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Research paper

Successful Aging among Older Adults Using Computers: a Systematic Review

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Abstract

Recently, most of the previous studies focused on technology use and adoption among adults. However, few studies have been conducted on older adults. More specifically the emphasis is on the problems in different areas i.e. health care, housing, education, employment, and product design. Therefore, in this study, a systematic literature is taken into account where it includes multiple databases with a cut-off starting point of 2007 to 2017 that empirically examined predictors of successful aging of older adults to investigate current empirical studies. This study found that the use technology such as automatic teller machines (ATM) or VCRs are the predictor of use of computers. Moreover, older adults are likely to adopt to new technology when they recognize potential benefits. It is expected that the consolidated literature will serves as a guideline for future studies.

Keywords: *Benefits of using technology, Older adults, Technology adoption, Successful aging.*

1. Introduction

Apparently, most of the developed countries in the world are currently experiencing the strike in the average age of their population and this has been proven as the OECD 2006 had reported that the population in the majority of developed nations throughout the world has shown improvement in the average age. This creates new problems and requires different undertakings in the issues of health, residences, transportation, education, employment and consumer products [1].

The definition of the term older adults basically takes into consideration about various perspectives as well as goals. For instance, according to the gerontologists, the highlight is being focused on those who are 65 years old and above. Based on what the federal government state, the age of 65 is actually used as a marker in relation to the Social Security and Medicare benefits. In general, the these are the subgroups identified by the researchers where "older adults" as "younger old" (ages 65-75), "older-old" (ages 75-85), and "oldest old" (ages 85+) [2].
The consequence of aging is the physical and cognitive changes. There will be a reduction in vision, hearing, and psychomotor coordination [3]. Cognitively, changes are in the form of reduced attention span, decline in cognitive processes

and retention, and changes in spatial relations among objects or space. Hence the need to create interfaces that contain fewer distractions, provide memory signals, and are user friendly [3]. To cater to these issues, the launch of the technology-enabled devices and systems are introduced to the market. Nevertheless, most are yet to see the importance and therefore the rate of utilizing them is still insignificant.
Most consumers do not embrace technology because designers do not consider the target market's characteristics, expectations, and needs [4]. The gap between technology and what the consumers need is broad, and the relevant industries have yet to tap the potential benefits from the older adult market, which holds substantial spending power [5]–[7].

It should be noted that the older adults is an emerging internet user group for both personal and professional purposes.[8]. This emerging trend of computer adoption by the older adults has undoubtedly become a research area which should not be disregarded.

2. Method

This paper intends to distinguish and outline the factors that affect technology adoption by older adults. For this purpose, the present article reviews the existing literature, and the questions that guide the systematic review are also presented: which factors are seen to be the most frequently identified predictors when it comes to the older adults' quality of life. what has been the methodological quality of the studies, especially the methodological limitations pointed out in the review in order to provide a holistic view of the field of successful aging. In the next section, the methodology that was used to find articles are presented, and subsequently the

literature analysis. This article ends with a discussion and conclusion of the findings that deliberates on how the fulfilment as well as consideration of each factor in the technology development can be a source of guidance towards the higher adoption besides being continuously used by the older adults.

The articles retrieved were all the English language peer reviewed journals from different database for the older adults' peer reviewed journal articles on the subject of human computer interaction among older adults and successful aging. Multiple databases were searched to gather the literature: information technology (Inspec); Social sciences (Social Sciences Abstracts, Social Sciences Citation Index, and the Applied Social Sciences Index); gerontology (Age Line and Abstracts in Social Gerontology); and SCOPUS. Search strings included reference to aging (age or aging or old or older or senior) and also the reference to computer use (computer or Internet or web or interface) and quality of life. A cut-off starting point of 2007 to 2017 that empirically examined predictors of successful aging of older adults was selected. Moreover, the reference list of these articles was also searched for additional studies.

A. Inclusion / Exclusion Criteria

Only quantitative studies reporting significant association of the benefits of the quality of life with probability level of $p < 0.05$ were included.

The organisation of this paper is as follows: Section 2 provides summarisation of technology use. Section 3 discusses technology adoption. Section 4 provides discussion on the literature review of the factors in which computer interaction benefits older adults and finally Section 5 concludes this paper.

3. Literature Analysis

The present literature covers two main areas of research, i.e. technology use and technology adoption. The reciprocal relationships between those elements, that are Internet-based facilities apparently might offer specific opportunities for this age group.

B. Benefits of Using Technology

The benefits mentioned in the literature can be divided into five categories. First, the Internet facilitates social interaction and communication. Second, the Internet improves entertainment and learning in the home. Third, the use of technology supports autonomy by providing access to information services and facilitation of routine tasks. Fourth, improved health-services. Fifth, the Internet improves mental stimulation.

1) Internet use and social interaction

Technology has the capability of improving the lives of the older people. Connections can be made through computer networks to enable communication between family members and friends, especially those on long distance relationships [9]. Network linkages can make it easy to communicate, especially with those who live in different time zone. Several studies e.g.[10]–[12] demonstrated that older adults are more open to using emails than that of the elderly for communication. Social connectivity basically helps the older people especially when it involved the ones who are apparently isolated or are living alone by themselves.

2) Provision of entertainment and learning

Computers may help older people to become involved in lifelong learning. There are numerous websites and softwares on many topics that are in existence now. It is already a trend currently for many industries to adopt e-learning for employee training. In education, e-learning caters for those who seek on-going pursuit of knowledge in life [13]. Videoconferencing and networking facilities have made the learning process more accessible to older adults, making them more actively engaged in intellectual activities without having to commit themselves to conventional classrooms. AARP has consequently commenced online degree programmes.

3) Technology use and autonomy

There are a number of ways older people can use computers at home to enhance their independence and qualities of life. Home computers can provide access to information and services and can facilitate the performance of tasks such as banking and grocery shopping [14], [15]. Many older people have problems performing these tasks because of restricted mobility, lack of transportation, inconvenience, and fear of crime [16]

4) Healthcare services

Advanced computers have also been utilized for the elderly's improvement of mental and physical health. They are able to connect themselves electronically to medical experts whereby these trained health care persons may be able to monitor them daily and conduct health assessments even though patients are on home treatment basis. Those patients who are required to be institutionalised may not have to but can remain in the comfort of their own residence.

e-Health, which is an interactive health communication portal enables a patient to communicate with medical authorities on health issues, involving consultations, support groups and managing health information [17]. In reference to the scope of e-Health applications, it is broad but it apparently includes the information about health, participation in support groups as well as consultation with the healthcare professionals. Modern consumers currently seek medical information and alternative treatments online. Easier access to health information, growth and development and technologies have reduced significantly cost and time of treatment. In addition, these easily obtainable information has promoted better self-handling and prevention of illnesses [18].

Table 1 Illustrates Some Benefits of Using Computers.

BENEFITS OF COMPUTER	Reference
Communication And Contact With Family And Friends	[18]
Limited Mobility	[19]
Social Interactions	[20]

Table 2 Demonstrates factors of using computers. Table 2 Summary of factors of older adults' use of computers

QUANTITY	References
leisure and entertainment	[21]
Information seeking	[19], [22]
Information, education, and productivity, including mental stimulation	[21], [23]
Barriers to computer use	[24]

C. Technology Adoption

Attitudes, intention and actual usage are several factors that affects users' when they are presented with a new technology [25], [26]. Besides social context, practicality and easiness of the technology are elements that are observed to be influencing the attitude of the people use [27]–[29]. Research has shown some aspects that can actually give an impact towards adoption decision are individual differences, including age, education, income, cultural background, technology self-efficacy, and life stage. [5], [30], [31].

Research on technology adoption by the public has covered

numerous areas, although it is unpopular among users of the older population. Past research, which viewed older users as non-adapters, has emphasised on physical disabilities and issues of safety [7]. Older users are incompatible to other users in the population because they are not as competent in physical and cognitive capabilities and not as exposed to technology [32]–[34]. They are normally seen as reluctant to accept the demands of technology, although they are in fact prosperous, independent and well-connected in the society [19], [35], [36] . The older users are actually conscious of the benefits of technology they are more open to undertake the demands of technology [37].

In accepting technology the older adults considers its practical use and the cost it incurs [38]–[40]. The subsequent section deliberates on the how the older users embrace technology.

3.1 Perceived Usefulness

The older users use technology to gain a certain outcome The SCAN Foundation (2010). They are interested only if the technology has practical benefits that contribute to their way of life [37], [41]–[43]. They are not keen to use technology if it does not offer practical use.[48] believed that older adults need to see the possible benefits of technology before they would embrace it.

3.2 Ease Of Learning And Use

Petrina, Feng, and Kim (2008) opined that it is essential for the older adults to find technology as user friendly to them in order to realise the benefit it brings. This is unfortunately not so in many existing systems, whereby researchers found that computer mouse, e-mail, and health information web sites are deemed as error-inducing and was found to be very difficult to manage [5], [8], [12], [43], [44]. Design principles and guidelines have been suggested in the effort of enhancing the usability. One of the ultimate rules stated is to keep the interfaces as simple as it can be [44]. Technology should not contain features, options, or information that may distress older users [38].

3.3 Affordability

Cost is also a factor that turns off older users. It should be reasonable to the older users. For example, Steele, Lo, Secombe, and Wong(2009) found that cost is a determinant for the acceptance of wireless sensor networks among the older users. The high cost of technology is due to the extensive duration of use. The older users disapprove the high initial cost for assistive technology systems, although in the long run the systems reduce the expenses of future hospital visits and disease management. An analysis of the cost incurred may assist the older adults to understand the high cost of technology, and what gain it brings [45].

3.4 Accessibility

Wang, Redington, Steinmetz, and Lindeman(2011) older adults tend to dislike technology that requires too much effort in learning or using. Accessibility to technology, in the form of the amount of information and how the system is delivered, is a factor that determines older users' awareness and acceptance [38]. It is therefore critical to select the most suitable and effective channel of marketing to these older users are critical [19].

3.5 Technical Support

Mitzner et a(2010) found that older adults disapprove extensive learning in order to be able to use technology. It is therefore crucial for them to be provided with proper coaching and technical support, which include in-person training as well as written manuals with specialized designs in simple language, to enable [them] to adopt technology as they have not received or exposed to technology education in their early life. [44]–[47]. Besides, it is believed that with the presence of specialised design, the technical support for older adults, which includes other efforts i.e. in-person training and written manuals will reach ultimate effectiveness [37], [46], [48], [49].

D. Aging as a Barrier to Technology Adoption

Growing old involves a gradual slow-down in the physical and cognitive abilities of an individual. These abilities are considered important to learn and use advanced technologies [50]. Age-related changes have been found effecting negatively on the sight, sense of hearing, memory, and motor control. Most of the age-related changes that are experienced by older adults started apparently in the early 40's and when they reached their 50's, the first stage of aging come into place [51]. Seniors generally lag behind technology acceptance and adoption than younger adults [52]. Potential reason of low rate of adopt was found to be unique challenges and barriers that older adults face due to aging [53]. Thus, it is really crucial for the older adults to actually have the awareness in adopting as well as using the new technologies. Among the barriers that they experienced are those which deal with vision, cognitive challenges, computer anxiety and technophobia.

1) Vision Challenges

The difficulty in terms of sight which started at a middle age for individuals actually brings problems in terms of their vision. Based on The American Optometric Association (2015), a number of the age-related vision changes such as problem with near vision (presbyopia), glare, lighting, and colour perception have been listed. Presbyopia (which literally means "aging eye") is commonly known as an age-related eye condition which happened to start around the age of 40-45 years [54], [55]. Older adults with decreased near vision makes finds it more difficult to focus on near objects; such as reading at close range, seeing the mobile phone numbers, or doing close work.

Haigh's study had also revealed that adults who are basically above 40 years old frequently have problems and difficulties with glare and meanwhile, for adults who are above 60 years old, they requires three times more intense light to see detail than a 20-year-old to see the same level of detail on average [56].

2) Cognitive Challenges

Cognitive abilities are found important in order to learn the use of complex technology products [24]. [12] studied intelligence among older adults the results of which indicated that fluid and crystallized intelligence (cognitive abilities) are essential in the prediction of technology adoption. Decreased memory capacity, attentional control, and difficulty in goal maintenance are the unique challenges that are brought with aging [57]. These challenges act as a barrier and slow down the level of performance of older adults which in turn increase the risk of chances of errors when they interact with technology especially that is not designed keep in mind the challenges and the capabilities of old age

Previous empirical found that older adults takes twice as long time to learn a new word processor than younger adults, whether they were beginners or experienced with another word processor [58].

3) Computer Anxiety and Technophobia

One of the major barriers of computer and internet access especially among elderly is computer anxiety and technophobia. Computer anxiety is a strange feeling of discomfort, stress, or fear that older people experience when they are confronted with computers. On the other hand technophobia is a fear of technology in general and a distrust in its beneficial effects [58]. Older adults experienced fear of consequence of use in new technology such Internet [21].

4. Discussion

This manuscript presents a systematic literature review on the factors in which computer interaction benefits older adults. With the systematic review of the methodology for this paper, it has successfully gathered as well as synthetized empirical studies aiming at evaluating the literature on the successful aging when it comes to the older adults who apply technology in their lives. Even though there are other studies mentioned in the literature which researched on the use of technologies for the seniors, there is still lack of information on the diversity of technologies as well as how it is seen to be effective in every day of the elderly's life besides the factors which play the role as the barriers for them in adopting technology. As the number of older people in using internet is increasing, there are lower than that of younger age groups. Apparently, technology is deemed as way that is effective for the older adults to keep themselves healthy, safe and independent as well as providing a room for them be connected to the society. As it also plays a big role to improve the quality of life for this particular age group of people, increasing attention has been observed when it involves the use of technology and internet and thus it is regarded as the potential solution [36], [37], [59]. However, there are shortcomings in accessing the Internet. For example, those who are more than 65 years old are much less likely to have a high speed internet connection in comparison to younger people [60]. Based on the recent data collected, it can be said that older adults are actually less likely left behind compared to the younger adults in terms of using other mediums of technology i.e. automatic teller machines or VCRs and that the general use of technology is a predictor of use of computers and use of the Internet.

5. Future Work

There are further directions for the future studies and basically, the first one involves the factors where they are defined from a conceptual integration of existing findings gathered. In investigating their validity in the applicability in various settings, empirical research can be a next step in the effort of completing this study. Also, possible associations and relationships between Internet benefits and technology use in improving the quality of life of older adults can be further examined.

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