FinJeHeW Finnish Journal of eHealth and eWelfare

SCIENTIFIC PAPERS

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Scoping review of intergenerational learning methods for developing digital competence and their outcomes

Mira Hammarén[1,2], Erika Jarva[1,2], Kristina Mikkonen[1,2,3], Maria Kääriäinen[1,2,3], Outi Kanste[1,2,3]

[1] Research Unit of Nursing Science and Health Management, Faculty of Medicine, University of Oulu, Finland; [2] The Finnish Centre for Evidence-Based Health Care: A Joanna Briggs Institute Centre of Excellence, Finland; [3] Medical Research Center Oulu, Oulu University Hospital and University of Oulu, Oulu, Finland

Mira Hammarén, M.Sc., Research Unit of Nursing Science and Health Management, Faculty of Medicine, P.O. Box 5000, FI-90014 University of Oulu, FINLAND. Email: mira.hammaren@oulu.fi

Abstract

Due to the rapid digitalization of healthcare, it is important to strengthen professionals' digital competence, particularly to support older professionals to stay in work until retirement age. People of different ages have different digital competencies. Younger generations are 'digital natives' who have learned to use digital devices fluently from a young age, while older generations have had to learn to use them in adulthood. The increasing number of new technologies causes in some cases stress, especially for more older healthcare workers. Intergenerational learning methods for developing digital competence may offer a way to narrow digital competence gaps in healthcare.

The aim of this scoping review was to identify current evidence regarding intergenerational learning methods for developing digital competence, and their outcomes. The results can be used to help develop methods for intergenerational digital competence development and improve healthcare professionals' digital competence. A scoping review was conducted across four databases (Scopus, CINAHL, Web of Science, ProQuest) without time limits. The search produced 2905 references, of which 23 studies are included in the review. Thematic analysis was used to analyze these studies' results.

The results showed that a key method for intergenerational digital competence development is reverse mentoring, where a less experienced person serves as a mentor to a more experienced one. Intergenerational digital competence development methods can be done one-on-one or in groups, in classes or on digital platforms. The outcomes of these methods illustrated that they promote mutual learning, increase the digital competence of older adults and the work life skills of young mentors, and narrow the gap between generations. Using such methods, it is possible to make better use of each generation's expertise. Intergenerational learning could suggest ways of narrowing the digital gap and enhancing intergenerational communication. Healthcare could benefit from implementing intergenerational learning methods for developing digital competence, increasing the digital competence of healthcare professionals, and narrowing the gap between generations.

Keywords: intergenerational relations, digital divide, mentoring, health personnel, review

Introduction

The use of technology and digital solutions is becoming more common across health and social care [1] as the need for such services grows due to an ageing population [2]. The adoption of new digital solutions is constrained by the speed of technological development on the one hand and the acquisition of new skills on the other [3]. Successful integration of digital methods into health services therefore depends on the digital competence of health care professionals [4]. Digital competence consists of an individual's digital knowledge, skills, attitudes, and ability to rise to complex digital challenges [5]. In the context of healthcare, specific digital competencies required include: the skills and knowledge to use telehealth, health information technology (HIT) or medical technology; attitudes towards using HIT; the social and communication skills to provide high quality health services via tele-technology; and the ability to made ethical decisions whilst using digital technologies in patient care [6].

The use of technology is increasingly required in healthcare, and this can cause stress, particularly for more older workers [1]. Differences in digital competence between generations have been observed [7,8]. Younger generations, 'digital natives', have been born into a digital age and feel confident using technology, while older generations feel more insecure about doing so and experience more technology-related stress [8]. One proposed solution to this digital gap is intergenerational learning, through which different generations share their respective knowledge: older and more experienced professionals share their professional expertise and experience, including tacit knowledge, whilst younger professionals share their expertise in digitalization [3]. Intergenerational knowledge transfer has been defined to any interaction between generational that shares informationa, facts, context, connections process, or other insight, whether it takes place individually or as a group, in person or in written or digital forms [9,10].

In this review intergenerational learning methods for developing digital competence are defined as any intervention or practice that aims to promote digital competence by sharing skills between different generations. Previous studies into methods for developing digital competence have highlighted reverse mentoring, and variations on it, as a way of sharing knowledge and expertise [11] A literature review by Chaudhuri et al. (2021) suggests that reverse mentoring can be successfully used to transfer intergenerational knowledge, including digital competence [11]. Reverse mentoring has been shown to have positive results for an organization: for instance it improves competence in human resource management such as managing diversity, narrows digital gaps in the workplace, and enhances organizational learning [12]. Clarke et al. (2019) suggest that, during reverse mentoring, mentors benefit by gaining new professionals skills, including teaching skills, and mentees gain new knowledge about the latest research and technology [13]. However, there is little research into the use of intergenerational learning methods for developing digital competence in healthcare contexts [5].

Implementing intergenerational learning methods in health care organizations can help nurses of all ages, and be an effective tool for utilizing the talents of each generation [1]. An improved understanding of intergenerational learning methods for developing digital competence could be useful in

identifying ways to promote digital competence among healthcare professionals. These methods could be used to share young professionals' expertise in digitalization, thereby better utilizing organizations' existing digital competence. The ability to use digital solutions could help older professionals to remain in work for longer, by alleviating the physical strain associated with the work [14] and this could help address the shortage of health and social care professionals. The aim of this scoping review is to identify what evidence already exists about intergenerational learning methods for developing digital competence, and their outcomes. The review provides insight which can be applied to improving healthcare professionals' digital competence using methods which encourage skill-sharing between generations.

Review questions:

What intergenerational learning methods for developing digital competence have been used?
What outcomes have these methods produced?

Material and methods

Search strategy

We used a scoping review to gather the existing evidence about a wide variety of intergenerational learning methods for developing digital competence that have been used in different contexts. The review adapted the Joanna Briggs Institute guidelines on conducting a scoping review [15]. Inclusion and exclusion criteria were defined using PCC: participants, concept, and context [16]. For the inclusion criteria, participants (P) were young adults and adults from other generations. Participants had to be from both young and older generations. Studies addressing children under the age of 14 were excluded. The concept (C) of interest in this study was all methods and outcomes concerning digital competence development. The method could be any kind of activity, training, or intervention that promotes, develops, or supports digital competence. The outcome could be any demonstrated influence of the method on the competence of the generations involved. The context (C) could be any context, not only limited to healthcare organizations. All study designs (quantitative, qualitative, and mixed method studies) were included in the review. Articles without a specified study design, e.g. opinion papers and essays, were excluded. No time limit was set on the studies to be included. Full-text articles available in English, Finnish or Swedish were included in the review.

The search of the original studies involved three steps, and an information specialist was consulted with in creating the search strategy. The first step was a limited search of Scopus and Google Scholar to identify knowledge gap on studied topic. In the second step, the keywords defined by PCC (Table 1) were used to search in electronic database of CINAHL, Scopus, ProQuest, and Web of Science. The third step completed the process by searching the chosen studies' references and an additional search was conducted to Google Scholar.

Selection process

Two researchers (MH, EJ) discussed the inclusion and exclusion criteria and then, having reached a consensus, conducted the screening of titles and abstracts simultaneously and individually. References were collected in the Covidence bibliographic management system. The search yielded 1967 references after removing duplicates. The screening process and reasons for exclusions are presented in the PRISMA flow diagram (Figure 1).

Table 1. Keywords used in the search strategy.

Participants (P):	"young adult*" OR “young people” OR “younger people” OR student* OR "digital native*" OR "digital immigrant*" OR millenial* OR generation-x* OR generation-Z* OR “generation Z” OR “generation Y” OR “generation-Y” OR ((junior* OR young*) W/2 (employee* OR worker* OR staff OR profession-al*)) OR "baby boomer*" OR "digital immigrant*" OR ((senior* OR old* OR aged) W/2 (employee* OR worker* OR staff OR professional*))
Concept (C):	intergenerational* OR inter-generational* OR cross-generational* OR "cross generational*" OR multigenerational* OR IGL OR "reverse mentoring*" OR age-diversif* OR "digital partners" OR “two-way mentor*” mentor* OR learn* OR (knowledge N2 (transfer* OR shar*)) OR ((digital OR technolog*) W/2 (competence* OR skill* OR literacy* OR inclusion*)) digital* OR technology* OR “information system*” OR ICT OR ehealth OR e-health OR computer*
Context (C)	no limits

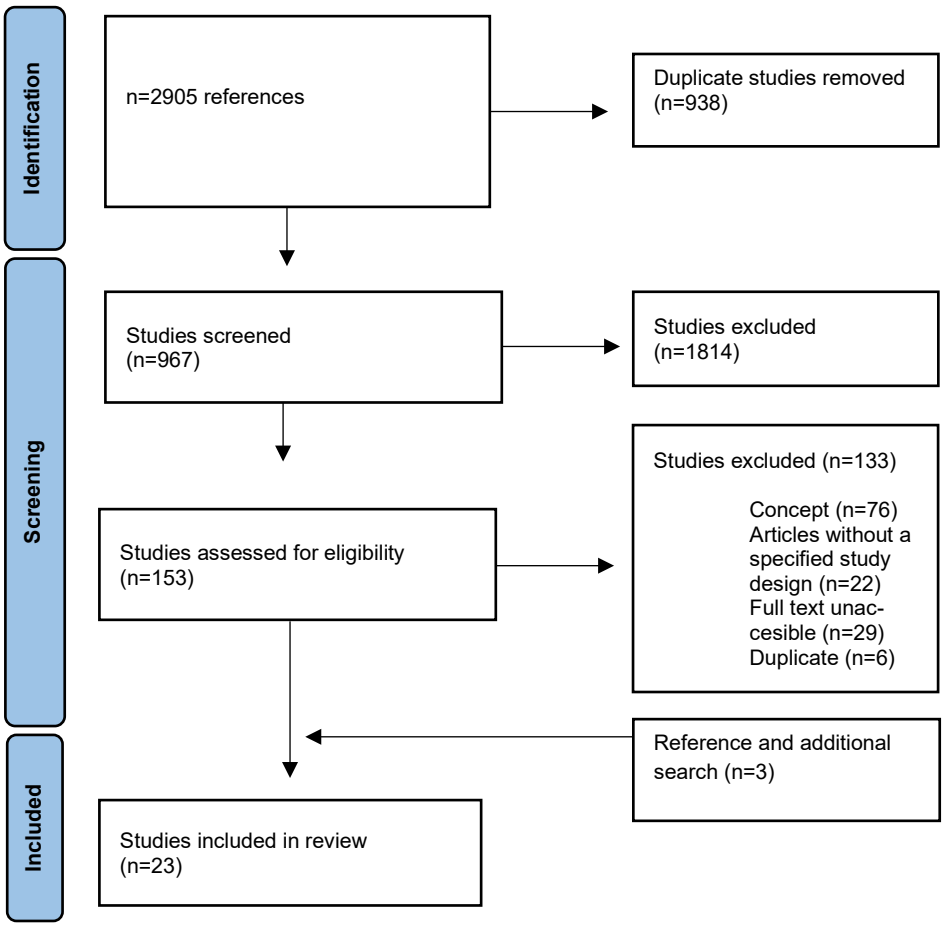

Figure 1. Prisma flowchart.

The quality of the studies is not formally assessed in a scoping review [16]. The following information was extracted from each publication: author, year, country, objective, participants, study design, intergenerational learning methods for digital competence development, outcomes of methods. The results were then subjected to thematic analysis, organising the results into themes according to our research questions [17].

Results

In total 23 relevant studies have been included. The majority of the publications were published between 2006 and 2021, apart from one study which was published in 1994. Most of the of the publications (n=12) originated from the United States, and the others came from Bahrain (1), Germany (1), Italy (1), Poland (2), Russia (2), Slovenia (1), Spain (1), and Taiwan (2). The methodology of nine publications were quantitative studies, five qualitative studies, and nine mixed methods (Table 2).

Participants in the studies included older adults, senior workers, retirees, young adults (over 14 years old), junior employees, young immigrants, and undergraduate students (in health sciences, psychology, pharmacy, occupational therapy, graphic design and digital media, and business). The studies' contexts included the classroom, service-learning courses, the workplace, and the service housing environment.

Intergenerational learning methods for developing digital competence

Reverse mentoring, in some form, was the most common method considered by these studies [18–24]. In reverse mentoring a younger person or junior employee serves as mentor to an older, or more experienced worker [18,19,21]. Reverse mentoring was explained by one-on-one mentoring, drop-in sessions, group sessions, and digital platforms (see Figure 2).

Table 2. Summary of the studies included in the review.

Author, year, country	Participants	Study design	Methods	Outcomes
Al Hashimi, 2021, Bahrain	N=144 older adults, N=144 students	Mixed method	Students teaching older adults	Older adults: enhanced digital literacy, self-confidence, and self-esteem. Youth: enhanced self-esteem and gratitude.
Biss & DuFrene, 2006 USA	N=183 employees	Quantitative study,	Reverse mentoring	Reverse mentoring enhanced participants' job performance (58%) and technology/computer learning.
Breck et al., 2018, USA	N=87 older adults, N=28 young adults	Qualitative study	Reverse-mentoring individual and group sessions	Improved mutual learning and self-efficacy. Older adults: enhanced confidence to use technology.
Chen, 2015, Taiwan	N=158 emploeyys	Quantitative study	Reverse mentoring	Reverse mentoring could narrow the generational gap among employees.
Chen, 2013, Taiwan	N= 14 participants	Qualitative study	Reverse mentoring	Generations influenced each other in a positive way to enhance learning outcomes.

Henner, 2009, USA	N=75 senior, N=9 students	Quantitative study	Reverse mentoring, workshops, small-group, weekly follow-up visit	Older adults: increased feel proficient using a computer (pre 25%, post 87), Youth: reduced communication barriers (100%). increased understanding of seniors' needs (99%).
Kaše et al., 2019, Slovenia	N=293 older adults N = 457 younger,	Quantitative study	Reverse mentoring, guided practice, one-on-one interactions	Older adults: could facilitate digital skills development. Youth: could enhance mentoring skills.
Kokol & Stiflic, 2011, Germany	N= 166 older people	Quantitative study	Students teaching older adults, e-learning course.	Older adults: improved computer skills during courses, month after the course, the skill level slightly decreased, and use of computer increased.
Kopeć et al., 2017, Poland	N=15 older adults, N=15 young adults	Quantitative study	Game, mixed-aged teams consisting of two players (a junior and a senior).	Older adults: increased technical skills. Enhanced positive intergenerational interaction.
Leek & Rojek, 2021, Poland	N=41 older adults, N=63 immigrant	Mixed method	Intergenerational internet course	Older adults: improved internet and computer use. Youth: improved communication skills with older adults and history and culture knowledge.
Leedalh et al., 2019, USA	N= 87 older adults, N= 28 students	Mixed method	Intergenerational service-learning program, reverse mentoring	Older adults: improved interest in technology ($p<0,05$). Youth: improved attitudes toward aging ($p<0,01$).
Leedalh et al., 2020, USA	N= 28 students	Mixed method	Intergenerational service-learning, reverse mentoring	Improved attitudes towards older adults ($z=-2,95$, $p<0,01$) and increased interest in working with older adults.
Lee & Kim, 2019 USA	N= 55 older adults	Mixed method	Intergenerational mentor-program	Improved eHealth literacy ($p<0.001$), technophobia ($p<0.001$), attitude ($p<0.001$), decreased social isolation($p<0.001$).
Lo Buono et al., 2019, USA	N=199 older adults, N=27 student	Qualitative study	Service-learning program, reverse-mentoring, group and drop-in sessions	Intergenerational program narrowed digital divide and connected two generations.
Lo Buono et al., 2020, USA	N=199 older adults, N=27 student	Qualitative study	Service-learning program, reverse-mentoring, group and drop-in sessions	Older adults: increased confidence, attitudes towards technology and technology adoption. Youth: improved teaching skills.
Lyashenko, & Frolova, 2014, Russia	N= 45 educators, N= 11 students	Mixed method	Learning Management Systems (LMS) platform for students and teachers.	LMS training platform can be an effective tool for learning intergenerational communication and ICT.

Natvig, 2007, USA	77 retirees, and student	Qualitative study	Service-learning course	Older adults learned computer skills. Youth: prepared for future employment.
Ogozalek et al., 1994, Russia	N= 35 older adults	Mixed method	Workshop organized by younger students	Reduced anxiety towards technology.
Ravazzani et al., 2013, Italy	N= 30 managers, N= 3 mentor	Mixed method	A face-to-face training sessions and coaching	Improved understanding of the potential of using web 2.0 applications for managers, enhanced intergenerational learning.
Sanders et al., 2013, USA	N =92 older adults	Quantitative study	The computer training program, one-to-one training sessions	Improved comfort at the computer (p<0,000)
Seguí et al., 2019, Spain	N=38 older adults, N=42 young adults	Mixed method	Digital Partners training space	Older adults: increased sense of security and motivation towards mobile device use. Young: a positive impact on self-esteem.
Shedletsky,2006, USA	N=44 senior N=36 student	Quantitative study	Course	Older adults: decreased computer anxiety, increased ability to use computer.
Wexler et al., 2011, USA	N=266 young and older students	Quantitative study	The Intergenerational Computing course	Improved attitudes and advocacy toward senior citizens (p<0,01).

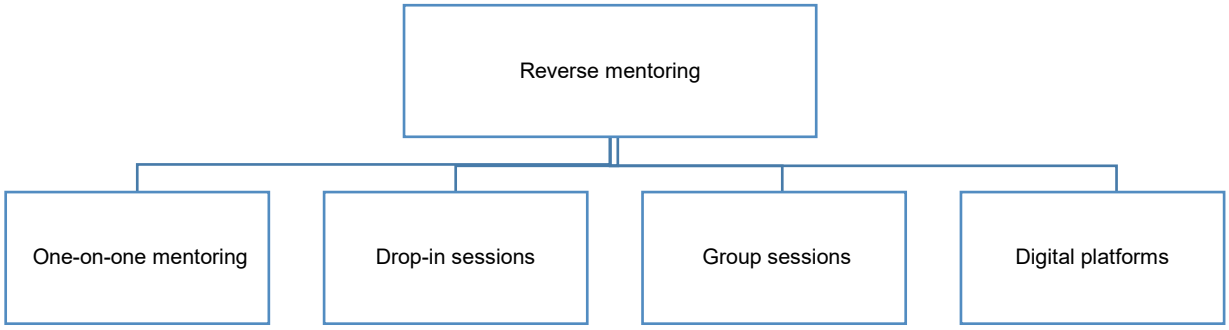

Figure 2. Intergenerational digital competence development methods.

One-on-one mentoring involved pairing a younger and an older person, with the younger person acting as a mentor. [19,22–30]. The pairs were determined by technological or social interests [24]. The pair either saw each other at an agreed time and place [27,28] or they worked together during a course or class. Young people held one-on-one sessions to coach and mentor older adults to learn to use technology [19,22–25,29,30]. In some sessions the older adults brought along their own devices. The young mentors tailored sessions to the older adults' individual needs. [27,28] They broke tasks down into smaller pieces, and gave step by step instruction, sometimes using simpli-

fied teaching materials [24]. They used the teach-back method (i.e. the mentor demonstrates a task after which the older adult performs same task and explains it), and collaborative learning (mentor and mentee learning together to use certain devices or programs) [23]. Mentors also offered hands-on assistance, guidance, and feedback [22] and provided encouragement and support [22,25].

Drop-in sessions were used to give rapid and easily available guidance on using technology to older adults [19,24,25,27,28]. Young mentors held sessions at specified places and times when older adults could drop in and get technical support [19,25,27,28]. During sessions mentors provided technical support, answered questions, gave brief presentations, and mapped training needs [25].

Young mentors held small *group sessions*, where they learned to use technology together with older adults [24,25]. The composition of small groups varied: in some sessions one older adult had two mentors, while in others several older adults had two or three mentors [23,24]. Mentors organized workshops which aimed to introduce older adults to technology and computer use [25]. Digital competence development was also pursued through a variety of computer, internet and technology courses [24,29–34]. Young people acted as course instructors and teachers, assessing the computer skills and developing the goals and objectives of each participant [31] and teaching them to use the internet and social media [26]. In some of the courses, young mentors worked alongside older adults, helping them to perform specific tasks [26,32].

Digital platforms were for example websites were used to share digital competence between generations [25]. These virtual platforms offered consulting, helpdesk, and technical support, and included online tutorials, forums, wiki sites, media stores, interactive tests, and opportunities for intergenerational interaction [33]. Both younger and older adults took advantage of digital tools (e.g. mobile phones, tablets, laptops, audio-visual systems) to share knowledge and skills, and to improve communication [34]. Intergenerational digital competence was also shared through a game using digital tools (tablet, mobile). In the game younger and older people perform tasks in pairs. Older adults used the device and mobile apps with indirect assistance from the younger participants, while the older team member was able to utilize her/his knowledge of the historical and cultural context to succeed in the game [35].

Outcomes of intergenerational learning methods for developing digital competence

Intergenerational learning experiences benefited both parties by increasing mutual learning [19,26,31]. They created opportunities for intergenerational knowledge to be exchanged, and older and younger people to learn from each other [19–21,26,31,34], both promoting older adults' digital competence and increasing young mentors' work life skills. Intergenerational learning also narrowed the generational gap more generally (Figure 3).

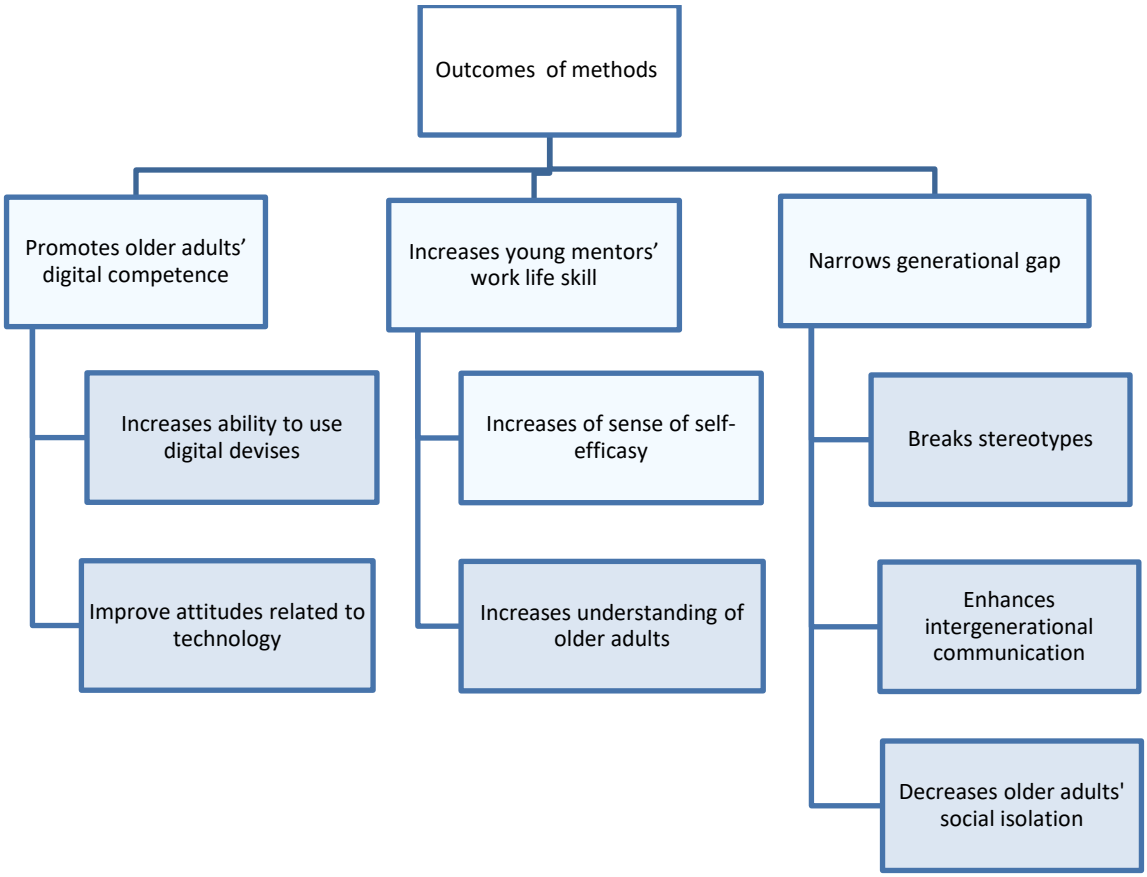

Figure 3. Outcomes of intergenerational learning methods for developing digital competence.

Intergenerational learning methods *promoted older adults' digital competence* and increased older adults' ability to use digital devices and improved their attitudes towards technology. Older adults gained new digital skills [31]. Their ability to use technology increased [19,23,25,26,30,34,36–38] and their eHealth literacy improved [26]. Gaining digital skills fostered older adults' sense of self-efficacy [30,38]. The methods used improved older adults' attitudes towards technology [23,30], reduced anxiety and technophobia [26,30,36,39], increased their interest in technology [26] and their adaptation to it [23]. In the workplace, reverse mentoring helped managers understand and take advantage of the opportunities offered by technology [29], and built digital competence [18].

Young mentors' work life skills increased while mentoring older people. Mentors' sense of self-efficacy increased and their understanding of older generations improved. Giving instruction to older adults enhanced young people's mentoring and leadership skills [22–24]. They appreciated the experience of teaching digital skills, and developed a stronger sense of themselves as capable of teaching others [19,38]. Intergenerational learning methods provided opportunities to learn from the experience held by older people [19,26,34]. Interaction with older adults also enhanced young people's understanding of older generations [27] and how older adults make use of the internet to access health information [25]. Teaching and work-

ing with older adults prepared young people for their future roles as professionals [23,24,31].

Interaction between different generations *narrowed the generational gap*, broke stereotypes, enhanced intergenerational communication and decreased social isolation among older people. Older people were pleased about this and expressed gratitude for the chance to interact with and learn from younger people [25,26,28,35]. Participants rated those from the other generation more positively following the experience of using these intergenerational learning methods [27,35]. Young people's general attitude towards aging improved [27,28,40] and their respect for older people increased [25]. Moreover, using these methods increased young people's enthusiasm to work with older adults in their future careers [27]. Intergenerational learning methods connected different generations [24] and improved their connection [19,25]. The methods reduced intergenerational communication barriers [25,34] and enhanced positive communication and interaction between generations [35,38]. Both generations, young and older, valued their one-on-one interaction [28] and repeated meetings with the same partners to deepen the friendships between them [32]. Intergenerational interaction decreased social isolation among older adults [26], and older adults were encouraged to participate socially in the digital world [19,40].

Discussion

The aim of this scoping review was to identify current evidence about intergenerational learning methods for developing digital competence, and their outcomes. The intention was to examine the results of the review from a healthcare perspective. The review shows that the methods most often used involve reverse mentoring, where the younger serves as a mentor or teacher to older people, in one-on-one or group situations, and sometimes utilizing digital platforms. In health care, mentoring has traditionally been used to transfer substantive knowledge from those who are more experienced to those who are less experienced [13]. Group mentoring, in which an experienced nurse acts as mentor, has been used to build the self-confidence of newly graduated nurses during their first year of work. Scott et al. (2008) noted that group mentoring can also allow nurses to mentor each other [41]. However, the possibilities for reverse mentoring to promote digital competence and utilize intergenerational knowledge has also been identified in the context of health care [1,42]. Bell (2013) suggests that pairing healthcare staff with someone who has strong digital competence could be one solution to spreading digital competence amongst healthcare professionals [42]. Identifying digital natives and assigning them with supporting their team's digital competence could be one way to utilize their digital expertise [1]. The utilization of digital solutions to share intergenerational knowledge was also identified in this review. In healthcare, e-learning courses have been used in low-income countries, to improve healthcare professionals' digital health literacy [43]. However, healthcare professionals have been found to prefer face-to-face methods, rather than formal ICT-based tools, for sharing tacit knowledge [44].

Based on the outcomes of the studies included in this review, intergenerational learning methods for developing digital competence could promote mutual learning in which older people learn digital competence and young people learn work life skills. Reverse mentoring is aimed at narrowing the technology gap between generations [11] In healthcare, older, more experienced nurses appear to have lower digital competence than their

younger colleagues [4]. Younger generations can help their older colleagues to adapt to technology [45] and, in return, more experienced nurses can share her/his substantive competence [42]. According to the results of this review, intergenerational learning can increase young people's knowledge and interest in working with those who are older. Thus, it may follow that intergenerational learning could enhance students' knowledge and interest in the healthcare sector. Young people's level of interest in the field is an extremely important driver of recruitment to health care professions which are currently suffering from a shortage of workers [46]. In a changing healthcare environment, multi-professional cooperation e.g. between healthcare, information technology and financial professionals, is increasingly important to how services are being developed [47]. Involving information technology students in reverse mentoring within a health care context could improve their understanding of that context, and increase their interest in working in social and health care.

The outcomes of this review suggests that intergenerational learning methods narrow the intergenerational gap by enhancing communication between, and increasing understanding of, different generations, promoting respect for the other generation. Intergenerational mentoring was recognized as way to build appreciation of other generations and improve the dynamics and cohesion of health care teams [48]. Implementing reverse mentoring in health care could help to break down hierarchical structures and reduce stereotypes [40,45]. However, interpersonal conflict and tension could arise when a younger professional works as a mentor to an older one [48]. The culture inside an organization must value intergenerational cooperation, mutual respect and understanding, to enable people to learn from each other [49] For this reason, organizational structures and management play a significant role in integrating intergenerational learning into healthcare [50].

Strengths and limitations

This review has certain strengths and limitations. The first limitation is that the selection process was not carried out by two separate researchers but by two researchers working together. However, the review followed the Joanna Briggs Institute guidelines for conducting a scoping review [15]. The screening process was guided by clearly defined research questions and eligibility criteria and all phases of the review process were constantly evaluated and discussed among the researchers. A comprehensive literature search was conducted by including several interdisciplinary databases for study retrieval and an additional search was conducted to attain all relevant studies. Limiting the selection to three languages (Finnish, English, Swedish) may mean that some relevant studies have been left out of the review.

Conclusions

Methods for developing digital competence between younger and older people have been studied but not in the healthcare context. The intergenerational learning methods for developing digital competence identified in the review can be applied to healthcare. These methods enable mutual learning, through which older adults' digital competence grows, and younger people learn work life skills. Based on the results of this review, intergenerational learning could be one solution to narrowing the digital gap and enhancing intergenerational communication. Methods for implementing reverse mentoring and intergenerational learning should be developed in health care contexts. Through intergenerational learning, it is possible

to make better use of the expertise of each generation, as the skills required at work change due to digitalization. Further research should investigate digital competence among different generations in health care. It would also be valuable to develop and pilot intergenerational learning methods for competence development in healthcare and to explore their impact on the digital competence of healthcare professionals.

Conflict of interest statement

The authors have no conflict of interest.

Acknowledgements

We would like to thank the information specialist Kirsi Vähäkangas from the University of Oulu for her time and effort in improving the search terms and strategy. We would like to acknowledge Sees-Editing Ltd (http://www.seesediting.co.uk) service for improving the language and helping us to communicate our findings to readers of the journal.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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*Studies which were included in the review.