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Active ageing in the digital era: the role of new technologies in promoting the wellbeing of older people in Hong Kong

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ABSTRACT

This qualitative study aims to examine the challenges and barriers older people face in technology usage and the experiences that motivate them to achieve active ageing using technology. A total of 34 older people and 12 professionals participated in the focus group or individual interviews. Technology could enhance older people's access to health information and social connections, which benefited their overall well-being. Policymakers and community stakeholders are suggested to support them in learning digital technologies. Social workers play a crucial role by tailored communication skills while promoting digital inclusion for older people.

1. Introduction

Active ageing is believed to contribute to life satisfaction for older people. It involves complex combinations of physical, cognitive, psychological, and social factors, with an active/passive distinction highlighting the enhancement or diminution of concrete powers of activity (Marsillas et al., 2017; Stenner et al., 2011). It may promote employment, active participation in society, independent living, intergenerational relationships, and enhancement of the quality of life for older people (Bar-Netzera & Bocoş, 2016; Rossi et al., 2014). Active ageing may help to propel economic development and sustainable social development, so appropriate policies and strategies need to be developed to support older people's active social participation (Thalassios et al., 2019; Walker & Maltby, 2012).

Over the past two decades, we have witnessed the global demographic change of the ageing population and technological improvement. Throughout those changes, due to interpersonal, environmental, health, and other social factors, older people are required to adapt to new information technologies and modern ways of living (Anderson & Perrin, 2017).

Hong Kong's rapidly ageing population places increasing pressure on medical services (K. Wong & Yeung, 2019). S. Chen et al. (2022) estimated that about one-sixth of all

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populations will be 60 or older by 2041. Over the past 30 years, the Hong Kong population has significantly increased to 7.12 million, while the older people aged 65 or above will increase to 1.27 million from 0.46 million. Based on the projection figures by CSD, the size of the older people will double up to 2.44 million, while the older people support will drop to 1.48 in 2066 (Census and Statistics Department, 2023b). Even though the extent of population ageing in Hong Kong is not as severe as that in Japan and Italy, it is a little more serious than in the selected developed economies in terms of the leading ageing indicators (K. Wong & Yeung, 2019). From the long-term demographic perspective, population ageing in Hong Kong is expected to be more threatening than the other selected economies in the region because of the low fertility rate and higher life expectancy (Thomassen et al., 2020; Zhu & Lin, 2022). Considering this, healthy ageing is the idea that ageing is a positive lifelong process (World Health Organization, 2021).

Nevertheless, an earlier study in Hong Kong found that older people mainly focus on the basic functions of the mobile phone (K. Chen et al., 2013). Their knowledge of mobile phone functions was limited to making or receiving calls, displaying dates and times, etc., and they rarely use advanced functions on mobile phones. Kwong (2015) pointed out that the causes of such a digital divide in Hong Kong were inadequate motivation, limitations in physical and material access to digital devices, and insufficient digital skills and usage. In terms of the factors behind this gap, a recent study (Zhang et al., 2024) found that the current technologies applied in Hong Kong still could not fully address older people's needs for healthy ageing, and there are still significant barriers hindering the adoption.

As technology has expanded quickly, there has been a good use of technology to increase the effectiveness of daily tasks and healthcare services, which has helped improve older people's quality of life and attain healthy ageing (Chelongar & Ajami, 2021; Zonneveld et al., 2020). Allemann and Poli (2020) and Ruggiano et al. (2019) pointed out that technology may enable communication between older people and their caregivers by offering platforms for understanding their real-time health conditions. Online social connectedness allows older people to stay active through involvement in social groups. Digital involvement can thus benefit older people, providing capabilities to connect over distances or overcome physical constraints and loneliness to access the abundance of health information and support available online (Byeon, 2019; Francis et al., 2019; Kadylak & Cotten, 2020; Quan-Haase et al., 2021). Online communications and assistive technologies could reconnect older people with the rest of the community and help them remain socially active (Bong et al., 2019).

Previous studies (Ollevier et al., 2020; Peine & Neven, 2021) reveal that community stakeholders, such as policymakers, service providers and technology professionals, should support and recognise the importance of technologies for older people (Gómez & Criado, 2021). In the contemporary world, family-centred support has given way to expert and high-tech solutions that assist older people live independently for longer. They have specific support needs in addition to their basic needs, which the digital services sector may meet appropriately (H. Chen et al., 2023).

Halicka (2019) acknowledged that technological influences in everyday life triggered further explorations of how older people could use the products to improve their quality of life. Furthermore, Huang and Oteng (2023) recognised that new technologies might help support healthcare workers, thus reducing the workforce and financial burdens of

the public health systems. In addition, the World Health Organization also suggested using technologies to promote active and healthy ageing (Sundgren et al., 2020; World Health Organization, 2021).

1.1. *Barriers to older people's use of mobile phones/technologies and marginalisation*

It is widely acknowledged that old age is a factor leading to lower access to technologies and falling on the wrong side of the digital gap. Drabowicz's (2021) study in Poland revealed an association between older age, lower education and income and lower digital skills. Older people's low acceptance of technology is a significant barrier (Guzek & Kowalska, 2020). Previous studies on the Technology Acceptance Model (TAM) argue that individuals should be nurtured with the perceptions of usefulness and ease of use to change their behaviour intentions and behaviours (Ahmad et al., 2020; K. Chen & Chan, 2014). Herzlinger (2006) pointed out that older people had deep-rooted mindsets wedded to previous norms and ways of life, so they might struggle to switch to the new norms in the digital age, such as communicating with others and shopping online. Therefore, older people might perceive using technology in social and medical services as a huge challenge (Esmaeilzadeh, 2020; Khan & Loh, 2022).

Older people are also less likely to utilise new technologies due to limited resources, physical and cognitive limitations, and nervousness in using technological devices, even if they have developed some basic knowledge. Also, there are few supporting community-based measures to enable older people to catch up with technological development in either financial affordability or digital literacy (K. Chen & Chan, 2014). Some older people need compatible devices and stable Internet connections, while many have difficulty financing the installation costs and learning the skills and knowledge required to operate the devices (Khan & Loh, 2022). In a digitalised society, information is a significant source of power, which allows social groups to get integrated into the mainstream community. The disparity in power and knowledge between various social groupings is the key problem H. Chen et al., 2023. As such, the lack of sustainable resources, knowledge, and acceptance of technologies will eventually contribute to a widening digital divide between older people and the general population. Apart from these barriers, some older people might resist using technologies despite the trends and need to utilise online utilities. Their technological resistance could be due to different factors, low perceived usefulness, and reluctance to try something new. Such attitudes and behavioural patterns could be a result of their preference for using traditional channels of interpersonal communication (e.g. telephone and mail) to obtain the information they need (e.g. television and printed matters) (Bertolazzi et al., 2024). Consequently, they could become indifferent to new technologies (Gallistl et al., 2021). Previous studies indicated the use of technology by older adults could possibly marginalise them in the digital world. For example, the complexity of the applications and rapid technological development trends could trigger cognitive overload in old age, as well as anxiety and a weaker sense of control over themselves, particularly when they are forced to engage in online transactions and communications (Francis et al., 2019; Kim et al., 2022).

Several previous studies also pointed out some detrimental impacts of using technologies on older people. Similar to the experiences of young people, some older people would become overly dependent on technology, leading to social isolation and distancing from real relationships (Sharkey & Sharkey, 2011; X. Wang, 2024). Additionally, the active participation of older adults in the digital age could lead to the emergence of Internet Addiction as a new challenge for public health (D. Wang et al., 2024). Frequent exposure to online fraud cases among those from older age groups had also become a concern. Due to cognitive decline, memory issues, and a lack of risk awareness, older adults struggle to manage complex passwords, putting them at significant risk of information leakage (Frik et al., 2019). Button et al. (2014) found that the encounter of online fraud cases by older people could, in turn, result in financial losses, emotional distress, and even depression-related illnesses.

1.2. Efforts to support older people to achieve digital inclusion

Previous research has revealed that the awareness and involvement of the role of technology in society must be enhanced and further developed to support older people in achieving digital inclusion effectively (Peng et al., 2018). For example, the older and younger generations could communicate with each other and learn how to utilise technologies through intergenerational programmes (Cheung et al., 2021; Delello & McWhorter, 2017; Vaportzis et al., 2017). Furthermore, the Jockey Club SMART Family-Link Project launched in Hong Kong in 2018 created a cutting-edge, evidence-based approach to delivering family services using technologies and data analysis to facilitate older people's access to social and health support services (Hong Kong Jockey Club, 2021). By facilitating higher exposure to technologies and opportunities to use the devices, older people might significantly advance the use of technology and successfully apply it to healthcare in Hong Kong (Li & Yan, 2018; Reddy et al., 2020). Older people with poor physical capability might acquire treatment and amenities at home. Such supporting programmes and measures could help to achieve digital inclusion for older people (Lorenz-Dant, 2020; Y. C. Wong et al., 2009).

More importantly, evidence from projects and programmes shows that cross-sectoral collaboration is vital for older people's digital inclusion. A previous study (Y. Wang & Zhang, 2019) highlighted the importance of public–private partnerships. However, studies have indicated that Hong Kong is falling behind in cross-sectoral efforts to include older people in developing digital products and services. S. Y. An et al. (2021) explained that this could be due to a shortage of funds for research and development in this discipline. The government, businesses and social service providers generally work separately without much coordination and synergy.

A review of the relevant literature has revealed older people need digital skills and knowledge to ensure social inclusion and their wellbeing in different dimensions. Due to various health and socioeconomic factors limiting their knowledge and access to new technologies, most older people cannot fully utilise the advantages of the Internet and gadgets. The proliferation of modern technologies could easily increase older people's social marginalisation. Nonetheless, few previous studies apply digital elements and technologies in promoting active ageing, especially in enhancing social interactions, participation, and physical and mental well-being. Therefore, this study aimed to understand the obstacles and difficulties

that older adults in Hong Kong encountered when using technology, as well as the experiences that inspire them to pursue digital literacy in achieving active ageing. The specific research objectives were as follows:

(1) To examine the barriers and challenges faced by older people in using new technologies;
(2) To examine how older people's learning processes and participation in technology-related activities empower them in the digital age; and
(3) To recommend policy and support service measures for supporting older people to achieve digital inclusion and facilitate active ageing.

2. Conceptual framework

The conceptual framework of this study refers to the model of technological use and its effects and influence on ageing perception developed by Juárez et al. (2018) and built on the findings from their grounded theory research. Originally, their model had three main categories (i.e. technological learning, use of personal interactive technologies and inhibitors), indicating that technological use could produce a series of effects and benefits that could influence the ageing process and its perception. In particular, cognitive, social, emotional and health-related benefits matched the impact of coping strategies that older people developed from learning and using technologies. The current study modified that model by examining perceptions of people older than age 65 regarding the functions and impacts of modern-day technologies for browsing online information relevant to their daily lives, entertainment and communicating with others, as well as how these perceptions were associated with their motivations to learn and use, challenges and barriers they experienced in applying such technologies (Figure 1). The World Health Organization (2002) responded to the global ageing trend with a set of policies named 'active ageing', which involved complex combinations of physical, cognitive, psychological, and social factors, highlighting one's enhancement or diminution of concrete powers of activity at old age (Marsillas et al., 2017; Stenner et al., 2011). Ultimately, we were interested in understanding how the extent of digital inclusion, a state in which older people could enjoy sufficient resources, literacy and ability to apply technologies, achieved by overcoming the motivational challenges and barriers affecting the extent of active ageing resulting from using technologies by older people (Betts et al., 2019; Leedahl et al., 2023; Olphert & Damodaran, 2013). The concept of well-being referred to by Behzadnia et al. (2020) and Lara et al. (2020), which they had defined it as a person who manages to live a joyful and fulfilling life with high levels of satisfaction, encompasses dimensions related to one's physical and emotional health, and social life.

Based upon this conceptual framework, this study aimed to explore the various challenges and barriers older people in Hong Kong face in technology usage and the experiences that motivate them to achieve active ageing by using technology. A list of research questions was developed to guide data collection and data analysis processes:

(1) What challenges and barriers do older people face in learning and using technologies and affect their perceptions?
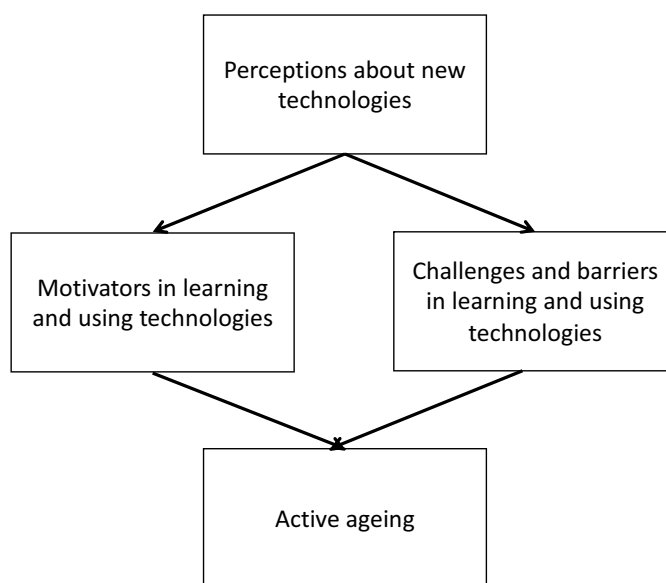(2) What experiences motivate older people to make use of technologies to achieve active ageing?

Figure 1. Conceptual framework of factors leading to common effects and benefits of using technologies by older people.

3. Methods

3.1. Research design and sample

This qualitative study comprised a series of focus groups and in-depth interviews with the stakeholders of the two co-creation and participatory community projects: 'GOActive.hk' and 'Silver Age DJ'. 'GoActive.hk' is an innovation project where the unit of the university with which the authors were affiliated partners with one senior in Hong Kong to digitalise their event registration through co-creating with members and staff of the Elderly Centre, facilitated with designers and technical expert, to design an age-friendly website. The project aimed to make the event registration process more convenient, empowering older people in terms of their social functioning and digital inclusion. Similar to 'GoActive.hk', the 'Silver Age DI' project also intended to enhance the social inclusiveness of older people through digital means during the COVID-19 pandemic. The authors partnered with another senior community centre and technological design consultant to run the project, which consisted of two elements: (1) the bi-weekly music programme 'Tuesday Music Friends' hosted by the elderly members and (2) a training course on broadcasting knowledge and techniques run by professional DJs from a local radio station. Since there were social segregation regulation during the COVID-19 pandemic, the 'Silver Age DJ' project was operated online via YouTube, manifesting the opportunities and challenges of virtualising services for older people. These innovative projects aimed to address the ageing characteristics experienced by the local older people as they struggled to enhance their digital knowledge and skills, which were essential for remaining active in the community and interpersonal connections to save them from social isolation. These echoed what N. An et al. (2022) suggested about aligning social care services with specific ageing scenarios.

A series of focus group or individual interview sessions were conducted with the intergenerational participants of the two projects between June and August 2021 to understand their perceptions and understandings of technology use among older people population due to the availability of the participants (Table 1). The adoption of focus group or individual interviews was entirely depended on the availability and preference of the participants being invited. Fifteen focus group participants comprised of the following intergenerational and cross-disciplinary backgrounds: 34 older people aged 65–80 who were the members of the two community centres, nine social workers and staff from the community centres, three design consultants and six co-creation members took part in the Projects from multidisciplinary backgrounds, including event organisers, digital platform developers, marketing practitioners and a university student studying gerontology who had participated in these two projects voluntarily.

3.1.1. Sampling method

Purposive sampling was adopted to recruit participants related to the 'GOActive.hk' and 'Silver Age DJ' projects, selecting participants based on their connections with these two projects (Rubin & Babbie, 2010). Each of them participated in the projects in various capacities, either as ordinary participants, service operators, designers, or technological consultants. This selection criteria could help us address our research questions, such as understanding the perspectives of using technologies by older people, the challenges and barriers they face in using technologies, approaches to motivate older people to make use of technologies and the potential impacts on them. We invited older people through the

Table 1. Summary of interview format, projects and types of participants.

Interview format	Relevant projects	Participants
(1) Focus Group	Control Group	3 older persons
(2) Focus Group	GoActive.hk	2 UI/UX designer consultants
(3) Focus Group	Silver Age DJ	3 Social Workers
(4) Focus Group	GoActive.hk	2 Co-creation members, (technology developer and marketing practitioner)
(5) Individual	Silver Age DJ	1 older person (co-creation member)
(6) Focus Group	Silver Age DJ	2 older persons (DJ Hosts)
(7) Focus Group	Silver Age DJ	6 older persons (DJ Hosts)
(8) Focus Group	GoActive.hk	4 Co-creation members (event organisers, game designer, Gerontology students)
(9) Focus Group	GoActive.hk	2 social workers
(10) Focus Group	GoActive.hk	4 social workers
(11) Focus Group	GoActive.hk	3 older persons
(12) Focus Group	Silver Age DJ	2 older persons (DJ Hosts)
(13) Focus Group	Silver Age DJ	4 older persons (Audiences)
(14) Focus Group	GoActive.hk	5 older persons
(15) Focus Group	GoActive.hk	8 older persons

collaborating social service agencies. They helped the research team inform potential interviewees about the research objectives, interview contents, and the time and venue of the interviews. The social service providers, co-creation team members and independent consultants were invited through the research team's existing connections with them. The Human Subjects Ethics Application Review Committee of The Hong Kong Polytechnic University granted ethical approval for the project (Reference Number:

HSEARS20210601001). Informed consent from participants was obtained before each interview.

3.2. Data analysis approach

The content of each interview was summarised and studied using thematic analysis. Thematic analysis was used for coding and theme development directed by the content of the data and following the procedural framework for thematic analysis outlined by Abd Kadir et al. (2023): (1) searching for themes; (2) reviewing themes; (3) defining and naming themes; and (4) writing up. All interviews and focus groups were audio-recorded with the participant's consent, and the recordings were reviewed. The raw data underwent a coding process to analyse qualitative data and categorise individual sets of data. The data were studied case-by-case and coded according to themes. We constantly compared raw data and codes/themes from the interviews. The differences between stakeholders' viewpoints on promoting digital inclusion amongst older people and the impact of the co-creation and participatory projects were identified and addressed.

The interviews were audio-recorded and verbatim transcribed. Moreover, since all the interviews were conducted in Cantonese, the local dialect of Hong Kong, the research team translated the narratives into English. To ensure the accuracy of the verbatims, three team members reviewed and revised the translations to confirm the inter-rater reliability.

4. Results

By adopting the thematic analysis methods mentioned in the above section, including the procedures of coding for each set of interview transcript, and then the themes were identified through constant reviews of raw data to finalise the themes. Four major themes were thus identified from data analyses. The new themes include (1) perceptions of technology, (2) barriers in acquiring new technological skills, (3) drivers leading to involvement in technological activities, and (4) health and social benefits leading to active ageing.

4.1. Perceptions of technology in older people

From the sharing by the older people who had attended the focus groups, all of them agreed that learning and using modern technologies had become essential. It was no longer viable for them to evade using technologies in many aspects of their daily lives despite the challenges they faced in their struggles for digital inclusion. Older people explained their negative perception when they resisted change: 'Technology is the new generation's reform; it replaces a lot of traditional thought. We always hold on to what we have done'.

Another older interviewee shared a positive perception that technology could help enrich their daily life through engagement in online entertainment.:

> Even though I do not understand English, the melody reminds me of the good old times of teenagers; it feels like all the memories flooded my mind. Listening to music every week relaxes me and eases my worries.

Staff support also remained positive by tracking older people's technology learning. The staff engaged the older people to discover the technology with optimum resources, and co-creation was achieved. They collaborated with other participants and participated in various stages of the programmes, allowing them to accept changes brought by technologies. As one older person reported:

> It is good for the supervisor from the community centre to check the details of running the programme for us, so we also know how to check the details of the DJ programme ourselves. The staff members patiently teach us to address various difficulties and strive for improvement.

Older people's perception of technology through the co-creation activities facilitated new bonding and technology design. For instance, a co-creation team member expressed older people's concerns about learning:

> The design is for better controllability. Previous websites or apps are not considered suitable for older people . . . , but this program is running smoothly because it is age-friendly.

The results show that older people's preliminary perceptions of technologies are negative, but enhanced perception through co-creation facilitated their higher acceptance of technologies. The staff support improved their perceived ease of use, positively motivating them to learn and use technologies.

4.2. Learning barriers in acquiring new technological skills

Challenges and barriers mean that when adopting and becoming proficient with technology, older people often cite obstacles stemming from inexperience, complexity, and restricted access. Older people reported challenges of misleading use of technology hindering learning and usage. An older person shared her opinions on why some older people had little intention to learn technology:

> I have done well to maintain my life for years. I don't need to learn new things. And some people, like me, I used to be very resistant to these things myself. Sometimes it depends on your own mindset . . . If you want to learn more things and understand, the world is so big. If you don't change . . . you will be left behind again.

Another older person had engaged with technology before but still faced challenges due to their physical condition: 'I can't remember things well because I have a poor memory. I had learnt it, but I would forget very quickly'.

In addition, resources from support centres might influence the effectiveness of older people's learning and developing technologies, including financial and workforce resources, which sustained older people's technology usage. A co-creation team member who was an app developer suggested that:

> The first element for empowering technology in older people is having the optimum level of resources. The first thing is money. The second is the human resources, including experts

such as in gerontology who know older people's needs to learn tech and support the development (of age-friendly tech applications) . . .

The co-creation team also reported that cyber security was the main barrier stopping older people from reinforcing their technological skills and digital literacy online. A staff member tried to explain that security was more advanced now, but one older person insisted: 'Cyber security is important for older people. It is like some grannies got a million or two million dollars and are all being cheated'.

Our findings further illustrate the challenges and barriers older people face nowadays. They have a sense of social information flow enabling them to understand the risks and adverse outcomes of misusing technology. Accurate resource assistance to support sustainable development for older people using technology might be a potential challenge.

4.3. Drivers leading to involvement in technologies

The research results revealed that experiencing technology practices could motivate an individual's intention to learn and use it in the long run. Four interviewees reported that having hands-on experience with technology may be inspiring. Older people are more inclined to study and use technology efficiently when they perceive its advantages and practical uses. Utilising technology to solve problems in the real world, complete work more quickly, or increase individual productivity could be considered practical experience. As one co-creation team member said:

> Virtual technology reduces loneliness among older people, such as joining a virtual party with friends. I think this can help older people have meaningful lives both physically and mentally. I believe that this minimises the pain suffered by older people, even those over the age of 70.

Many staff members and design consultants believe that social experience is vital for older people to absorb new knowledge. Social interactions can offer information exchange, feedback, and assistance from others. Moreover, technology can facilitate collaboration and social connections. Finding like-minded people online, participating in group projects and online groups can all help create a feeling of community and drive to learn and use technology. One staff member reported that the centre was increasingly using ICT to deliver its services to older people:

> Instead of only promoting new technologies amongst older people, our aim is to enhance their frequency of utilising gadgets and digital platforms. The Jockey Club has some programmes there, and then we have some programmes for older people living alone; they will use ICT, or they may have tablets and tools. So, at this level, the centres have been used more. . .to provide services.

Some older people advocated that personalised experience could encourage them to continue to learn and use technology. Particularly after the restricted intervention of the COVID-19 outbreak, they realised the need for technology in their social and daily life. Customising technology-based instruction to each learner's requirements and preferences could be very motivating. One older adult shared their experience after using

tailor-made technology for health check-ups: 'A phone notice reminds me how often I have to go back to the clinic, and if I do not get it, I will have to ask someone to give me the medicine'. Another older person shared their conviction that technology had enabled them to pass through COVID-19 and enhance prevention measures: 'It seems that you can check the status of the appointment, such as checking the location, vaccine appointment, and so on'.

A few older people also shared their thoughts on the benefits of advanced mobile technology for health monitoring that prevented misinformation. By learning technology, older people effectively build up their intention to use it after various experiences and can tackle external turbulence in their daily lives. Some older people who reject technological experience are more likely to receive feedback from centre staff, encouraging them to use and learn the updated technology.

4.4. Health and social benefits constituting active ageing

Common effects and benefits of using technology refer to the numerous benefits and advantages of improving older people's social and physical well-being. Eight interviewees reported that technology enhances their ways of health monitoring. Some respondents show significant health improvement supported by technology. One health-tech developer said:

> Self-serve healthcare supported by technology could immediately provide physical and mental support, especially in an emergency; I believe technology must be useful.

Programme participants also shared that technology could enhance their social mobility. Especially during the lockdown of the pandemic, Technology-driven mobility aids and devices, including motorised wheelchairs, can increase older people's mobility and independence. Older people who use these assistive gadgets can walk about more readily, engage in social activities, and lead active lives. The impact of technology on breaking through social life restrictions was clearly revealed during the COVID-19 lockdown. A staff member in the elderly community centre reflected on technology and the development of the digital world:

> The elderly centre helped the older people discover many different online worlds, much different software, and so on. It may enrich their lives or make them easier . . . The pandemic encouraged older people to acquire healthcare knowledge online.

Furthermore, technology usage maximises the social connection between older people and their social networks. Older people can maintain relationships with friends, family, and support systems using social media channels, video conversations, and messaging apps. This may lessen social isolation. One older person shared:

> So, I use my mobile more often. I have Facebook, and I use WhatsApp more frequently because I can save on phone calls, and it is convenient for texting, and so on. Also, due to the pandemic, Zoom is used more often. . . Why do you use Zoom? Because there are events, or I went to a prayer meeting at my church.

In short, the expected effects and benefits for older people in using technologies lead to significant health improvements. Social connectivity assists older people who suffer from emotions of isolation and loneliness. In general, older people's physical and mental health greatly benefited from using technologies.

5. Discussions

By applying the method of thematic analysis, four major themes were identified from the findings related to older people's use of technologies and the promotion of active ageing, namely 1) older people's perceptions of technology; 2) the barriers they encountered in acquiring new technological skills; 3) the drivers leading to involvement in technological activities, and 4) the health and social benefits associated with active ageing. It has been found that the common challenges and barriers that older people faced in learning and using technologies include inexperience in the complex configurations of the digital devices and their cybersecurity concerns. These factors often led to negative perceptions of technology, as many older people felt overwhelmed by new skills and knowledge or resistant to change. Also, a shortage of financial resources could hinder their willingness to engage with digital tools. The study identified that positive digital experiences, such as the hands-on application of technology in daily life and supportive engagements in online social interactions, can motivate older adults to learn and use these tools. Older people also tended to accept and embrace technology when they perceived some tangible benefits, such as improved social connectivity and health monitoring. The co-creation model employed by the programmes discussed in this study, in which members of the senior community centres were engaged in operating the agencies' digital platforms, also played a crucial role. It fostered a sense of ownership and empowerment among older people, enhancing their motivation to participate in digital activities and achieve active ageing. These concur with what H. Chen et al., 2023 suggested that older generally prefer traditional forms of social engagement while they experience digitalisation in daily life.

We acknowledge that the study did not capture detailed demographic parameters such as educational background and health status, which is a limitation. Regarding socio-economic status, we believe that our participants should be similar to the demographic characteristics of the general older population in Hong Kong since they were affiliated with two senior community centres serving residents from typical public housing estates and neighbourhoods nearby. Hence, the results of this study might be valuable references for policymakers, service providers, and other stakeholders in Hong Kong and other ethnic Chinese metropolitan societies.

While the digital era continues to evolve, active ageing requires advanced information and communication technologies and co-creation. This study examined the barriers to using mobile phones or technologies, which led to a widening digital gap to promote the well-being of older people and achieve digital inclusion. This study is consistent with the findings of Cheung et al. (2021), Vaportzis et al. (2017) and Delello and McWhorter (2017) that more frequent technology usage and adequate digital proficiency could enhance mutual connections between older people and their social networks. Social media or messaging apps could prevent older people from being socially excluded.

The study revealed that older people encountered barriers to using technological gadgets and learning new technologies due to physical changes in old age. Given these

patterns, older people are less likely to become skilled at high-complexity technologies, echoing the findings of Herzlinger (2006), Esmaeilzadeh (2020), and Khan and Loh (2022) that older people's lack of exposure to new norms in the digital world would lead to their lower acceptance of technology. Community centre support played a vital role in assisting older people in their technological learning experiences, which could empower them in new social norms that increasingly emphasise using technologies in different aspects of daily life. Moreover, older people could be easily discouraged if they experienced financial difficulties and lack of support from others in learning and using technology, as K. Chen and Chan (2014) and Khan and Loh (2022) also found in their research.

This study also identified factors facilitating older people's empowerment in the digital age. Hands-on experience with using and co-creating technological activities, such as those associated with entertainment and interactions, may encourage older people to learn new technologies more sustainably and confidently. Our finding are consistent with those of Thalassios and colleagues (2019), that active participation in activities related to mutual communication with older people's families, peers and other members of their communities helped empower them in the technological learning processes. Generally speaking, the convergence of the digital age and population ageing presents a critical social trend in which older people often encounter challenges in becoming proficient in digital technology due to poor memory, reduced physical and mental capability and financial affordability. The recent COVID-19 pandemic has further highlighted the challenges of digital connectivity for older people experiencing isolation and illnesses.

Although this study has only focused on the participants recruited from two programmes, it should not affect the representation of diverse circumstances and viewpoints captured by the participants. The older participants being interviewed in our study had different proficiency levels and application in technologies, which helped enrich our findings and analyses. Some participants had initially resisted learning and using new technologies at the beginning and had reservations about the potential benefits. This concurs with a few previous studies on older people's resistance towards new and their perceptions of the detrimental impacts on them (Bertolazzi et al., 2024; Button et al., 2014; X. Wang, 2024). Nonetheless, most of the participants from these two programmes had been gradually integrating themselves into the digital world. Some transformations of their attitudes, mindset, digital skills and knowledge, and social life had been observed. Also, some admitted that they were still struggling with getting more skilful in different smartphone configurations at the time of the interviews, mainly due to problems such as poorer memory at old age, physical limitations and lack of support from others in learning and using the gadgets. Hence, the study is represented not only by positive and favourable examples related to the success of older adults in learning and using technologies but also by overcoming issues related to their initial scepticism and resistance towards technologies and the ongoing challenges they were undergoing.

Based on the results of the current research, we suggest that more effort should be made by policymakers, social service providers and the entire community to support older people in learning and utilising the benefits of new technologies in their everyday lives to achieve digital inclusion. This recommendation is in response to the obstacles frequently encountered by some older interviewees in our study stemming from inexperience, complexity, and restricted access using smartphones, gadgets and other online

applications. Poor memory and their limited linguistic abilities have also hindered their learning and usage of technologies. This also echoes Y. Wang and Zhang's (2019) research in which various community-based stakeholders and sectors provide different programmes to assist older people to learn and use. According to the 2021 Census, 44.6% of the Hong Kong residents aged 65 or older had only attained primary education or below (Census and Statistics Department, 2023a). These unique demographic characteristics of Hong Kong's older population might have brought significant barriers to developing technological skills and knowledge compatible with what they need for daily survival in the digital era. Therefore, the government, service providers, and community groups can offer more platforms for older people to learn digital technology, such as running regular digital training courses that balance practicality and amusement, which are believed to be essential for active ageing. These classes could include content like using instant messaging applications to connect with significant others, ordering takeaway online, and using government platforms and medical appointment services.

It would also be helpful to utilise the influence of peer groups by nurturing knowledgeable older adults to become tutors, who should be more empathetic to older adults' mentality and learning progress. Another potential initiative could be cultivating 'digital ambassadors' through the 'Care Teams', a community mutual help model recently developed by the Hong Kong government, to strive for comprehensive digital inclusion in an immersive manner in different neighbourhoods. As some of our interviewees pointed out, older adults tend to rely on staff members of the community centres to resolve operational problems of their digital devices and use online platforms related to their daily lives. Therefore, the 'digital ambassadors' can work closely with the community centres to offer intensive and timely digital support for older people at the community level so that they can be provided help whenever they encounter technological difficulties.

In assisting older people to enhance their skills and knowledge of new technologies, social workers should also exhibit patience and proficiency in what older people are concerned about technologies, especially barriers and worries about using specific configurations. Local social workers need to develop and employ specific communication skills tailored to this context, ensuring they teach digital skills that align with each older person's unique learning progress. Additionally, to further empower older people in grasping digital skills and align the digital services with their specific health and learning needs, the co-creation models could be adopted by getting the older people involved in developing websites, applications, and devices to be used in the community centres, as proven to be effective by the two projects focused by this study. By being attentive to these factors related to digital initiatives, social workers can create a supportive learning environment that strengthens older adults in the community, so as to achieve active ageing.

On top of offering training and supportive services for older people in learning technologies, we would like to highlight the co-creation model the two programmes employed. Although we acknowledge that the experiences of the participants in these two programmes were district-based and might not fully represent the broader population of older adults across Hong Kong, the co-creation model of applying technologies in older people's daily lives could enhance active ageing by enabling older participants to engage in projects related to technological skills and knowledge

directly. This model shall shed light on future policies and service initiatives to foster similar initiatives elsewhere.

Most of our older adults and stakeholders interviewed by us pointed out that consistent and cohesive support offered by social service providers is essential to resolving some imminent technical difficulties on their gadgets and equipping them with the technological skills and knowledge in the long run. A technological expert reflected that community centres could help older adults expand their digital proficiency. To improve the efficacy of the digital inclusion approaches, more is needed to solely provide training programmes for older people; there should also be follow-up support services in different neighbourhoods to address any technological difficulties they may encounter. Quite a few of our older interviewees pointed out that some online platforms and applications played an important role in their daily lives. For example, during the heyday of the COVID-19 pandemic when a lot of them were put under quarantine and subject to other preventive measures, the applications on smartphones provided useful health and medical information to them. Hence, to a certain extent, technologies have helped them to stay connected with the community. Therefore, it is recommended that public resources should also be allocated to develop more user-friendly devices and applications to enable older people to access the digital world more easily, such as improving the platform interfaces mentioned above. Service providers and IT developers could be crucial in this regard. For example, introducing easy-to-use apps related to public transport, healthy diet and habits, grocery shopping, ordering meals, and cultural activities that older people feel interested in may enhance their digital experience, making technology more accessible and enjoyable.

As mentioned above, this study has several limitations. First, it only considered the clientele and stakeholders of two programmes in Hong Kong, 'GOActive.hk' and 'Silver Age DJ'. However, other agencies in Hong Kong provide other programmes and intervention approaches for older people. A larger sample of participants enrolled in other intervention approaches and programmes related to digital inclusion for older people would make the study more representative. Second, we did not collect detailed demographic data from participants, so we cannot take their exact age, family background, educational attainment, and employment status into account. Future studies should use a sample of older people and relevant stakeholders from more intervention programmes and projects related to facilitating digital inclusion. This will enable exploration of the diversity between different contexts and how different experiences in learning, participation and receiving support services affect the extent of digital inclusion and active ageing.

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Disclosure statement

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