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Aging, E-literacy, and Technology: Participatory User-Centered Design for Older Adults' Digital Engagement

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Abstract

Though information and communication technologies (ICTs) have increasingly changed peoples' experience of e-literacy learning practices in a contemporary digital environment, many researchers have identified that older adults have not considerably benefitted from such technologies. Therefore, to benefit older adults to a greater extent from ICTs, we need to promote intergeneration communication through which older adults, especially novice users, get an opportunity to gain a deeper understanding of how to use ICTs in their everyday life. I propose a participatory user-centered design model through which I seek to illuminate a pathway toward a potential involvement of older adults with ICTs innovation. Such an involvement, I argue, can be afforded by deploying usability in product design for older adults. I contend that participatory user-centered design can also substantially promote social justice as older adults continue reciprocal e-literacy learning practices for active civic engagement by bridging the digitally divided gap between information haves and have-nots in modern digital times.
Keywords: ICTs, e-literacy, intergenerational communication, social justice, digital divide, participatory user-centered design

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Introduction

Over the past few years, many, if not most, societies in the world are facing a demographic change due to increased life expectancy, relatively low birth rate, urbanization, advanced healthcare systems, and a relative increase of older adults (Schäffer, 2007; Moody & Sasser, 2015; Haux et al., 2014). According to Rodríguez et al. (2009), "The aging of population is a phenomenon faced by many nations" and "it is estimated that over the next decades, the old populations will significantly age as a consequence of birth cohorts during the 1950s and 1960s and a worldwide decline in fertility since the 1970s" (p. 610). Research has shown that birthrate in many developed countries has been dramatically declining and mortality rate is accelerating in a way that the populations of older adults would surpass the populations of younger adults within the next few decades. According to the report prepared by the United Nations Department for Economic and Social Affairs, Population Division (2014), "an important consequence of observed and anticipated changes in fertility and mortality is population ageing" (p. 30). More so, the report claims that though the number of young people has grown rapidly in recent decades, the number is expected to remain relatively stable over the next 35 years; on the contrary, the number and proportion of older adults are expected to continue rising well into the foreseeable future (p. 30). This means that older adults are the fastest growing populations, especially in the developed countries, where healthcare facilities, education, and technological innovation are newly available for quality of life and self-sufficiency.

The proliferation of information and communication technologies (ICTs) has played a key role in changing the lifestyle of many people, including older adults, in recent times. Interest in the study of technology and its impacts on older adults is growing in a range of fields and disciplines. For a few years, many researchers have begun to pay their attention toward older

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adults to identify to what extent and in what ways new information and communication technologies have benefitted them. In some of the countries like Germany, Italy, and the USA, digital or ICT literacy for older adults has been taken as a central theme in the discourses of educational and communicational science. Adopting an analytical approach, Burkhard Schäffer (2007), for instance, studied how older adults are devoted to the concurrent international two "mega trends": IT revolution, and the turning of demography in history, which is accompanied by a change in the structure of age and aging. By drawing attention to the relationship between literacy and older adults' use of ICTs, Schäffer's research reveals the significant differences with respect to the media use and media competence of older adults.

In order to know about older adults' experiences of the Internet use, Naomi Bloch and Bertram C. Bruce (2011), on the other hand, conducted an in-depth interview with 18 participants in the Senior Odyssey (SO) program in the U.S.A. Interestingly enough, Bloch and Bruce found that many older adults view the Internet as "a one-way, transmissive information source, and as a supplementary means of communication, primarily with friends and family" (p. 1). Inasmuch as older adults did not know much about the benefits of ICTs, using ICTs for them, according to Bloch and Bruce, was just a "waste of time" because they did not know the value of new technologies for civic engagement, content creation, and empowerment through public expressions of their own voices. Even more so, the authors also identified how the existing social infrastructure determines older adults' civic engagement—a high level of participation in social activities by maintaining social connections for a quality of life—in daily use of the Internet. Bloch and Bruce write, "as more and more agencies turn to the Internet to inform and communicate with the public, and open government policies gear heavily toward online civic engagement, serious consideration needs to be given to those left out of our online discourse" (p.

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1). Thus, in exploring the issues of information behavior and literacy, the authors found that much attention is yet to be paid towards older adults to engage them in online discourse.

Essentially, along with the advent of networked technology, we must orient toward the rapid growth of older adult populations and their technology use for their active civic engagement by staying connected to other people and communities. While examining the impacts of networked technology on older adults' life, many researchers have indicated the deficit aspects of aging as a problem for learning practices (Morris, 2007; Scialfa, Ho, & Laberge, 2004; Bloch & Bruce, 2011). But inclusive attention to such aspects support the view that technologies is to be enjoyed by younger generations. Instead, I argue that designers should develop innovative approaches to developing information and communication technologies that support older adults' e-literacy learning practices to enhance their quality of life. In discussing aging and older adults' use of computer technology for e-literacy, my goal in this paper is to map a model that might resolve, at least, some of the consequences or pitfalls of ICTs, which are designed without paying attention toward older adults as potential users for late life e-literacy development and practices.

In order to enhance older adults' e-literacy learning practices, I propose a participatory user-centered design model that allows ICT designers to understand the needs, expectations, and preferences of older users. Adopting such a model ultimately helps ICT designers and developers work with, in Jesse James Garrett's (2011) words, "every possibility of every action the user is likely to take and [understand] the user's expectations at every step of the way through that process" (p. 19). Following Garrett, I argue that ICTs designers and developers have a rich role to support older adults for e-literacy learning practices. In what follows, I, first, define e-literacy to reinforce its difference from other similar terms such as digital literacy, technology literacy, or

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computer literacy. Then, I focus on the need of ICTs for older adults to enhance e-literacy learning practices for socially integrated active aging in later life. This section is followed by the discussion of intergenerational communication that motivates older adults to participate in e-literacy learning practices in the digital world. Next, I point out the two key pitfalls—digital divide and social injustice—of designing ICTs without considering older adults as prospective users. I conclude by proposing and discussing a participatory user-centered design model to be deployed in ICTs in order to empower older adults to continue late life e-literacy learning practices for digital as well as civic engagement.

Defining E-literacy

While e-literacy is understood as the knowledge and ability to use computers, the Internet, and related technology effectively and efficiently, digital literacy is defined as "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computer" (Gilster, 1998, p. 1). Unlike computer literacy, which is about the knowledge of computer, e-literacy is what Cynthia Selfe (1999) calls "screen literacy," the knowledge of reading and writing practices on computer. While computer literacy signals programming and advance problem solving or understanding the concepts, terminologies and operations that relate primarily to general computer use, digital literacy refers to "cognition of what [we] see on the computer screen when [we] use the networked medium" (Gilster, 1998, p. 2). In other words, digital literacy is heavily associated with digital or networked media. Technological literacy, on the other hand, is closely tied to the knowledge of accessing, managing, integrating, evaluating, creating, and communicating information. In other words, technological literacy means knowing how to work with basic tools like word processing and spreadsheets. Since all these terms carry layers of meaning that include skill or ability to use

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technology, I use e-literacy not only to mean "knowledge of" or "ability to," but also, broadly speaking, to infer social or local practices of using ICTs that enable users to access, use, and share information in a networked society. In the next section, I focus on the need of ICTs for older adults' e-literacy learning practices and development to enhance and support their social connectedness and well-being.

ICTs and Older Adults' E-literacy Learning Practices

Information and communication technologies (ICTs) have become an integral component of everyone, including older adults, to continue education, health information, and online banking/shopping. Though recent research has shown that older adults are receptive to using ICTs (Czaja & Lee, 2007; Zickuhr, 2013; Berridge, 2014; Smith 2014), a commonly held belief is still prevalent that supports the idea that older adults are unwilling to use ICTs due to bodily and cognitive decline in working memory, attention, and spatial abilities. In "Perceptual Aspects of Gerontology," Scialfa and Laberge (2004) discuss older adults' difficulties of spatial vision (acuity and contrast sensitivity), slow visual processing, and poor visual sight and hearing loss (pp. 18-19). Their research primarily focuses on how modern technology is a problem for older adults. Offering some recommendations based on cognitive aging, Brett D. Jones and Ute J. Bayen (1998), in a different way, suggest that teachers need to design their course to compensate for older adults' cognitive slowing, limited processing resources, and sensory deficits (p. 685). Owing to older adults' perceptual, cognitive, and psychomotor decline, many researchers have found why older adults encounter a number of challenges while practicing e-literacy.

In their research findings, Anne Morris and Helena Brading (2007) identified that "many older people have some form of *cognitive impairment*" and "simple sites are often best and should be promoted because while they benefit all, simple designs are especially helpful for

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people with *cognitive impairment*" (pp. 21-22, emphasis added). Though Morris and her colleague provide a number of positive reasons why older adults cannot involve in e-literacy learning practices, we must understand that "older adults as a group are very heterogeneous and individual differences are very prevalent throughout the life courses" (Czaja & Lee, 2007, p. 344). Despite the heterogeneity of this group, older adults are commonly faced with manifold challenges that influence their immediate life situations (Thalhammer, 2014, p. 48). Emphasizing the need of assistive technology for older adults with cognitive impairment, Martha E. Pollack's (2005) states that assistive technologies should be developed to supplement human caregiving. Pollack claims that such technologies have the potential to improve the quality of life for both older adults and their caregivers (p. 9). While developing assistive technologies to enhance older adults' quality of life, it is also important to acknowledge whether or not these products are designed from users' perspectives to maintain usable quality.

Bloch and Bruce stress how we can work to improve cognitive or physical well-being among older adults with the growing commitment to the development of an "age-friendly" environment. Because many older adults comprise a population segment more vulnerable to social isolation during late life (Ihm, 2015), they are very likely to be excluded from the public or civic spheres, and are, thus, treated as a social problem to be addressed, but not as a necessary component of a healthy society. Bloch and Bruce (2011) write,

> As more and more agencies turn to the Internet to inform and communicate with the public, and open government policies gear heavily toward online civic engagement, serious consideration needs to be given to those left out of our online discourse. Rather than allowing online media to further exclude the elderly, as is often the case today, we

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> might instead see it as a means to include them even more by overcoming barriers of mobility and physical limitations. (p. 1)

In exploring issues of information behavior and literacy, attention should (or must) be given to the older adults who do not increasingly benefit from the growing role of information and communication technologies. Thalhammer argues that "in view of rapid technological development it is also very important for all stakeholders (e.g. software engineers, education providers, and participants) to work together regarding the implementation and further development of [e-literacy learning practices] for older adults" (p. 57). However, to a larger extent, older adults are not adequately taken into account as potential users of technology, and, thus, many interfaces are designed without considering age-related changes in abilities (Czaja & Lee 2007). In effect, paying less or no attention towards the importance of late life e-literacy for older adults results in the digital divide, a pitfall that I discuss later, which is certainly detrimental to individual and society.

Since more and more information, personal communication, and business and financial news are conducted online in modern times, scholars such as Heidi McKee and Kristine Blair (2006) argue that older adults need to gain the valuable knowledge on their health issues and care. McKee and Blair write,

> As more news and information, governmental business, and personal communications are conducted online, older adults who do not use the Internet are at an increasing disadvantage in terms of developing social relations, participating in civic discussions, and gaining valuable knowledge on issues such as health care. (p. 14)

While McKee and Blair find that older Americans are increasingly facing the digital divide, Fausto Amaro and Henrique Gil (2011) examine the divide being created by "the designers of

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software and hardware," who are usually young people and who often lack the opportunity "to know the [sic] 'another perspective,' the perspective of [older adults] . . . " (p. 1026). It should come as no surprise that barriers to ICT use have resulted from the lack of attention towards older adults as potential users. At the same time, it is what Schäffer (2007) calls "a generation effect" that the older adults who "have made a habit of the media practice cultures they acquired during adolescence and approach modern technology from this perspective" face challenges while using computers to perform their desired tasks (pp. 38-39). To develop more useful and usable ICTs for older adults, the field of human factors should, therefore, seek to improve design for older adults by applying an understanding of what Janna Leikas and Pertti Saariluoma (2008) call "worth" and "form of life" (p. 306). Technical objects, products, devices, or services should be designed in a way that users must be motivated by the added value (i.e. worth), related to their form of life (i.e. lifestyle), the way of life, and life area.

In their research findings from Finland, Leikas and Saariluoma identified that well-being and health as well as daily living activities are the most valued life areas of older adults. According to Leikas and Saariluoma, the next most valued areas are "friends, relatives, and everyday issues" (p. 320). Among many factors involved, ICTs do play an important role in these valued areas. As demographic change continues to expand and older adults as onliners wish to act independently, it is urgent to recognize the importance of ICTs and e-literacy for them. From professional healthcare facilities to retirement benefits programs to communication with family members, friends, and other relatives in the current migratory phenomenon, older adults might need to go online in order to stay connected in the digital world. Certainly, Internet access and affordability are not sufficient enough to accomplish tasks if communication tools are complex to use. As Rodríguez et al. (2009) state, "Even though Internet access can become more

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ubiquitous and affordable for older adults and a feasible alternative to support communication with family members abroad, its adoption will not change dramatically if the communication tools are not designed to serve their needs" (p. 610). I argue that the adoption of ICTs can change people's life dramatically if de facto users are involved during the tool design process to identify users' needs, expectations, and abilities. Inasmuch as societies, industries, and governments are looking for new technological solutions for supporting older adults' different needs and for enabling them to cope with their loneliness, older adults need to develop e-literacy skills, and use those skills to know what benefits they can get from ICTs.

Now, tremendous progress has been made in healthcare services/systems such as eHealth/telemedicine and health enabling technologies as well as Internet use in information search and analysis. In effect, progress has been made worldwide with the development of new information and communication technologies that contribute to preserving and/or improving older adults' quality of life, health, and self-sufficiency. For instance, to identify how ICTs contribute to enhancing older adults' quality of life and health and to evaluate new techniques of ICTs for the design of environment for aging, a group of researchers in Germany ran a five-year research project from 2008 to 2013. Through this project known as "the Lower Saxony Research Network Design of Environment for Ageing (GAL)," the team learned how "multimodal and speech-based communication and human-machine interaction mechanism for persons with functional restrictions can implemented, and developed new methods and algorithms for identifying activities of daily life and for detecting acute events, such as falls" (Haux et al., 2014, pp. 173-174).

Since the demographic change in aging populations results in more and more older adults living alone, ICTs can support them to maintain their quality of life by their continual

involvement in e-literacy learning practices. For older adults who are homebound, Internet access, for instance, allows them to feel like they are out of the house, improves their connection with the outside world, and helps them avoid or reduce feelings of social isolation (Woodward et al., 2011). At the same time, programs that benefit older adults' e-literacy learning practices through intergenerational communication between older generation and younger generation should be launched. The next section discusses the need for intergenerational communication to motivate older adults for ICT-education that supports their social connectedness in the digital world. I believe that communication across generations would even help younger adults understand what it means to grow old in digital times. Through such communications, older adults also would perceive that incorporating ICTs into their lives would be increasingly advantageous and beneficial.

Intergenerational Communication

Older adults with ICT skills can access online sources for important information needed to live an active late life. However, many older adults may face challenges in accessing information due to insufficient knowledge of e-skills and usage gap. To support and develop e-skills through e-literacy learning practices, intergenerational communication between older adults and younger adults can be beneficial. Clara Berridge (2014) also mentions that generational incompetence is one of the main reasons why the population of older adults is considered to be far behind the technological curve (p. 174). This concept of generations incompetence, according to Berridge, "is based on a nearsighted perception of technology development and adoption over the lifespan, as well as misperceptions about older adults' abilities and willingness to learn how to use new technologies if they perceive that incorporating them into their lives would be of benefit" (pp. 174-175). When older adults lose their work and

the social ties associated with it due to generational incompetence, they must develop alternative ways of finding social connections to develop a new, post-retirement lifestyle. Therefore, intergeneration communication for digital technologies knowledge development can function as a bridge between pre-retirement and retirement life stages as older adults can continually remain actively online for civic engagement when they have time, resources, and position to do so. Such an engagement can demonstrate that they are still productive and are contributing to society (Gasiorek & Giles, 2013). In fact, intergenerational communication can help people involved to make new contacts and extend their social ties.

The role of ICTs in the process of active late-life is particularly important for older adults and may in fact account for many of the social, cultural, and economic benefits of their digital engagement. Gasiorek et al. write, "As older adults retire and subsequently disengage from their professional networks, pursuing new social avenues becomes a means of staying connected to other people and the community more broadly, a factor associated with successful aging. . ." (p. 2665). Gasiorek et al. also propose that "insofar as older adults become more isolated as they age, social connections made through volunteering may be beneficial and correlate with successful aging" (p. 2670). To be sure, older adults have been the most active demographic in the United States in terms of volunteering (U.S. Department of Labor, 2014).

One of the motivating factors for volunteering engagement is social connections that influence older adults' life in a number of ways. For instance, older adults, who offer volunteer services in various places such as hospitals and religious organizations, get communication opportunities with different people. ICT skills and e-literacy learning practices further enhance their social connectedness and companionships in such places. Moreover, knowledge about ICT use can open up other communicational channels through which older adults can gather

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information about health, entertainment, and ways of living a better life. As Berridge puts it, "access and ability to use the Internet can open channels of communication for older adults, whether the purpose is to maintain existing social ties or build new ones, gather information about health or social services, or for entertainment or education attainment" (p. 176). To further boost e-skills and e-literacy learning practices of aging people, intergenerational communication should be promoted so that older adults, especially those who fear using ICTs, can build confidence in using web-based tools for effective communication.

Recent research has shown that older adults need social support and motivation to develop their confidence and ability in using ICTs. As Thalhammer (2014) observes, "Older adults usually decide for themselves whether they want to participate in further education or not on the basis of their motivation, learning experiences, health status, and interest" (p. 47). In their research findings, Minnamari Naumanen and Markku Tukiainen (2009) also noticed that though older adults are "capable of and enthusiastic in acquiring ICT-skills and of gaining knowledge," (p. 1), motivation from younger generation encourages older adults to stay the pace of ICT-skills knowledge development. Moreover, their research suggested to consider the preference older adults give to practical and applicable skills. In addition, the authors found that the social mode of learning such as peer tutoring encourages older adults to participate effectively in e-literacy learning activities.

A similar research was conducted in Portugal by Maria Raquel Patrício and António Osório (2011) in order to find out and understand how "children and older adults think of lifelong learning and generational solidarity, particularly through organised training activities with the use of Information and Communications Technology (ICT)" (p. 224). The authors suggest that we need to encourage older adults to remain longer in the labor market by remaining

healthy, active and independent. Patrício and Osório envision that if the aging population is not supported for "intergenerational lifelong learning" through ICTs in general and the Web 2.0 (and perhaps the Web 3.0) in particular, this population might "suffer from a risk of exclusion of the benefits of the Information and Knowledge Society" (pp. 224-25). However, active aging and intergenerational solidarity are the common challenging issues in most of the countries where older adults are not supported by younger tutors or coaches.

It is through intergenerational knowledge sharing that both older adults and younger generations learn from each other, and learn how the innovation of new technologies provides new meanings of social connectedness in the digital world. For successful or active aging, older adults, therefore, should be engaged in e-literacy activities, which can help them keep their relationships with their distant family members, friends, and others. In other words, older adults' active participation in contemporary society is necessary so as to involve them in opportunities for lifelong learning and "e-inclusion to bridge the digital divide and make e-Inclusion a reality" (Patrício & Osório, 2011, p. 226). Nevertheless, many older adults may still lack the realization of possible benefits which ICTs can provide.

To benefit older adults from e-world, social motivation can bring a significant change in their life. Socio-emotional and instrumentals or social- and classroom support (emotional and assistance support during the learning respectively) play an important role in using and navigating modern technologies (Naumanen &Tukiainen, 2009). Naumanen and Tukiainen argue that "there is also a strong need for flexible adjustment" and "age friendly pedagogy" (p. 2). To promote lifelong e-literacy learning practices, older adults should be provided an opportunity to work with the younger generation because, as Patrício and Osório (2011) posit, "Intergenerational learning provides a context that can improve both learning the specific

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learning topics and the tacit knowledge and life experiences relating to them" (p. 226). In order to demystify the notion that older adults, especially novice older users of ICTs, cannot use modern technology, we need to work for them by running specific e-literacy learning and/or training programs which can motivate and encourage them to think of lifelong learning, interests, and need of ICTs. By actively participating in such programs, older adults can comfortably update and acquire new digital skills according to their interests, needs, and availability on the one hand, and younger adults as designers can "better pinpoint what needs to be emphasized in training program and instructional materials" (Olson, O'Brien, Rogers, & Charness, 2011, p. 142) on the other hand. Ultimately, such programs help older adults fight against socio-cultural and physical barriers by disseminating information and e-literacy knowledge education in an age-friendly manner. More so, we can also break the barriers by planning and implementing correct methodologies, strategies, and activities that are important and significant in the development of ICTs to support older adults' lifelong e-literacy learning practices. Most importantly, ICTs designers and developers should take older adults into consideration to avoid the tensions between design and distribution of information and technology products. Indeed, inconsideration of older adults as potential users of ICTs results in two pitfalls— digital divide and social injustice. In the next section, I discuss these two key pitfalls of paying less or no attention towards the fast-growing population of older adults, who are the potential users of ICTs for e-literacy learning practices and development.

Pitfalls

One of the main consequences of designing information and communication technologies without considering older adults as target audiences is the digital divide—the gap between those who use ICTs and those who choose not to use or do not have access to use them. When the

concept of digital divide emerged, it was primarily used to address the issue of inequality in the information society. Instead of one single divide of having access to a computer and the Internet, many divides have arisen with the new media technology at the turn of the century. Some other types of divides associated with an access to ICTs are "motivational, physical or material, skills, and usages" (van Dijk, 2005, p. 4). Van Dijk argues that "the digital divide is deepening where it has stopped widening" because "in the places where people are motivated to gain access and physical access is spreading, differences in skill and usage come forward" (p. 2). I find this gap still widening as many older adults face complex issues involved in using modern information and communication technologies, especially computer technology and the Internet.

To stop the widening digital divide without delay, ICT designers and developers should consider to adapt and adopt a more effective model that allows them to know about users' needs and preferences. Though many usability scholars have advocated user-centered technology that emphasizes user-experience, user knowledge, and user-involvement (Nielsen, 1993; Johnson, 1998; Salvo, 2001; Brady, 2004; Norman, 2013), I propose the participatory user-centered design model through which designers get an opportunity not only to work for older adults, but also to work *with* them to produce systems from users' perspectives by recognizing their conditions of living such as, in Moody et al.'s (2015) words, "social class, formal education, and occupational experience" (p. 2). In addition to allowing the designer to understand the needs and preferences of older adults' ICTs use, the model will also, I hope, help avoid the potential pitfalls by enhancing older adults' e-literacy learning practices for civic engagement in the digital world.

In order to increase older adults' confidence in ICTs use, they should be regularly encouraged to use them, especially when they are suspicious about the reliability of going online to verify information. "Many older adults," write Morrell et al. (2004), "do not use the Internet

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because they do not know how to verify that the information that they find there is current and reliable" (p. 80). Though many older adults may not stay abreast of rapidly changing information and communication technologies, they should not be excluded with the assumption that older adults have cognitive and physical barriers, and, thus, get less benefits from adopting modern technologies. If they are deprived of using communication affordances such as computer technology and the Internet, they will eventually be alienated from the "information haves." Consequently, greater digital inequities will appear in their abilities to critically engage in e-literacy learning practices in a networked society. Thus, focusing only on the younger generation for technological affordances and usability would foreground issues of social injustice, another pitfall of not designing information and communication technologies by considering older adults as prospective users.

Iris Marion Young (2000) defines social justice as "the institutional conditions for promoting self-development and self-determination of a society's members" (p. 33). For social equity, all member, including older adults, should be involved in decision-making through their participation in the ICT development process and they must have equal opportunities to practice e-literacy for civic engagement. We can promote social justice when every citizen can enjoy social equality. By equality, I do not intend to mean the equal distribution of social goods. I mean primarily, in Young's (1990) words, "the full participation and inclusion of everyone in a society's major institutions, and the socially supported substantive opportunity for all to develop and exercise their capacities and realize their choices" (p. 173). We can, I hope, close the digital divide and establish social justice by launching different ICT-educational programs and trainings in which older adults are (or must be) included. Berridge (2014) also states that "attempts to close the digital divide include programs to enhance access and provide targeted education for

older adults, such as offering classes with peers who want to learn how to use technologies at a speed that does not assume lifelong or workplace computer experience" (p. 177). Participation in ICTs-educational and training programs for e-literacy learning practices allows older adults to keep pace with younger adults in the digital world. In other words, intergenerational communication would eventually maintain social justice as older adults and their younger counterparts get an opportunity to learn from each other.

Today, voices for social justice and equity are heard more frequently from divergent social spheres than a decade ago. If a certain group of people are left behind from using ICTs while others are substantially progressing, we must find the reasons why a segment of the population cannot exploit the potential benefits of ICT use for lifelong learning. A recent research conducted in six suburbs in the Chicago area indicated that socio-economic status plays a crucial role in the digital inequality among older adults, and their existing organizational memberships had very little influence on ICT access and use (Ihm & Hsieh 2015). Certainly, affordability should not be the key reason for depriving people of their rights for ICT use. At the same time, the way product is designed most not limit their access to information and communication. Many older adults still assume that ICTs are complex to use and difficult to understand and they also expect to face serious security threats and technical problems (Woodward et al., 2011; Friemel, 2014). Therefore, ICTs that provide usable interfaces for older adults can serve as bridges to reach family members, friends, and other relatives that are using standard tools (Rodríguez, 2009). More importantly, ICTs must be simple and easy for access, use, and engagement for older adults to live a better life in an inclusive society.

If designers do not consider older adults' needs and expectations in the process of system design, exclusive society will be promoted as many users, especially older adults with

knowledge gap as well as usage gap, are left behind in digital exclusion due to poor system design. In addition to appropriate support provided by family and friends to use ICTs more effectively, technological improvements are necessary to address age-related barriers affecting older adults' ICT use (Friemel, 2014). Sara J. Czaja and Richard Schulz (2006) remind that by 2030, it is estimated that "people over the age of 65 will represent about 22 percent of the population in the United States, with the fastest growing cohort within this subgroup those 75-plus years of age" (p. 6). If such is the case, and older adults are not taken into account as potential users of ICTs, we may not be able to accomplish our commitment to establish a society of equity. To promote social justice, each citizen, including older adults, should, therefore, be able to use ICTs so that they can continue learning e-literacy skills in and outside of their home. To accomplish our mission of establishing a society of equity, I propose a participatory user-centered design model, which allows designers to develop information and communication technologies from users' point of view.

Participatory User-Centered Design

In order to augment older adults' participation in e-literacy learning practices, I propose a participatory user-centered design model for technology design and development because the model allows designers and developers not to work for the users, but to work *with* them. Many usability specialists have advocated either participatory design or user-centered design, which, I believe, are not sufficient enough to design useful and usable technology for older adults because both participatory and user-centered design model are "guilty of not putting users in charge of design" (Agboka , 2013, p. 43). Following the path led by Donald Norman (1988), Pelle Ehn (1992), Nielsen (1993), and Johnson (1998), Michael J. Salvo (2001) argues for the need to consider users at the center of technology design. Applying the collaborative design method or

what he calls "user participatory method" to the design process, Salvo supports collaborative design which "not only relies on participant with users, but defines designer, expert, and user roles in innovative ways" (p. 274). Such a sentiment is echoed in Ann Brady's (2004) "Rhetorical Research: Toward a User-Centered Approach," in which she asserts the importance of usability and participant design theory. For Brady, human factors, usability, and participatory design factors increase the chance of reciprocity between researchers and participants-as-users in several ways.

Though participation of real users during usability testing has been advocated by many usability specialists, very little attention has been given to the need of older adults' participation for usability in designing and developing of ICTs. The International Organization for Standardization (ISO) 9241 (1998) defines usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use." In Nielsen's (2012) words, usability means "a quality that assesses how easy user interfaces are to use." Despite its emergent presence in academia and the corporate world, usability is still often seen as an end-of-the-production-cycle affair (Johnson, Salvo, Zoetewey, 2007, p. 320; Salvo, 2001, p. 280). Instead of designing for usability, the approach to technological artifacts is still governed by designers' skills and their involvement in the production process. However, a shift in perspective of user-centered design process to that of participatory design experiences is occurring. As E. B. N. Sanders (2002) writes, "It is a shift in attitude from designing for users to one of designing with users" (p. 1). In this new design movement, all people get an opportunity to offer to the design process and can express themselves through the products designed for them.

In participatory user-centered design model, end-users are, however, not only participating during product development process as passive agents, but they are, through collaborative work and interactions with designers, also actively involved in contributing to designing user-centered technology or what Garrett (2011) calls "user experience design" (p. 7). Garrett argues that it is user experience that determines the quality of products and services (p. 12). Even more so, as Agboka (2013) says, "the idea of ownership of design is important in bringing users into the center—rather than onlookers—in the design process, where communities of people own what they use" (p. 43). Interface-level accessibility, which is designed through a participatory user-centered design process at every level of the product development cycle, not only serves the majority users, it also enhances usability for older adults, the young, novice, and the disabled (Oswal, 2014, p. 15).

In participatory user-centered design, users, then, become a critical component of the process by participating directly and proactively in the design development process. If designers have enormous amount of collective influence through users' real participation, they can better understand the ways of designing usable and useful products for end users. Essentially, a participatory user-centered design process assists older adults in engaging with e-literacy learning practices more meaningfully because technology designed in this way is more useful and usable for them. Even more so, participatory user-centered design experience allows designers to learn about older adults' experiences of digital engagement for education and/or e-literacy learning practices.

Since we are living in what Naumanen et al. (2009) call an "e-permeated world"—the world permeated by digital technology—, there is a paramount importance of ICT use and e-literacy for older adults. From finding actual websites of their interest to sending emails and

entering into online business world, older adults might want to work independently for privacy and security reasons. Designers barely know if older adults can use ICT products self-sufficiently by maintaining their privacy and security concerns unless these audiences' characteristics, problems, and interests of using ICTs are identified. Therefore, if designers do involve older adults to assess usability quality during product design and development process, the outcome would not only benefit the users, but it would also help fill up the widening gap of digital divide between younger generation and older generation. Summarizing the research results of internet use amongst older adults in the UK, Morris and Brading (2007) assert that "encouraging more older people to go online, providing specialized training and suitable equipment, and making websites more accessible should help to combat the grey digital divide in the UK and reduce the information gap between the 'haves' and the 'have nots'" (p. 22).

Though there are other possibilities to encourage older adults for gaining e-literacy skills, I contend that their digital literacy trajectories may remain simply unproductive if they are not taken into consideration for participatory user-centered design. Because "it is fairly established that many technology products and systems are not easily accessible to older adults" (Czaja &Lee, 2007, p. 342), older adults must be involved during the product design and development process to better understand their needs, preferences, and abilities. Since there are innumerable possibilities for designing simple and usable technology, I suggest that designers who only consider a certain group of the population as end-users should be challenged to consider what kind of technical solutions they themselves would accept as an older adult in their everyday life and what kind of approaches they would expect from younger designers.

Technological development in the past century, as we know, has made fundamental improvements in many areas of our lives such as transportation, communication, healthcare, and

leisure activities; but at the same time we have witnessed how technological failures can have dire consequences (Rogers, Mayhorn, & Fisk, 2004). We should not forget that fact that technologies most often fail not because users are too dumb to use them, but because designers lack the knowledge of user experience design. As Rogers et al. (2003) write, "For older adults to benefit from the advances that technology brings, but not be harmed by the potential for technological failures, we must ensure that systems are designed with the capabilities and limitations of the older user in mind, proper training is provided, and the needs of older users are considered in the development of future technologies" (p. 1). When we listen to what people want, what technological issues they are concerned with, what culturally-adaptive interface can be designed, and how technology can be useful and usable for them, only then can we, in Yvonne Cleary et al.'s (2012) words, "give them opportunities for socialization and self-empowerment" in the digital world (p. 307). To resist the dominance of decline narratives related to aging and to promote social justice, ICTs should be designed and developed through participatory user-centered design processes for *human beings*, not just for certain age-group populations, so that every citizen, young or old, can join the digital world to perpetually impart their embodied experiences of growing old as they continuously invest in digital engagement through e-literacy learning practices.

Conclusion

Information and communication technologies have extensively influenced our life in modern digital times. However, a segment of population of older adults are likely to be left behind to keep pace with younger generations because of knowledge/practice gaps, differences in technology uptake, complex product designs, and other factors such as lack of motivation and intergeneration communication. Though people's lives within the context of regional, cultural,

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and social domain influence their level of understanding e-literacy and its significance in their daily life, the way ICTs have been designed also determines whether or not older adults want to use it for late life e-literacy practices. Unless attention is oriented toward older adults' usability experiences, unless ICTs-education and training programs are run to empower older adults by overcoming the barriers of e-literacy learning practices, older adults might not benefit from ICTs and we might not be able to fulfil our civic duty and obligation for social justice. If older adults are left behind, who are "the most excluded group of citizens in terms of [e]-literacy" (Amaro & Gil, 2011, p. 1027), the world in the near future will perhaps be digitally divided not only between the population of older adults and their younger counterparts, but among older adults of "information have" and "have-nots." Therefore, to promote social justice by bridging the widening gap of digital inequality, I call upon ICT designers and developers to consider participatory user-center design as an alternative model to traditional design model to empower older adults by providing more usable ICT products for e-literacy learning practices in digital times. Ultimately, participatory user-centered ICTs allows older adults share their life experiences, accumulated wisdom, and their social connectedness with their distant family members, friends, relatives, and among others through their digital engagement at all times.

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