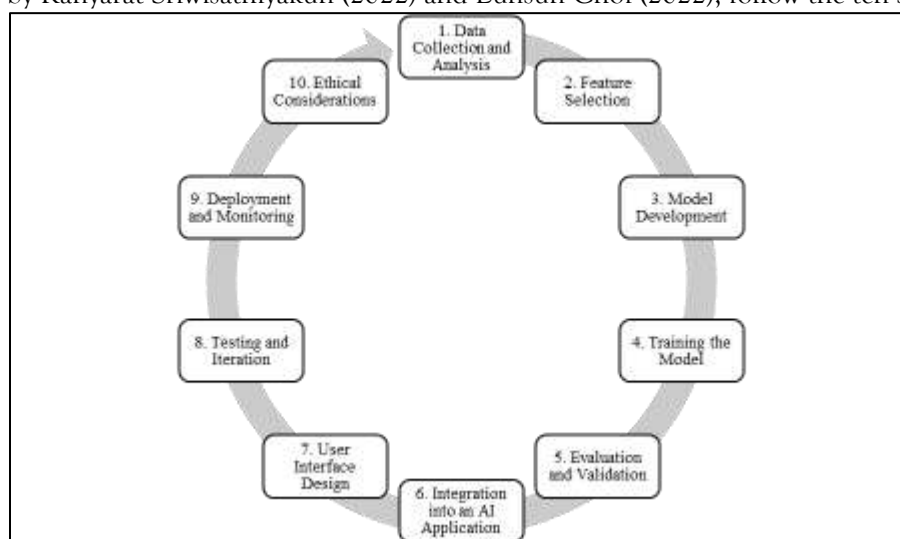


Figure 2. The ten steps to Creating an AI application to determine digital literacy for older adults (Researcher) Figure 2. Illustrates the ten steps involved in creating an AI application to assess digital literacy for older adults. The details are as follows;

1. Data Collection and Analysis - These studies likely include information on the types of technological support services provided to seniors, their usage patterns, and the effectiveness of intelligent conversational agents in enhancing digital literacy.
2. Feature Selection - Identify key features or indicators of digital literacy for older adults based on the findings of the research studies. These features could include frequency of technology usage, proficiency in using different digital tools, confidence levels with technology, etc.
3. Model Development - Utilize machine learning techniques to develop a predictive model for digital literacy. This model should take into account the identified features and use them to predict the level of digital literacy for elderly individuals.
4. Training the Model - Train the model using data collected from the research studies. This involves feeding the model with input data and corresponding output labels.
5. Evaluation and Validation - Evaluate the performance of the trained model using appropriate metrics. This step ensures that the model accurately predicts digital literacy levels for older adults based on the input features.
6. Integration into an AI Application - Develop an AI application that incorporates the trained model. This application should take input data from elderly users and use the model to assess their digital literacy level.
7. User Interface Design - Design a user-friendly interface for the AI application, keeping in mind the needs and preferences of elderly users. The interface should be intuitive and easy to navigate.

8. Testing and Iteration - Test the AI application with elderly users to gather feedback and identify areas for improvement. Iterate on the design and functionality based on user input to enhance usability and effectiveness.

9. Deployment and Monitoring - Deploy the AI application for use by elderly individuals, either independently or through organizations that provide support services for seniors. Continuously monitor the application's performance and gather feedback for further refinement.

10. Ethical Considerations - Ensure that the AI application respects user privacy, maintains confidentiality of data, and operates in an ethical manner. Provide clear information to users about how their data will be used and stored.

By following these steps, The AI application endeavours to bolster the digital literacy of elderly individuals by guiding them through a series of steps. Its goal is to enhance their proficiency with technology while prioritizing ethical standards and safeguarding user privacy.

4. DISCUSSION

The findings from two articles contribute to the current body of knowledge on digital literacy and AI applications aimed at combating it for older adults. These key findings allow us to develop a critique of existing literature, identify limitations in the body of evidence, and make suggestions for further exploration. The article underscores the significance of customized technological interventions in augmenting digital literacy among elderly populations in Thailand and Korea. Within the Thai context, the focus centres on intelligent conversational agents designed to serve as personalized guides, assisting seniors in navigating digital platforms through step-by-step guidance and support (Kanyarat Sriwisathiyakun, 2022). Conversely, in Korea, priority is given to technological support services, pivotal in facilitating seniors' access to and mastery of digital technologies via tailored training, assistance, and resource provision (Eunsun Choi, 2022). Collectively, both nations underscore the importance of tailored strategies in fostering digital literacy and inclusivity among older cohorts. This aligns with the research of Keya Sen (2022) and Simon Kemp (2018), which accentuates the transformative influence of technology on global interconnectedness and emphasizes the imperative of harnessing technological advancements to effectively address societal challenges.

The process of developing and implementing an AI application to assess digital literacy among elderly individuals comprises ten sequential steps. It initiates with data gathering from research endeavours conducted in both Korea and Thailand, progresses to feature curation, and culminates in model construction utilizing machine learning methodologies. The resultant model is then integrated into an AI application equipped with a user-friendly interface tailored to suit elderly users. Subsequent stages involve rigorous testing and iterative refinement of the application's design and functionality to ensure optimal usability. Upon deployment, ongoing monitoring of the application's performance and solicitation of user feedback are conducted, facilitating continuous refinement based on user input. Ethical considerations, encompassing privacy, confidentiality, and transparency concerning data utilization, are paramount throughout the process. Furthermore, this methodology aligns with the design principles delineated by Selma Dilek (2014), which advocate for the application of AI techniques to augment human efforts in combating cybercrimes, owing to their inherent adaptability and learning capabilities. Dilek underscores the imperative of intelligent decision support systems in cyber defence, which can be effectively realized through the utilization of AI methodologies. Additionally, the ten-step design process aligns with the systematic analysis framework provided by The ADDIE model, widely adopted by educational designers and training programmes for developing education and training programs. Originating in 1975 at the University of Florida, the ADDIE model's acronym represents its foundational steps: Analysis, Design, Development, Implementation, and Evaluation (Adamantia G. Spatioti, 2022).

Finally, to underscore the imperative of tailored interventions in promoting digital literacy among elderly populations, stakeholders can effectively address the distinctive needs and hurdles confronted by seniors in embracing digital technologies through the utilization of AI applications like intelligent conversational agents and the implementation of targeted technological support services. These concerted endeavours not only augment digital literacy but also contribute to the overarching digital inclusion of older individuals, ensuring their full participation in the digital world.

5. Limitations

In this systematic review, several limitations should be considered when interpreting the findings. First, the review was restricted to studies published in English, potentially introducing a language bias. Our search strategy, which included SCOPUS, Education Research Complete, and ERIC, might not have captured all relevant studies, particularly those in non-indexed journals. The included studies varied significantly in methodological quality, with some featuring small sample sizes and lacking control groups, affecting the overall robustness of the evidence. There is also a risk of publication bias, as studies with positive outcomes are more likely to be published. Data extraction was performed by a single reviewer, introducing potential bias, and the heterogeneity of study designs precluded a meta-analysis, necessitating a narrative synthesis of results. Furthermore, AI apps is the lack of extensive research in the field. Since AI technology is relatively new, there may be insufficient data and studies available to thoroughly understand its potential limitations and capabilities. This can result in uncertainty about the reliability, accuracy, and ethical implications of AI applications. Additionally, the rapid pace of technological advancements may outpace the rate at which research can be conducted, leading to gaps in our understanding of AI's long-term effects on society, privacy, and employment. This shortage of research may hinder the development of effective regulations and policies to ensure the responsible use of AI technology. Lastly, given the rapid advancements in the field, more recent studies may offer different insights not captured in this review.

6. Suggestion

The study on digital literacy and AI implementations among older adults provides valuable insights and recommendations for both current application and future research endeavours. Firstly, it suggests implementing personalized technological remedies tailored to assess digital literacy among seniors. The systematic approach outlined, comprising ten essential steps, underscores the importance of individualized interventions to enhance older adults' engagement in the digital world. However, several limitations need consideration. The study's focus on English publications introduces a potential language bias, warranting future research to include multilingual studies for a more comprehensive understanding. Additionally, efforts to expand search strategies beyond indexed journals can mitigate the risk of overlooking relevant literature. Future research should prioritize methodological rigor, with larger sample sizes and standardized methodologies to enhance the reliability of findings. Addressing publication bias through comprehensive reporting of outcomes is essential. Robust data extraction processes involving multiple reviewers can minimize bias and enhance the credibility of systematic reviews. Longitudinal studies are crucial to track the long-term effects of AI on digital literacy among older adults. Ethical considerations, such as privacy and bias, should be central to future research efforts. Collaboration between researchers, policymakers, and industry stakeholders is vital for developing effective regulations and policies to ensure the responsible use of AI technology. Continuous monitoring of technological advancements and integration of recent insights from newer studies are essential to inform interventions and policies effectively. Overall, applying these suggestions can advance our understanding of digital literacy and AI implementations among older adults while promoting their active engagement in the digital community.

7. CONCLUSIONS

AI application empowers elderly individuals to navigate technology confidently, fostering social inclusion.

Declarations: Author contribution statement

Author have significantly contributed to the development and the writing of this article.

Competing interest statement; The authors declare no conflict of interest.

Additional information: This paper was reviewed for grammatical accuracy by Claude.

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