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Recent issues of elderly intergenerational instructional strategies: a scoping review

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ABSTRACT

This scoping review investigates instructional strategies implemented in recent studies to enhance the digital application usage experience for the elderly, addressing emerging issues in the context of a rapidly aging global population. With the World Health Organization predicting a significant increase in the proportion of individuals aged 60 years and above by 2030, the imperative for digital literacy among the elderly becomes crucial. The review, drawing from 14 eligible articles sourced from Web of Science and Scopus, categorizes findings into two main themes: i) intergenerational strategies of instruction and ii) contemporary issues associated with intergenerational approaches. By exploring these dimensions, the paper provides valuable insights for researchers seeking to understand and tackle current challenges in instructing the elderly on digital applications, contributing to the ongoing discourse on improving the quality of life for the aging population through digital technology.

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1. INTRODUCTION

According to the World Health Organization (WHO) [1], by 2030, estimated that 1 in 6 people in the world will be aged 60 years and above. WHO also stated that between 2015 and 2050, the proportion of the world's population over 60 years will nearly double from 12 to 22%. This data proves that global population growth shifts towards an ageing society. The government of Malaysia defined the elders as individuals aged 60 and above. While Department of Statistics Malaysia [2] expects that Malaysia will experience an ageing population in 2020, when the percentage of the population aged 65 and above reaches 7.2%. This scenario is parallel with the world's rapid digitalization and makes digital literacy become increasingly important for the elderly. Czaja *et al*. [3] stated that digital literacy is important because digital technology become a central role in every aspect of daily life.

A previous study conducted by LoBuono *et al*. [4] has identified the common technology used by the elderly such as basic functions, staying connected, organization, leisure, managing photos, productivity, managing money and health. There are many features and applications to help the elderly's quality of life become much better. The applications can be run on compatible devices such as mobile phones/smartphones, tablets, and computers. Moreover, technology also can be described as constantly changing, evolving, and

infiltrating every aspect of life [5]. This rapid evolvement become a problem for the ageing society because they are used to a slow-paced and closely connected world [6]-[8]. This situation creates a gap between the elders and the technology making them incompetent to use the technology and seek support to use technologies either with the family [9], [10] or non-family [4], [11]-[15].

Some elders faced digital exclusion due to the increment of reliance on technology for healthcare, health information, and public health resources [16]. This condition makes the elders forced to adapt to digital technologies, especially during the COVID-19 pandemic [17]. The limited activity during COVID-19 makes the social isolation faced by the elders become worse and affects their mental health making digital applications become the only way to connect them with family and friends [18]. Intergenerational instructional strategies conducted by previous studies provided beneficial effects and addressed this problem [5], [9], [10]-[15], [17]-[22]. This scoping review will provide a list and explore the instructional strategies and the recent issues that have been discussed by other studies related to the intergenerational approach.

2. RESEARCH METHOD

The scoping review has been selected for this study to identify the instructional strategies used recently to improve the experience of using digital applications by the elders. The study follows the framework outlined by Arksey and O'Malley [23], the scoping study must be conducted in five stages which are: i) identification of research question, ii) identification of relevant studies, iii) published articles selection, iv) charting the data, and v) summarizing the collected data. Thus, the study can identify the issues from the previous study regarding the digital application of intergenerational instructional strategies. Figure 1 shows the scoping review framework flow to enhance the visualization of this study process.

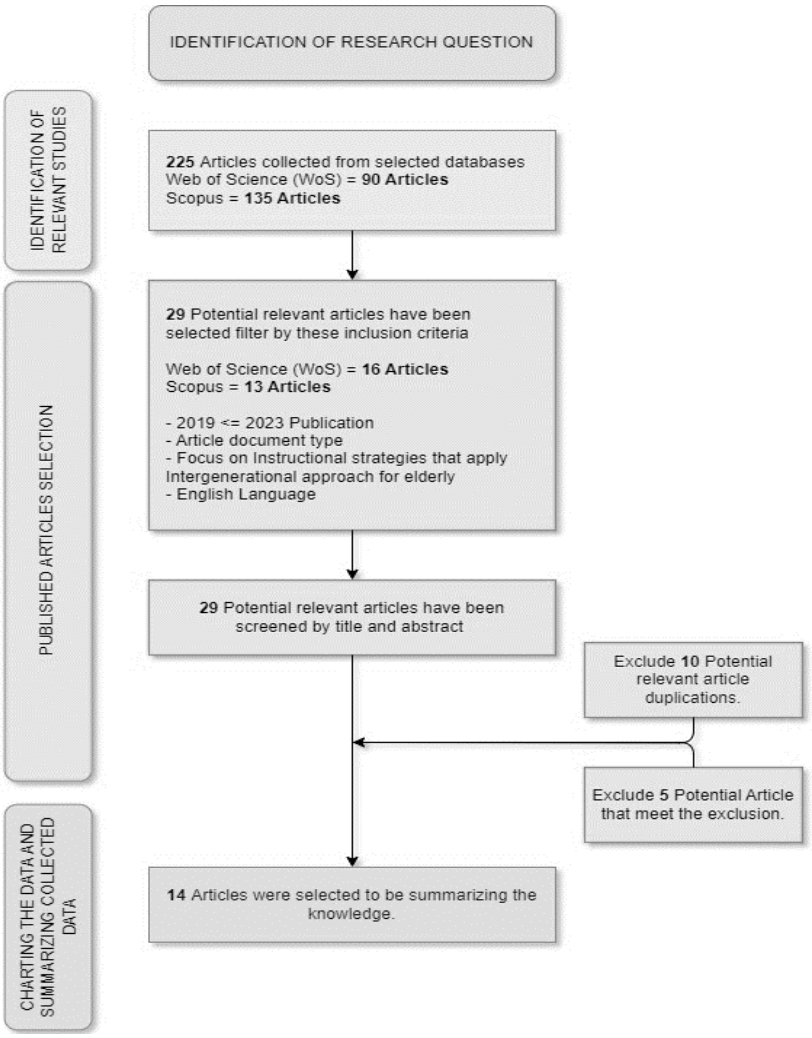

Figure 1. Scoping review framework flow

The gathered data should be able to generate meaningful objectives and eligibility criteria for the scoping review [24]. To collect related data precisely and meet the first stage of the scoping review, the study designed the research question using the population, concept, and context (PCC) framework recommended by the Joanna Briggs Institute (JBI) [25]. The PCC framework will guide the study in constructing potential data items of interest [26] and developing research questions. Aromataris and Munn [27] stated that developing research questions based on the PCC framework will help the study develop a search strategy to find relevant literature by breaking down and categorizing the research questions into separate components. In conclusion, the research questions can serve as the foundation for the entire paper.

The study's goal is to identify instructional strategies that have recently been used to improve elderly users' experiences with digital applications, including recent issues. Along with the objective, the study seeks questions in order to gather prominent content on this topic. Based on the implementation of the PCC framework, the question is as follows: i) What are the current digital application instructional strategies that use intergenerational approaches and are effective with the elderly? and ii) What are the issues raised in the previous study regarding the digital implementation of intergenerational instructional strategies?

Identifying relevant studies will enrich the scoping review content with information from previous studies that will be useful in future studies. The formulated questions can help construct search keywords for the corresponding articles [28]. The keyword selection aids in the use of synonyms from the online thesaurus, which will be concatenated with the Boolean and/or operator, truncation, and wildcards embedded to form the search string shown in Table 1. The search string input entered into the Web of Science and Scopus search engines is executed to produce the best results. As stated in the previous study [29], [30], both databases have certain advantages such as advanced search functions, extensive findings with over 5,000 publishers, article quality preservation, and the provision of multidisciplinary resources [31].

Article selection regarding the topic needs to be specified to prevent bias in the review and promote the validity of the findings mentioned by Salmond and Bennet [25]. Moreover, to determine which studies to include in the review, more than one author should redo the selected approach, to make sure the most influential decisions can be identified in the review process [32]. Based on Table 2, the study develops the inclusion and exclusion of the selected articles to narrow down the results provided by the databases to ensure the homogeneity of the articles is adequate [25]. These criteria will be filtered by using the databases' features that have been provided. The results from both databases sometimes provide the same result. Thus, any duplicate publication is excluded to avoid redundancy of data.

The selection of articles for this study focuses on publications spanning from 2019 to 2023. This timeframe was chosen because the search commenced in December 2023, necessitating the inclusion of recent data from prior studies. Employing a strategy suggested by Higgins and Deeks [32], this method minimizes the risk of publication duplication by considering distinct periods of recruitment. Additionally, Okoli [28] recommends this approach for determining publication dates post-search initiation. To uphold the quality of the review, articles selected are strictly of the "article" document type, and preference is given to English-language publications. This choice is motivated by the need to prevent mistranslations, confusion, and misunderstandings [31] that may arise during the review process. In the subsequent screening phase, articles related to instructional strategies and intergenerational aspects for the elderly will be assessed based on their titles and abstracts. Any articles deemed irrelevant will be excluded [32].

The relevant articles were organized according to the research questions, and the data were analysed to identify the implemented strategies and issues discussed in previous studies to address the research questions. The information extracted from the articles that address the research questions has been categorized in the table. This table aids in visualizing the data more clearly and facilitates the summarization of information with ease. Table 3 displays the instructional strategies used in previous studies, including the authors, country and titles. Table 4 presents the current issues mentioned in the selected articles. Detail explains in result and discussion.

Table 1. Search strings

Database	Search string
Web of Science	**TS** = (("effect*" **OR** "benefit*" **OR** "advantage*" **OR** "outcome*") **AND** ("digital* application*" **OR** "digital*" **OR** "application*" **OR** "software") AND ("strateg*" **OR** "method*" **OR** "design*" **OR** "instruct*" **OR** "teach*" **OR** "instruction* strateg*" **OR** "instruction* design*" **OR** "instruction* method*") **AND** ("intergeneration* approach*" **OR** "intergeneration*" **AND** ("Elder*" **OR** "older*" **OR** "senior*" **OR** "older* adult*"))
Scopus	**TITLE-ABS-KEY** ((“effect*" **OR** "benefit*" **OR** "advantage*" **OR** "outcome*”) **AND** (“digital* application*" **OR** "digital*" **OR** "application*" **OR** "software”) **AND** (“strateg*" **OR** "method*" **OR** "design*" **OR** "instruct*" **OR** "teach*" **OR** "instruction* strateg*" **OR** "instruction* design*" **OR** "instruction* method*”) **AND** (“intergeneration* approach*" **OR** "intergeneration*") **AND** (“Elder*" **OR** "older*" **OR** "senior*" **OR** "older* adult*"))

Table 2. Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Publish years	2019 until 2023	Less than 2019
Document type	Article	Book, Chapter in book, Book series, Conference Proceeding, Review Article
Language	English	Non-English
Approach/Focus	Instructional strategies, Intergenerational for elderly	Other approach, too-medical centered, application development, intergenerational for younger generation, application design

Table 3. Strategies implementation

No	Years	Authors	Country	Title	Strategies
1	2023	Mannheim *et al*. [5]	Netherland	An "ultimate partnership": Older persons' perspectives on age-stereotypes and intergenerational interaction in co-designing digital technologies.	Intergenerational interaction
2	2023	González-Afonso *et al*. [17]	Spain	Is Virtual Communication Possible in Intergenerational Programs? The SIMUL Project	
3	2022	Niksirat *et al*. [19]	Japan, Switzerland	Understanding intergenerational fitness tracking practices: 12 suggestions for design	
4	2023	Dorris *et al*. [22]	United States	Project Unmute: A Digital Music Program Delivered by Adolescent Musicians to Older Adults with Cognitive Decline	
5	2022	Wang *et al*. [20]	Taiwan	Construction of a Tangible VR-Based Interactive System for Intergenerational Learning	
6	2022	Appel *et al*. [21]	Canada	VRCHIVE: experiences conducting an online workshop teaching intergenerational participants to create virtual reality films about their lives during the COVID pandemic	
7	2022	Brandão *et al*. [18]	Brazil	Playing remotely in times of crisis: A program to overcome social isolation	
8	2023	Avci and Eren [11]	Turkey	Intergenerational Interdisciplinary Reverse Mentoring: School-University Collaboration	Intergenerational learning
9	2019	Leedahl *et al*. [13]	United States	Implementing an Interdisciplinary Intergenerational Program Using the Cyber Seniors ® Reverse Mentoring Model Within Higher Education	
10	2023	Leedahl *et al*. [12]	United States	Using a Quasi-Experimental Study to Examine Program Participation and Outcomes for Older Adult Intergenerational Technology Program Participants	
11	2022	Cheng *et al*. [10]	China	Bridging the Digital Divide for Rural Older Adults by Family Intergenerational Learning: A Classroom Case in a Rural Primary School in China	
12	2023	Matenga-Ikihele *et al*. [9]	New Zealand	Navigating digital inclusion and the digital vā among Niue mamatua through the provision of mobile phones during COVID-19	
13	2020	Lee *et al*. [15]	Korea	Life Review Using a Life Metaphoric Game to Promote Intergenerational Communication	
14	2021	Lee *et al*. [14]	Korea	Mobile Game Design Guide to Improve Gaming Experience for the Middle-Aged and Older Adult Population: User-Centered Design Approach	

Table 4. Recent issues from previous studies

No	Years	Authors	Recent issues
1	2023	Mannheim *et al*. [5]	Ageism and age-stereotypes
2	2022	Niksirat *et al*. [19]	
3	2019	Leedahl *et al*. [13]	
4	2023	Leedahl *et al*. [12]	
5	2020	Lee *et al*. [15]	
6	2021	Lee *et al*. [14]	
7	2023	González-Afonso *et al*. [17]	Adaptation to digital technology
8	2023	Avci and Eren [11]	
9	2022	Cheng *et al*. [10]	
10	2023	Matenga-Ikihele *et al*. [9]	
11	2020	Lee *et al*. [15]	
12	2022	Wang *et al*. [20]	
13	2022	Appel *et al*. [21]	
14	2019	Leedahl *et al*. [13]	
15	2022	Niksirat *et al*. [19]	Social isolation
16	2023	Matenga-Ikihele *et al*. [9]	
17	2022	Brandão *et al*. [18]	
18	2023	Dorris *et al*. [22]	
19	2022	Appel *et al*. [21]	

3. RESULTS AND DISCUSSION

Based on Figure 1, this study retrieved 14 eligible articles from the World of Science and Scopus databases. The intergenerational study for the elderly using digital technology was conducted in 12 countries: the Netherlands, Spain, Japan, Switzerland, the United States, Taiwan, Canada, Brazil, Turkey, China, New Zealand, and Korea. Previous studies implemented the intergenerational approach with various devices to enhance the elderly's experiences and facilitate their adaption of technological appliances for daily routines. The devices used in these previous studies included smartphones, tablets, computers, and, more recently, virtual reality machines.

The study formulated two research questions, as stated earlier: i) what are the currently used digital application instructional strategies using intergenerational approaches that are effective for the elderly? and ii) what are the issues from the previous study regarding the digital application of intergenerational instructional strategies? To address these questions, the study analysed the retrieved articles and categorized them into two tables that summarize the information extracted from the articles. According to Table 3, many studies focused on two types of strategies: intergenerational interaction and intergenerational learning.

3.1. Intergenerational interaction strategies

Intergenerational interaction strategies play a crucial role in promoting social exchanges and fostering communication for both the young and old generations. Collaboration between both generations shows a positive significant to improve their interaction. Reseachers [3], [5], [15], [17], [19] conducted a collaborative study involving both generations to complete a common project. Elders who willingly participated were instructed by researchers to express their perspectives and experiences, making a significant contribution to the project. The elders felt respected during collaboration sessions, as their feedback was thoughtfully considered and implemented in the project. Additionally, they had the opportunity to learn from the younger generation about the current digital application. This not only made them more willing to embrace new digital applications but also encouraged their active contribution to the other elders.

This intergenerational strategy represents best practices, contributing to the development of more user-friendly technological products for the elderly. Involving the older generation in digital application development projects enhances understanding, emphasizing the importance of certain aspects in designing technological products [33], [34]. Additionally, Dorris *et al*. [22] conducted a study to learn how music programming can benefit both generations by allowing them to work together using social constructivism that promotes learning through shared experiences from both generations [35]. However, it is important to note that this approach is particularly suitable for the elderly who are familiar with the basics of digital technology. Nevertheless, it remains a one-way method for sharing information between both generations during collaboration.

During the COVID-19 pandemic in 2020 to 2021, face-to-face learning became limited. Although digital technology enables remote interaction, it may not be the most effective strategy for conducting intergenerational programs. González-Afonso *et al*. [17] conducted a study evaluating the feasibility of remote intergenerational programs using Google Meet in the SIMUL project. Remote interactions facilitate knowledge sharing anywhere and anytime, but their success depends on internet connectivity, device availability, and suitable meeting spaces. González-Afonso *et al*. [17] found that interactions between

generations were developed, but generational group barriers were not broken down, affecting both generations' ability to form a single cohesive group.

However, remote interaction introduces greater variation in activities compared to face-to-face style. Brandão [18] conducted a study during the COVID-19 pandemic, exploring remote play to enhance the well-being and social connections of the elderly. They proposed art-related activities such as clowning, dancing, storytelling, and cooking, forming four groups for each activity to be live-streamed simultaneously for three months. This approach emphasizes creating meaningful and enjoyable communication situations to encourage social interaction. The younger generation actively participated in the program, taking responsibility for assisting the elders if any issues arose. Even though this strategy proves benefits for educating and instructing the elderly through live streams, it is important to note its dependency on success. The elderly should receive support from a family member to facilitate the setup process [18].

Furthermore, virtual reality (VR) technology opens a new strategy for the researcher to conduct the study regarding the intergenerational program. VR promote new interfaces that are different from graphical user interfaces (GUIs), the brand-new user-interfacing concept proposed by Ishii and Ullmer [36] called tangible user interfaces (TUIs) allows the users to operate the interfaces without struggling to understand the mechanism by performing movement such as moving, grabbing, flipping, and knocking, and optional way that are suitable for controlling human-computer interface. TUIs allow a tangible form to employ digital information or run programs [37]. Previous study has focused on intergenerational learning by using this VR-based interactive system for such activities between both generations. Figure 2 shows the TUI concept in the illustration form.

Wang *et al*. [20] integrated the uses of VR and TUIs with conventional learning and found that communication, learning, and interaction between both generations were strengthened by performing multiple interaction techniques and immersive experiences. Figure 3 shows the illustration for the VR-based interactive system conducted by Wang *et al*. [20]. Besides, Appel *et al*. [21] conducted an online workshop to teach participants to create virtual reality films about participants lives during the COVID-19 pandemic. The study included a pilot workshop where intergenerational pairs of both generations shared life experiences and learned from each other. The participants also learned to use 360° VR cameras to capture personal stories, share experiences and create meaningful memories. Both studies gained positive feedback from the participants and reported there are no negative impacts of the program on their feelings of isolation, connectedness to other people or confidence in learning technology.

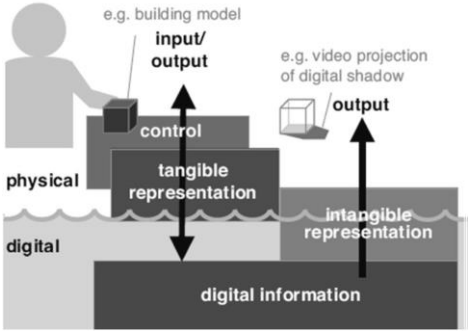

Figure 2. Tangible user interfaces

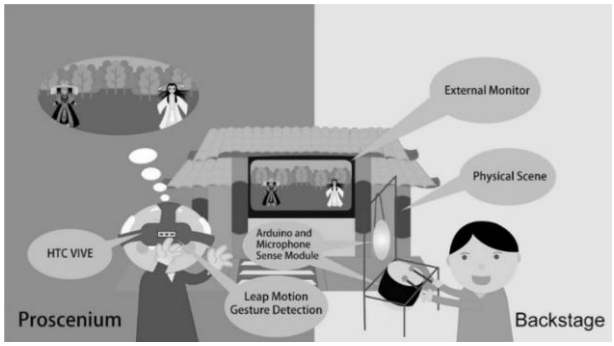

Figure 3. VR-based interactive system

3.2. Intergenerational learning strategies

In contrast to intergenerational interaction strategies, intergenerational learning promotes the knowledge and skills being passed down, exchanged and shared between different generations. The first intergenerational learning strategy that applied by the previous study is reverse mentoring. Reverse mentoring can be defined as engaging young people to educate the elderly about information technology (IT) as a mentor [13], [38], [39]. For example, the reseachers [11]-[13] implement and promote the reverse mentoring application in their study by letting the young generation be a mentor to the older generation to improve elders' adaption to digital application usage. Reverse mentoring can be beneficial for both generations. As listed by Murphy [40] young generations as a mentor can enhance their leadership skill and the older generations as a mentee may gain technical proficiency and cultural awareness.

Furthermore, intergenerational learning can be done in two ways, either with family members or non-family members. Children and grandchildren act as important social support networks for elders' family members to learn how to navigate new technology [41], [42]. Previous studies implemented family intergenerational learning (FIL) because Cheng *et al*. [10] believes that this strategy is a more practical and individualized strategy to help elders gain digital literacy and Matenga-Ikihele *et al*. [9] found that elders will become motivated to maintain connection with people important to them. Matenga-Ikihele *et al*. [9] discusses that intergenerational learning with family can be done with small steps of instruction using repetition and writing down notes to help the comprehension of the elders. FIL strategies help elders to gain knowledge about digital society, improve digital skills, change lifestyles [10], and strengthen intergenerational connections [9].

Lastly, learning can be expressed in many ways. One of them is playing. Elders can learn digital applications by joining the intergenerational play workshop to improve their digital literacy. For example, the previous study conducted by Lee *et al*. [14], [15] used intergenerational play strategies to enhance the communication and interaction between both generations and help the elders play games on mobile phones with the help of younger generations as a guide for them. During co-playing, the younger asked questions to the elders to promote reminiscence [15]. There are many benefits from this activity, such as reinforcing family bonds [43], both generations mutual understanding [43], [44], reducing social anxiety [43], and developing positive perceptions toward other age groups [45]. Figure 4 shows the photographs from the intergenerational play workshop conducted by Lee *et al*. [14].

Figure 4. Photographs from the intergenerational play workshop

3.3. Ageism and age-stereotypes

The emergence of each strategy discussed earlier must have a reason. Recently, many of the studies highlight that ageism and age stereotypes related to the technology used and development become problematic [5], [12]-[15], [19]. Before the study elaborates more on this problem, it is important to know what ageism and age stereotypes is. Ageism can be defined as a part of stereotypes, discrimination and prejudice [46]. Agism can be affected by many generations, but commonly the older generations face it the most [47]. Age stereotypes toward the elders related to digital technology are the assumption of lower technological abilities, chronic illness, dependence, frailty and non-adaption of technology [48].

The elders commonly known as the homogenous group of 'non-users' have the complex representation and approaches to implement the technology in their lives [49]. This issue leads developers and application designers to be insensitive to the technological experiences of elders [14] and exclude the elders from the research and design of digital technology [50]. Elders are often perceived as if they cannot contribute useful insights to the design process [50]. Therefore, intergenerational programs, studied by many, aim to enhance digital adaption among the elderly, fostering interaction and communication between generations, ultimately improving and bridging the generation gap [12], [13].

3.4. Adaptation to a digital technology

The fast-paced realm of digital technology and the COVID-19 pandemic limit face-to-face interaction from past events, forcing the elders to adapt to digital technology [17]. The pandemic affected the behaviour of people interacting, such as learning, work, health, faith-based services, shopping and maintaining social connections with family and friends [51], [52]. However, these activities can work in other ways, virtually and reduce the spread of the COVID-19 virus. Thus, one of these reasons proved that technology plays a central role in various aspects of everyday life [3]. Although digital technology can enrich the lives of individuals, elders often encounter barriers to accessing useful and practical digital tools due to low skills, leading them to become digitally excluded [9].

The previous study indicated that elders who engaged in training programs focused on digital technology demonstrated improved use of communication applications, as well as positive shifts in attitudes toward technology and revealed that elders themselves perceived enhancements in various aspects of their daily lives, including work, hobbies, education, and social networks [53], [54], increase their confidence to use technology. This proved that elders should join any program that helps them to adapt to the technology to reduce low confidence in handling the devices, such as fear of doing something wrong or pressing the wrong buttons [9]. Moreover, new technology has been introduced, such as VR technology, which might be popular in the future and some of the studies already include the elders in the study and found many further benefits that elders can achieve if they learn it [20], [21], make the digital literacy increasingly important [3].

3.5. Social isolation

Digital exclusions are related to the social isolation [55]. Beyond the solitude experienced by elders with low competence in digital technology usage, a previous study found that it produced a negative effect on their mental health [52] and became worse during COVID-19 [56]. Elders themselves also provide feedback that they are feeling anxious, and isolated from family and friends. Limitations of face-to-face interaction during the pandemic make their routines change unexpectedly [57]-[59], including postponing and cancelling care-related services and group activities [59], [60], especially for those living with cognitive impairments or cognitive decline.

This condition makes most of the activities run remotely. Digital applications typically need an internet connection [9], and the users should know how to operate it. International study highlights that video chat, emails, text and social media interactions are the source of comfort and joy amid the stressors of COVID-19 in-person restrictions [61]. Therefore, literacy regarding digital applications is needed to help to reduce elders' social isolation. Appel *et al*. [21] highlights that the workshop related to the intergenerational program during COVID-19 is crucial to address the digital divide and consequent increased social isolation faced by elders.

4. CONCLUSION

This scoping review aims to identify the instructional strategies that have been used recently to improve the experience of using digital applications by the elderly including the recent issues. After the screening process, there are 14 eligible articles collected from both databases, World of Science and Scopus. The 14 articles were classified into two main categories: i) intergenerational strategies of instruction and ii) recent issues related to intergenerational approaches, aiming to address the research questions. First main category, the study revealed two common types of strategies employed by previous researchers, for example, intergenerational interaction and intergenerational learning. Intergenerational interaction takes various forms,

including collaborative efforts, remote interaction, and VR-based interactive systems. These forms are beneficial in reducing ageism and promoting the sharing of knowledge. Intergenerational learning promotes knowledge and skills being passed down, exchanged and shared between different generations. Sub-strategies for this method are reverse mentoring, family intergenerational learning and intergenerational play, enhancing the adaption to digital technology for the elderly. Second main category, the study found 3 types of issues that most researchers keep discussing such as ageism and age stereotypes, adaptation to digital technology and social isolation. These issues grow because several major events became a catalyst to these issues such as the COVID-19 pandemic and the advancement of digital technologies. This paper is suitable for the study that needs ideas and to determine the current issues regarding the intergenerational instruction of digital applications.

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REFERENCES

[1] World Health Organization, "Ageing and health." Accessed: Mar. 11, 2024. [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/ageing-and-health

[2] Department of Statistics Malaysia Official Portal, "Population Projection (Revised), Malaysia, 2010-2040." Accessed: Mar. 11, 2024. [Online]. Available: https://v1.dosm.gov.my/v1/index.php?r=column/ctheme&menu_id=L0pheU43NWJwRWVSZklWdzQ4TlhUUT09&bul_id=Y3kwU2tSNVFDOWp1YmtZYnhUeVBEdz09#

[3] S. J. Czaja *et al.*, "Factors predicting the use of technology: findings from the center for research and education on aging and technology enhancement (create).," *Psychology and Aging*, vol. 21, no. 2, pp. 333–352, Jun. 2006, doi: 10.1037/0882-7974.21.2.333.

[4] D. L. LoBuono, S. N. Leedahl, and E. Maiocco, "Older adults learning technology in an intergenerational program: Qualitative analysis of areas of technology requested for assistance," *Gerontechnology*, vol. 18, no. 2, pp. 97–107, Jul. 2019, doi: 10.4017/gt.2019.18.2.004.00.

[5] I. Mannheim, D. Weiss, Y. van Zaalen, and E. J. M. Wouters, "An 'ultimate partnership': Older persons' perspectives on age-stereotypes and intergenerational interaction in co-designing digital technologies," *Archives of Gerontology and Geriatrics*, vol. 113, p. 105050, Oct. 2023, doi: 10.1016/j.archger.2023.105050.

[6] T. N. Friemel, "The digital divide has grown old: determinants of a digital divide among seniors," *New Media & Society*, vol. 18, no. 2, pp. 313–331, Feb. 2016, doi: 10.1177/1461444814538648.

[7] R. Mostaghel, "Innovation and technology for the elderly: Systematic literature review," *Journal of Business Research*, vol. 69, no. 11, pp. 4896–4900, Nov. 2016, doi: 10.1016/j.jbusres.2016.04.049.

[8] O. A. Atoyebi, A. Stewart, and J. Sampson, "Use of information technology for falls detection and prevention in the elderly," *Ageing International*, vol. 40, no. 3, pp. 277–299, Sep. 2015, doi: 10.1007/s12126-014-9204-0.

[9] A. Matenga-Ikihele *et al.*, "Navigating digital inclusion and the digital vā among Niue mamatua through the provision of mobile phones during COVID-19," *AlterNative: An International Journal of Indigenous Peoples*, vol. 19, no. 1, pp. 145–154, Mar. 2023, doi: 10.1177/11771801221148343.

[10] H. Cheng, K. Lyu, J. Li, and H. Shiu, "Bridging the digital divide for rural older adults by family intergenerational learning: a classroom case in a rural primary school in China," *International Journal of Environmental Research and Public Health*, vol. 19, no. 1, p. 371, Dec. 2021, doi: 10.3390/ijerph19010371.

[11] Z. Y. Avci and E. Eren, "Intergenerational interdisciplinary reverse mentoring: school-university collaboration," *Hacettepe University Journal of Education*, Jul. 2023, doi: 10.16986/HUJE.2023.497.

[12] S. N. Leedahl, M. Brasher, A. Capolino, and E. Estus, "Using a quasi-experimental study to examine program participation and outcomes for older adult intergenerational technology program participants," *Journal of Intergenerational Relationships*, pp. 1–23, May 2023, doi: 10.1080/15350770.2023.2209556.

[13] S. N. Leedahl, M. S. Brasher, E. Estus, B. M. Breck, C. B. Dennis, and S. C. Clark, "Implementing an interdisciplinary intergenerational program using the cyber seniors® reverse mentoring model within higher education," *Gerontology & Geriatrics Education*, vol. 40, no. 1, pp. 71–89, Jan. 2019, doi: 10.1080/02701960.2018.1428574.

[14] S. Lee, H. Oh, C.-K. Shi, and Y. Y. Doh, "Mobile game design guide to improve gaming experience for the middle-aged and older adult population: user-centered design approach," *JMIR Serious Games*, vol. 9, no. 2, p. e24449, May 2021, doi: 10.2196/24449.

[15] S. Lee, H. Oh, C.-K. Shi, and Y. Y. Doh, "Life review using a life metaphoric game to promote intergenerational communication," *Proceedings of the ACM on Human-Computer Interaction*, vol. 4, no. CSCW2, pp. 1–21, Oct. 2020, doi: 10.1145/3415169.

[16] L. R. Betts, R. Hill, and S. E. Gardner, "'There's not enough knowledge out there': examining older adults' perceptions of digital technology use and digital inclusion classes," *Journal of Applied Gerontology*, vol. 38, no. 8, pp. 1147–1166, Aug. 2019, doi: 10.1177/0733464817737621.

[17] M. González-Afonso, M. C. Estévez-Moreira, A. Delgado-Castro, and D. Pérez-Jorge, "Is virtual communication possible in intergenerational programs? the SIMUL project," *Social Sciences*, vol. 12, no. 4, p. 199, Mar. 2023, doi: 10.3390/socsci12040199.

[18] L. Brandão *et al.*, "Playing remotely in times of crisis: a program to overcome social isolation," *International Journal of Geriatric Psychiatry*, vol. 37, no. 1, Jan. 2022, doi: 10.1002/gps.5638.

[19] K. Salehzadeh Niksirat, F. Rahmamuliani, X. Ren, and P. Pu, "Understanding intergenerational fitness tracking practices: 12 suggestions for design," *CCF Transactions on Pervasive Computing and Interaction*, vol. 4, no. 1, pp. 13–31, Mar. 2022, doi: 10.1007/s42486-021-00082-2.
[20] C.-M. Wang, C.-H. Shao, and C.-E. Han, "Construction of a tangible VR-based interactive system for intergenerational learning," *Sustainability*, vol. 14, no. 10, p. 6067, May 2022, doi: 10.3390/su14106067.
[21] L. Appel, S. Lewis, E. Kisonas, and J. Recknagel, "VRCHIVE: experiences conducting an online workshop teaching intergenerational participants to create virtual reality films about their lives during the COVID pandemic," *Educational Gerontology*, vol. 48, no. 7, pp. 305–330, Jul. 2022, doi: 10.1080/03601277.2022.2039848.
[22] J. L. Dorris, K. Chang, D. J. McLaughlin, S. S. Murray, S. Schaumburg, and J. Rodakowski, "Project unmute: a digital music program delivered by adolescent musicians to older adults with cognitive decline," *Journal of Intergenerational Relationships*, vol. 20, no. 4, pp. 493–501, Oct. 2022, doi: 10.1080/15350770.2022.2086958.
[23] H. Arksey and L. O'Malley, "Scoping studies: towards a methodological framework," *International Journal of Social Research Methodology*, vol. 8, no. 1, pp. 19–32, Feb. 2005, doi: 10.1080/1364557032000119616.
[24] M. D. J. Peters *et al.*, "Updated methodological guidance for the conduct of scoping reviews," *JBI Evidence Synthesis*, vol. 18, no. 10, pp. 2119–2126, Oct. 2020, doi: 10.11124/JBIES-20-00167.
[25] S. Salmond and M. J. Bennett, "Systematic review of qualitative evidence," in *Comprehensive Systematic Review for Advanced Practice Nursing*, New York, NY: Springer Publishing Company, 2021. doi: 10.1891/9780826152268.0012.
[26] D. Pollock *et al.*, "Recommendations for the extraction, analysis, and presentation of results in scoping reviews," *JBI Evidence Synthesis*, vol. 21, no. 3, pp. 520–532, Mar. 2023, doi: 10.11124/JBIES-22-00123.
[27] E. Aromataris and Z. Munn, "Chapter 1: JBI systematic reviews," in *JBI Manual for Evidence Synthesis*, JBI, 2020. doi: 10.46658/JBIMES-20-02.
[28] C. Okoli, "A guide to conducting a standalone systematic literature review," *Communications of the Association for Information Systems*, vol. 37, 2015, doi: 10.17705/1CAIS.03743.
[29] A. Martín-Martín, E. Orduna-Malea, M. Thelwall, and E. Delgado López-Cózar, "Google Scholar, Web of Science, and Scopus: a systematic comparison of citations in 252 subject categories," *Journal of Informetrics*, vol. 12, no. 4, pp. 1160–1177, Nov. 2018, doi: 10.1016/j.joi.2018.09.002.
[30] M. Gusenbauer and N. R. Haddaway, "Which academic search systems are suitable for systematic reviews or meta-analyses? Evaluating retrieval qualities of Google Scholar, PubMed, and 26 other resources," *Research Synthesis Methods*, vol. 11, no. 2, pp. 181–217, Mar. 2020, doi: 10.1002/jrsm.1378.
[31] N. A. Ahmad, M. F. A. Rauf, N. N. M. Zaid, A. Zainal, T. S. T. Shahdan, and F. H. A. Razak, "Effectiveness of instructional strategies designed for older adults in learning digital technologies: a systematic literature review," *SN Computer Science*, vol. 3, no. 2, p. 130, Mar. 2022, doi: 10.1007/s42979-022-01016-0.
[32] J. P. Higgins and J. J. Deeks, "Selecting studies and collecting data," in *Cochrane Handbook for Systematic Reviews of Interventions*, Wiley, 2008, pp. 151–185. doi: 10.1002/9780470712184.ch7.
[33] U. Abelein and B. Paech, "Understanding the influence of user participation and involvement on system success – a systematic mapping study," *Empirical Software Engineering*, vol. 20, no. 1, pp. 28–81, Feb. 2015, doi: 10.1007/s10664-013-9278-4.
[34] B. Fischer, A. Peine, and B. Östlund, "The importance of user involvement: a systematic review of involving older users in technology design," *The Gerontologist*, vol. 60, no. 7, pp. e513–e523, Sep. 2020, doi: 10.1093/geront/gnz163.
[35] R. W. Rieber and A. S. Carton, Eds., *The collected works of L. S. Vygotsky*. Boston, MA: Springer US, 1988. doi: 10.1007/978-1-4613-1655-8.
[36] H. Ishii and B. Ullmer, "Tangible bits: towards seamless interfaces between people, bits and atoms," in *Proceedings of the ACM SIGCHI Conference on Human factors in computing systems*, New York, NY, USA: ACM, Mar. 1997, pp. 234–241. doi: 10.1145/258549.258715.
[37] H. Ishii, "Tangible bits: beyond pixels," in *Proceedings of the 2nd international conference on Tangible and embedded interaction*, New York, NY, USA: ACM, Feb. 2008. doi: 10.1145/1347390.1347392.
[38] O. E.-K. Lee and D.-H. Kim, "Bridging the digital divide for older adults via intergenerational mentor-Up," *Research on Social Work Practice*, vol. 29, no. 7, pp. 786–795, Oct. 2019, doi: 10.1177/1049731518810798.
[39] L. V. Morris, "Reverse mentoring: untapped resource in the academy?," *Innovative Higher Education*, vol. 42, no. 4, pp. 285–287, Aug. 2017, doi: 10.1007/s10755-017-9405-z.
[40] W. M. Murphy, "Reverse mentoring at work: fostering cross-generational learning and developing millennial leaders," *Human Resource Management*, vol. 51, no. 4, pp. 549–573, Jul. 2012, doi: 10.1002/hrm.21489.
[41] J. D. Portz *et al.*, "'Call a teenager… that's what i do!' - grandchildren help older adults use new technologies: qualitative study," *JMIR Aging*, vol. 2, no. 1, p. e13713, Jun. 2019, doi: 10.2196/13713.
[42] R. Reynolds, "JanvanDijk. (2020). The digital divide. Cambridge, UK: Polity, 208 pp. £17.99 (paperback) (ISBN 9781509534456).," *Journal of the Association for Information Science and Technology*, vol. 72, no. 1, pp. 136–138, Jan. 2021, doi: 10.1002/asi.24355.
[43] T. De la Hera, E. Loos, M. Simons, and J. Blom, "Benefits and factors influencing the design of intergenerational digital games: a systematic literature review," *Societies*, vol. 7, no. 3, p. 18, Jul. 2017, doi: 10.3390/soc7030018.
[44] S. Osmanovic and L. L. Pecchioni, "Playing with words: the experience of self-disclosure in intergenerational gaming," in *Human Aspects of IT for the Aged Population. Social Media, Games and Assistive Environments. HCII 2019. Lecture Notes in Computer Science()*, Cham: Springer, 2019, pp. 189–203. doi: 10.1007/978-3-030-22015-0_15.
[45] P.-H. Chua, Y. Jung, M. O. Lwin, and Y.-L. Theng, "Let's play together: effects of video-game play on intergenerational perceptions among youth and elderly participants," *Computers in Human Behavior*, vol. 29, no. 6, pp. 2303–2311, Nov. 2013, doi: 10.1016/j.chb.2013.04.037.
[46] A. Officer and V. de la Fuente-Núñez, "A global campaign to combat ageism," *Bulletin of the World Health Organization*, vol. 96, no. 4, pp. 295–296, Apr. 2018, doi: 10.2471/BLT.17.202424.
[47] V. de la Fuente-Núñez, E. Cohn-Schwartz, S. Roy, and L. Ayalon, "Scoping review on ageism against younger populations," *International Journal of Environmental Research and Public Health*, vol. 18, no. 8, p. 3988, Apr. 2021, doi: 10.3390/ijerph18083988.
[48] L. Neven, "'But obviously not for me': robots, laboratories and the defiant identity of elder test users," *Sociology of Health & Illness*, vol. 32, no. 2, pp. 335–347, Feb. 2010, doi: 10.1111/j.1467-9566.2009.01218.x.
[49] A. Quan-Haase, C. Williams, M. Kicevski, I. Elueze, and B. Wellman, "Dividing the grey divide: deconstructing myths about older adults' online activities, skills, and attitudes," *American Behavioral Scientist*, vol. 62, no. 9, pp. 1207–1228, Aug. 2018, doi: 10.1177/0002764218777572.

[50] I. Mannheim *et al.*, "Inclusion of older adults in the research and design of digital technology," *International Journal of Environmental Research and Public Health*, vol. 16, no. 19, p. 3718, Oct. 2019, doi: 10.3390/ijerph16193718.
[51] D. Enari and R. Faleolo, "Pasifika collective well-being during the COVID-19 crisis: Samoans and Tongans in Brisbane," *Journal of Indigenous Social Development*, vol. 9, no. 3, pp. 110–126, 2020.
[52] K. Choi *et al.*, "Life during lockdown: a qualitative study of low-income New Zealanders' experience during the COVID-19 pandemic.," *The New Zealand medical journal*, vol. 134, no. 1538, pp. 52–67, Jul. 2021.
[53] C. Bell, C. Fausset, S. Farmer, J. Nguyen, L. Harley, and W. B. Fain, "Examining social media use among older adults," in *Proceedings of the 24th ACM Conference on Hypertext and Social Media*, New York, NY, USA: ACM, May 2013, pp. 158–163. doi: 10.1145/2481492.2481509.
[54] M. S. Marx, J. Cohen-Mansfield, K. Renaudat, A. Libin, and K. Thein, "Technology-mediated versus face-to-face intergenerational programming," *Journal of Intergenerational Relationships*, vol. 3, no. 3, pp. 101–118, Oct. 2005, doi: 10.1300/J194v03n03_07.
[55] W. J. Chopik, "The benefits of social technology use among older adults are mediated by reduced loneliness," *Cyberpsychology, Behavior, and Social Networking*, vol. 19, no. 9, pp. 551–556, Sep. 2016, doi: 10.1089/cyber.2016.0151.
[56] L. Pancani, M. Marinucci, N. Aureli, and P. Riva, "Forced social isolation and mental health: a study on 1006 Italians under COVID-19 lockdown," 2020.
[57] L. Cuffaro, F. Di Lorenzo, S. Bonavita, G. Tedeschi, L. Leocani, and L. Lavorgna, "Dementia care and COVID-19 pandemic: a necessary digital revolution," *Neurological Sciences*, vol. 41, no. 8, pp. 1977–1979, Aug. 2020, doi: 10.1007/s10072-020-04512-4.
[58] C. Ellis and M. Jacobs, "The cost of social distancing for persons with aphasia during COVID-19: a need for social connectedness," *Journal of Patient Experience*, vol. 8, p. 237437352110083, Jan. 2021, doi: 10.1177/23743735211008311.
[59] A. P.-H. Kong, "The impact of COVID-19 on speakers with aphasia: what is currently known and missing?," *Journal of Speech, Language, and Hearing Research*, vol. 64, no. 1, pp. 176–180, Jan. 2021, doi: 10.1044/2020_JSLHR-20-00371.
[60] D. Barros, F. Borges-Machado, Ó. Ribeiro, and J. Carvalho, "Dementia and COVID-19: the ones not to be forgotten," *American Journal of Alzheimer's Disease & Other Dementiasr*, vol. 35, p. 153331752094750, Jan. 2020, doi: 10.1177/1533317520947505.
[61] B. R. Whitehead and E. Torossian, "Older adults' experience of the COVID-19 pandemic: a mixed-methods analysis of stresses and joys," *The Gerontologist*, vol. 61, no. 1, pp. 36–47, Jan. 2021, doi: 10.1093/geront/gnaa126.

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