Technology in Society xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Technology in Society

journal homepage: www.elsevier.com/locate/techsoc

The socio-demographic divide in Internet usage moderated by digital literacy support

Ramón Tirado-Morueta[a], José Ignacio Aguaded-Gómez[a], Ángel Hernando-Gómez[b,*]

[a] Department of Education, University of Huelva, Campus "El Carmen", Huelva, 21007, Spain
[b] Department of Psichology and Educación, University of Huelva, Campus "El Carmen", Huelva, 21007, Spain

ARTICLE INFO

Keywords:
Digital literacy
Internet use
Digital divide
Digital literacy
Socio-demographic status
Support
Older adults

ABSTRACT

The facilitating conditions (FC) are one of the factors contemplated in the main theories that explain the use and acceptance of technology. For older adults, these FC can be implemented through digital literacy support (DLS) programs that promote the use of the Internet, reducing the obstacles derived from advanced age and the lack of resources. This research study, from the perspective of the studies on the digital divide, proposes to: (a) verify the relative effect of the socio-demographic factors on the different levels of access and use of the Internet by adults older than 55, and (b) verify the moderating ability of the DLS on these effects. For this, two studies were conducted using quota sampling of older adults who used both types of DLS. Using a structural equation methodology, the data showed that the socio-demographic factors were associated to the most basic levels of access and use of the Internet, and likewise, that the DLS could moderate the obstacles derived from age and socio-economic resources.

1. Introduction

The presence of Information and Communications Technologies (ICT) has become more evident in social relations, economic transactions, productive processes, etc. (EUROSTAT data). The growing activity on the Internet is a reflection of the economic, social and cultural activities and relations that exist off-line, including inequalities [58]. In this sense, the appropriation of technology by the citizenry will be a factor for social inclusion [49], with many arguments on the subject of the Internet affecting social inclusion reflected in the "digital divide" discourse.

As in the rest of the world, life expectancy in Europe and Spain has been increasing, with an increase of more than 15 million citizens older than 55 years of age from 2005 to 2016 in the EU (27) according to EUROSTAT data. Similarly, in Spain, and using the same age range, there has been an increase of more than 1.5 million people, while the number of people aged 15 or less has remained stable. Furthermore, according to EUROSTAT data (2018), the citizens older than 55 years of age in Spain usually access the Internet at a lower rate as compared to the European average. More specifically, in Spain, while 69% of the total Spanish population accesses the Internet daily, only 40% of the people aged 55 to 74 do so, decreasing to 7% in the case of people aged 75 or more.

However, as shown by Van Deursen & Helsper [46] in two studies conducted in the Netherlands, the group of older adults is very diverse, with some individuals having more probabilities of becoming excluded than others. In this sense, many studies have compared the socio-demographic data with indices of device ownership and the use of the Internet, and correlations were found between the digital activity and socio-economic variables such as income, the level of education, employment or work activity [59].

However, other studies have shown that the socio-demographic status has relative influence on the use of the Internet, only affecting the physical access and operational use, with this influence being scarce on the more advanced levels of digital use [3,47,55,60,61]. In this sense, the educational compensation measures pushed forward by public organisms can reduce the effects of socio-economic factors by promoting an intelligent use of the Internet in disadvantaged social strata [33].

To facilitate access to the use of the Internet in the European Union as in Spain, many digital literacy support (DLS) programs have been presented. There are many older adults who have participated in DLS programs [55]. However, it is not known to what extent the participation of older adults in DLS programs moderates the influence of socio-demographic factors on Internet use. This knowledge could be very useful, taking into account that the programs are channels for the digital literacy of the older adults.

The objectives of this study were: (a) to verify the existence of a relationship and a sequence between the different levels of Internet use

* Corresponding author.
E-mail addresses: rtirado@uhu.es (R. Tirado-Morueta), aguaded@uhu.es (J.I. Aguaded-Gómez), angel.hernando@dpsi.uhu.es (Á. Hernando-Gómez).

https://doi.org/10.1016/j.techsoc.2018.06.001
Received 1 March 2017; Received in revised form 14 April 2018; Accepted 4 June 2018

by older adults (55 or older) in Spain; and (b) to check to what extent participation in DLS programs moderate (reduce) the effects of socio-demographic factors on different levels of Internet use.

The sections of the manuscript are now presented: The first section will present a review of the latest advancements and the hypotheses studied will be presented, as based on the stated objectives above. The second section will be used to describe the methods; the type of sampling, the validity of the measurements and the data analysis procedure. The third section will present the results obtained, and lastly, the last sections will present the discussion, conclusions and limitations.

2. Literature review

2.1. The use of technology for active ageing

As the standard of living constantly improves and the life expectancy increases in developed countries, a gradual increase has been observed in the number of older adults who want to have an active, gratifying and high-quality life in the sense of inclusion, socialization and independence [35].

The World Health Organization (WHO) has defined active ageing as "the process of optimizing the opportunities for health, participation and safety to improve the quality of life as the person ages" [56]; pg. 12). In this sense, there has been a great deal of consensus in accepting that the ICT play an important role in the prolongation of an active life [30].

There have been many studies that have analyzed the benefits of Internet use and the ICT for older adults, and how these technologies can meet their needs. This literature shows that digital technology helps older adults communicate with their families and friends [44], widen their permanent learning opportunities [11], allows access to information related to health [10], and helps in exploring resources to satisfy their personal and entertainment needs [19,57]. In summary, digital technology can improve the quality of life of older adults [7] and can help older adults in their daily routines [39].

2.2. Internet use in digital-divide research

The term "digital divide" has a North-American origin, dating back to the 1990's, and was used for the first time in an official publication by the National Telecommunications and Information Administration (NTIA, 1999) [18]. In the first reports about its state [62], the term *digital divide* was identified with the physical access to the ICT, using as independent variables demographic factors such as race, gender, age, economic situation, level of education, type of household and geographic location. As the presence of the PCs and the Internet became more evident in developed countries, the term started to evolve, and more complex conceptualizations were developed.

With the overcoming of the simplistic notion of "digital divide", more comprehensive models were developed in digital-divide research that included a sequence of Internet access indicators: spanning awareness, autonomy of use, attitudes, physical and material access, skills access, usage access and benefits access [3,47,55]. Research studies on the digital divide have differentiated it into three (successive) types. The first type is focused on the differences of the user's access to the infrastructure, including factors such as autonomy and continuity of access [36]. When the population can freely access resources, a second type of divide appears that is related to the type of use and abilities required [58]. The studies on the second type of divide have contributed numerous classifications of the type of activities conducted by the population online, and of the abilities needed [6,48]. The third type of digital divide refers to the most recent concern, which appears when two individuals have autonomous and unlimited access to the Internet and possess the abilities required, but nevertheless do not obtain the same benefits when using it [46].

Although many studies have revealed the existence of interactions between the different types of access, the current understanding of these interactions is limited [48] in older adults. In general terms, this study will try to show that there is a sequence between the different types of Internet use. We expect that physical access (defined in this study as the frequency of access to the Internet), is associated with the frequency of operational use. And to a lesser degree, it is associated with the more advanced Internet use, such as informative-expressive use. Based on this reasoning, the following hypotheses are posited:

H1. *A (higher) physical access (PA) to the Internet is associated with the operational use of the Internet (OU) (H1a), and with the informative-expressive use (IEU) (H1b).*

H2. *The high level of operational use (OU) is associated with the informative-expressive use (IEU)*

2.3. Age-based digital divide

Scholars have also argued that 'there is a strong association between age and the so-called digital divide' [41,63] and have coined the terms 'age-based digital divide' [63] to describe the lack of 'access, skills and/or knowledge that can result in older citizens being 'information poor" [28]. However, research in this area has also been criticised for treating older adults as a homogenous group and neglecting the diversity in older adult's lives and how they use digital technologies [40]. That older adults 'do not uniformly conform to technology-averse stereotypes' [2] and that 'focusing on chronological age offers incomplete explanatory power' [23], p.1311). For example [54], in their review of the literature, found that computer use among older citizens varied significantly, 'suggesting that predictions should not be based solely on chronological age' (p.876). They highlighted that there were different ways to conceptualise age, including functional or performance-based age, psychosocial or subjective age, and the life span concept of age [28,54,63] .

Therefore, an advanced chronological age usually appears in association with a lack of use and exploitation of the ICT. However, this by itself has a weak force of prediction, as other variables associated to chronological age are not considered. In this sense, the collective of older adults is very heterogeneous. Therefore, the following hypotheses are posited:

H3. *(Advanced) age is inversely associated with the level of education (H3a), with monthly income (H3b) and their employment status (H3c)*

H4. *(Advanced) age is inversely associated with the high frequency of PA (H4a) and OU (H4b).*

2.4. Gender-based digital divide

Gender has been another focus of study, with Eurostat data and other surveys showing that while Internet usage is fairly equal between genders in the general population, older women still lag behind older men in their adoption of digital devices and Internet usage [29]. While some studies have found no significant associations between gender and ICT use [53], other studies have argued that gender differences in usage disappear if controlled for education, income, technical interest, pre-retirement computer use and marital status [16] and that 'gender inequality in ICT use may be diminishing among older citizens who were able to access and use ICT' [29]. Kim et al. [29] found that older men were 'more likely than women to access and use digital technology for different purposes. These authors sustained that this could be due to the influence of their life's trajectories based on gender; access to education, the opportunities of employment or their responsibility as caregivers.

Ultimately, studies have found that demographic factors such as gender were not the sole determinants, but were part of a broader picture of life experience [45] and a large range of other mediating variables. Therefore, the following hypotheses are posited:

H5. *Gender is associated to the level of education (H5a), with monthly income (H5b), and their employment status (H5c).*

H6. *Gender is associated with a high frequency of PA (H6a) and OU (H6b).*

2.5. Socio-economic based digital divide

Many studies have compared the demographic data with indices of device ownership and the use of the Internet, and correlations have been found between the digital activity and socio-economic variables such as income, the level of education, employment or work activity [32,37,42,59]. However, it could be attested that the influence of the socio-economic characteristics on the access to the ICT is relative. For example, studies conducted by Tirado-Morueta et al. [60,61] on Internet access in Ecuador, showed that the socio-economic features especially affected physical (material) access, while the intelligent exploitation of the ICT was conditioned by the digital competence of the users.

H7. *The level of education (high) is associated with monthly income (high) (H7a), and employment status (H7b).*

H8. *The level of education (high) is associated with a high frequency of PA (H8a) and OU (H8b).*

H9. *The monthly income (high) is associated to employment status.*

H10. *Monthly income (high) is associated to a high frequency of PA (H10a) and OU (H10b).*

H11. *Employment status is associated with a high frequency of PA (H11a) and OU (H11b).*

2.6. Digital literacy support (DLS)

The facilitating conditions (FC) are one of the factors used in the more influential theories that try to explain the use and acceptance of the technologies by the older adults [13,32]. In essence, the technology acceptance model (TAM) [15] theorizes that the use of technology is mainly influenced by two beliefs: the perceived ease of use and the perceived usefulness. In this sense, on the one hand, recent studies have revealed that the older adult's perception on the usefulness of the Internet for their daily routines is one of the main factors that explains their decision to use it [22,24,45]. On the other hand, the lack of abilities that could make its use easier is another of the reasons that usually explains the delay in acceptance of the Internet by older adults (e.g., [8].

The FC are factors that are included within the unified theory of acceptance and use of technology (UTAUT) [50] and that directly determine the intent of using technology. The facilitating conditions refer to the organizational and technical infrastructure that supports the use of the technology (Internet) (e.g., [50]. Recent studies have shown that the FC positively influence the perceived usefulness, the perceived ease of use, and the intention of using smartphones [32]. Likewise, some studies showed that CF can reduce the obstacles derived from age and from the scarcity of socio-economic resources (e.g., [33].

In the European Union and in Spain, many policies and programs have been put forward to foment the population's universal access to the Internet through digital literacy support programs (DLS) [31]. Likewise, universities, through programs such as the University Programs for Seniors (UPS), as well as community centers, through the Centers of Public Access to Internet (CPAI) [34], have facilitated the use of the Internet by, and digital literacy for older adults, through classes [12] or through active aid [55], respectively.

On the one hand, the CPAI, which emerged in the 1990's, were promoted by the European Union with the aim of facilitating citizens' access to the ICT. The CPAI (telecenters and public libraries) have been defining their community service functions, guaranteeing access to the Internet and online services to all the members of the community [1,4].

On the other hand, the UPS, which arose in the 1970's, were designed to improve the basic skills of older adults in order to promote their social, cultural participation and personal development [52]. Although two UPS models can be differentiated (University Classes for Older Adults and Experience Universities [EU]), in this study we only considered the EU model as it was the most frequently applied in Spain [51].

The study presented in this article takes into account both DLS (UPS and CPAI) as each program stimulates access to Internet and its use in different ways. While the UPS tend to use training classes [51], the CPAI use the range of online services available as well as active aid [34], so it was assumed that their influence on Internet use was different, as well as its capability to reduce the effects of old age or lack of socio-economic resources.

We hypothesize that:

H12. *The effects of age, gender and the socio-economic factors on the frequency of PA (H4a, H6a, H8a, H10a and H11a) and the OU (H4b, H6b, H8b, H10b and H11b), are moderated by the DLS.*

3. Methods

3.1. Sample

The sample was composed by citizens aged 55 years old or older, who resided in Spain, who attended CPAI and/or UPS, and who used the Internet at least once in the last 3 months. A selective quota sampling of older adults in both DLS programs was conducted.

During the sampling process, quotas were established based on the DLS program (equal number of subjects in categories CPAI [N = 225] and UPS [N = 225]), and Spanish provinces (equal number of subjects in categories Huelva, Cordoba, Seville, Malaga, Granada, Murcia, Cantabria, Lugo and Valencia).

The data was gathered at the CPAI and UPS in various sessions through a link to an online questionnaire, with the help of a member of the research team.

Table 1 contains the characteristics of the subjects in both studies.

The gender breakdown was 264 (58.6%) women and 186 (41.3%) men. The age range was 137 (30.44%) subjects between the ages of 55 and 60, 101 (22.4%) between 61 and 65, 108 (24%) between 66 and 70, and 104 (23.1%) older than 70. In terms of level of education, in the overall sample, 58 (12.8%) had no formal education, 111 (24.6%) had attended primary school, 128 (28.4%) were high school graduates and 153 (34%) had studied at university. Regarding digital literacy level, 199 (44.2%) had not attended any courses, 205 (45.6%) had attended courses/workshops, 39 (8.7%) had specialized training and 7 (1.6%) had university education on communications or similar.

The analysis of the sample showed that there were differences among the individuals who had visited a CPAI or who had taken part in a UPS.

3.2. Measurements

Respondents were asked to indicate to what extent they used Internet for thirteen *activities* that regularly appeared in recent scientific research. Two types of activities were taken into account: (a) operational activities such as: online shopping [64], online banking [65], participate in online forums, social networks [38], use of Whatsapp, contacting the authorities [25,43] and organizing events; and (b) informative and expressive activities such as read/see/hear news, search for information [66], participate in wikis, create a blog, and share a video on YouTube [33]. Respondents were asked with what frequency they engaged in these activities, by using a five-point scale ranging from never to daily/very often as an ordinal-level measurement in a scale ranging from 1 to 5.

Table 1
Sample.

Variables		Total		Study A. CPAI		Study B. UPS	
		N	%	N	%	N	%
DLS	CPAI	225	50	225	50	0	0
	UPS	225	50	0	0	225	50
Province/City	Cantabria	50	11.1	25	11.1	25	11.1
	Cordoba	50	11.1	25	11.1	25	11.1
	Granada	50	11.1	25	11.1	25	11.1
	Huelva	51	11.3	25	11.3	26	11.5
	Lugo	50	11.1	25	11.1	25	11.1
	Malaga	49	10.8	25	11.1	24	10.6
	Murcia	50	11.1	25	11.1	25	11.1
	Seville	50	11.1	25	11.1	25	11.1
	Valencia	50	11.1	25	11.1	25	11.1
Gender	Men	186	41.3	90	40	96	42.6
	Women	264	58.6	135	60	129	57.3
Age	55 to 60	137	30.4	78	34.6	59	26.2
	61 to 65	101	22.4	43	19.1	58	25.7
	66 to 70	108	24	42	18.6	66	29.3
	Over 70	104	23.1	62	27.5	42	18.6
Household composition	Live alone	80	17.8	37	16.4	43	19.1
	Two	172	38.2	87	38.7	85	37.8
	Three	95	21.1	41	18.2	54	24
	Four	71	15.8	41	18.2	30	13.3
	Over four	32	7.1	19	8.4	13	5.8
Employment status	Private sector	31	6.9	22	9.8	9	4
	Public sector	51	11.3	27	12	24	10.7
	Business person	22	4.9	13	5.8	9	4
	Unemployed	37	8.2	13	5.8	24	10.7
	Retired	245	54.4	110	48.9	135	60
	Homemaker	64	14.2	40	17.8	24	10.7
Monthly income	< 600 Eur.	55	12.2	41	18.3	14	6.2
	601 to 1200 Eur.	117	26	68	30.2	49	21.8
	1201 to 1800 Eur.	101	22.4	52	23.1	49	21.8
	1801 to 2400 Eur.	73	16.2	29	12.9	44	19.6
	2401 to 3000 Eur.	59	13.1	22	9.8	37	16.4
	Over 3000 Eur.	45	10	13	5.8	32	14.2
Level of education	No formal education	58	12.8	47	20.8	11	4.8
	Primary school	111	24.6	78	34.6	33	14.6
	Secondary school	128	28.4	56	24.8	72	32
	University	153	34	44	19.5	109	48.4

For the validation of the classification of Internet usage activities, an exploratory factor analysis was first conducted (Table 2). In the first step, a list of thirteen activities was created and a principal component analysis with varimax rotation was subsequently used to identify the underlying factors. Factor loading were set at 0.5 and above for each item [21]. Two factors were extracted as the result of analysis, both showing eigenvalues above the acceptable 0.7. The factors were named “operational use” (OU) and “informative-expressive use” (IEU), and their eigenvalues were 3.57 and 2.64, respectively.

Second, the following properties were analyzed: unidimensionality, reliability and convergent validity.

The unidimensionality results showed that in first place, the variables that comprised each construct were unidimensional. A principal component analysis was performed for each construct, and the Kaiser criteria [27] was applied, meaning that a value greater than 1 was only given to the first component. Another important detail was that the first component explained the greatest part of the variance. The analysis of the results showed that the value of the first component for all the constructs was > 1. On the other hand, the data on the percentage of variance explained by the first factor showed that all the constructs came close to the recommended value of 50% (OU = 57.39%; IEU = 44.20%).

To measure reliability (the consistency of the indicators that comprised the constructs), Cronbach's Alpha (α) and composite reliability (CR) were calculated. The results showed that all the constructs had values above those recommended.

To measure convergent validity (degree in which the indicators mirrored the construct), the following were used: a) the average variance extracted (AVE), with the minimum value recommended of .5; and b) the indicator's factorial load, with a variance above .5 recommended for each indicator. The results on the factorial loading shown in Appendix 1 indicated that all the constructs' indicators were near .50.

Appendix 1 shows the descriptive results of each of the indicators taken into account in each construct, as well as the properties of each of the constructs used in this study. Likewise, Table 2 shows the descriptive results of each construct.

Data on *age* were collected using four categories (55–60 = 1, 61 to 65 = 2, 66 to 70 = 3 and over 70 = 4). *Gender* was included as a dichotomous variable (men = 1, women = 2). Data on *level of education* were collected according to degree received. The education data were subsequently divided into four groups (no formal education = 1, primary school = 2, secondary school = 3 and university = 4). *Employment status* was coded as variables into the following groups: private work = 1, public work = 2, business person = 3, unemployed = 4, homemaker = 5, retired/pensioner = 6. *Income* was measured as gross income in the last month, into six categories, for every 600 Euros earned. The values ranged from no income to over 3000 Euros.

3.3. Data analysis

In order to test the hypothesis posited in Fig. 1, Structural Equation Modeling (SEM) was used with the Amos 18.0 software. According to this modeling method, each theory consists of a set of correlations, and if the theory is valid, then the correlation patterns (suppositions) can be reproduced in empirical data [9].

Through SEM, it is possible to statistically-test the theoretical model (Fig. 1) through a simultaneous analysis of all the variables and their relationships, in order to verify to what degree the proposed model is consistent with the data. In the case that the goodness-of-fit is suitable, the model supports the plausibility of the relationships presented. However, if it's unsuitable, the plausibility of the model is rejected. With the aim of measuring the goodness-of-fit of the model, the indices that are normally used for the three categories of model adjustment

Table 2
Descriptive results of the constructs.

	Study A. CPAI					Study B. UPS				
	N	Mean	*SD*	Skewness (*SE*)	Kurtosis (*SE*)	*N*	Mean	*SD*	Skewness (*SE*)	Kurtosis (*SE*)
PA	225	2.55	1.581	.41 (.16)	−1.40 (.32)	225	3.45	3.45	-.49 (.16)	-.81 (.32)
OU	225	11.80	6.39	1.43 (.16)	1.19 (.32)	225	12.72	12.72	.29 (.16)	-.52 (.32)
IEU	225	14.70	7.178	1.32 (.16)	1.02 (.32)	225	17.34	17.34	.84 (.16)	.17 (.32)

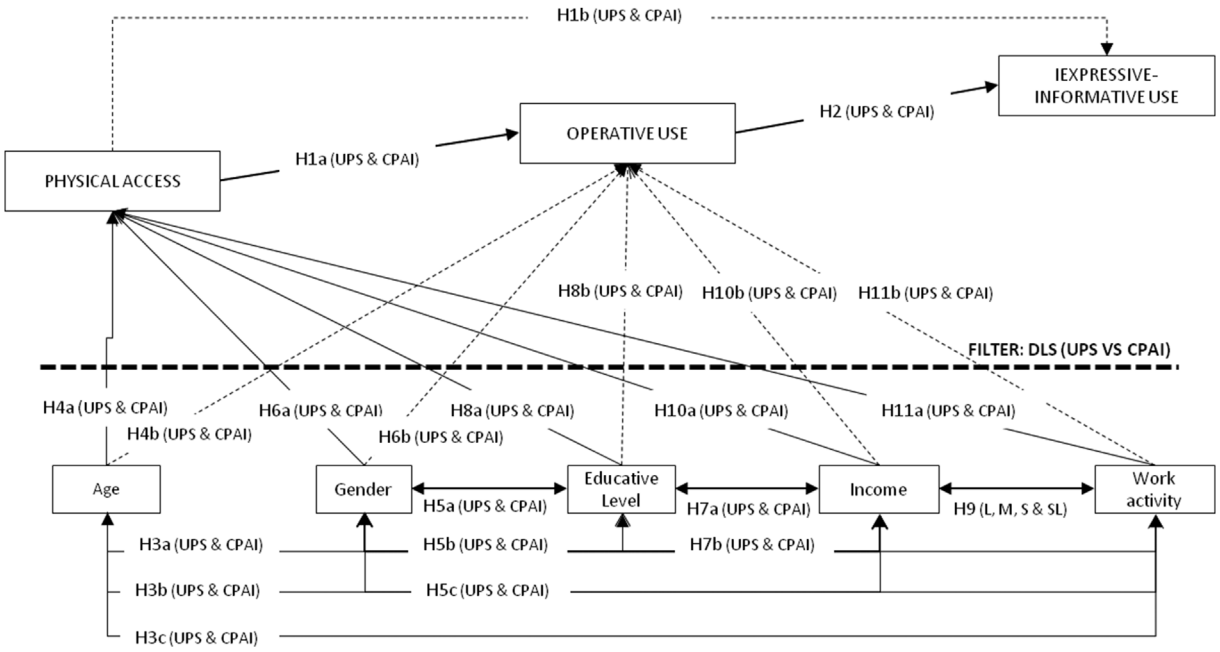

Fig. 1. Research and hypothesis model.

(Hair el al. 2006) (absolute, parsimonious and incremental) were utilized.

For the absolute measurements of adjustment, the following were used: χ^2/df ($0 \geq \chi^2/df \leq 3$; $.01 \leq$ p-value ≤ 1), and the *root mean square error of approximation* (RMSEA) ($0 \leq$ RMSEA $\leq .08$). And for the incremental measurement of fit, the comparative fit index (CFI) ($.97 \leq$ CFI ≤ 1) and the *normed fit index* (NFI) ($.95 \leq$ NFI ≤ 1) were used. Lastly, for the measurement of parsimonious fit, the parsimony normed fit index (PNFI) was used (differences between .06 y .09).

4. Results

4.1. Structural model

In first place, a statistical analysis was conducted in order to examine the assumption of normality of the variables used in the structural equation model. In this case, the Komogorov-Smirnov test was not used, as it is too sensitive when using large sample sizes. Therefore, an analysis of skewness and kurtosis (see Table 2) was conducted. The results showed that the values from both statistical tests for all the variables were < 1, so the condition of normality was accepted [14].

Table 3 shows the correlations between the variables.

Fig. 2 and Fig. 3 show the regression indices of all the paths (relationships) in the model, as well as the explained variances for each variable. After testing the validity of the causal structure of the conceptual models, the fit indices obtained were found to be good:

Study A (CPAI): $\chi^2/df = 2.22$ ($p = .005$); TLI = .95; RMSEA = .07 (90% confidence interval [CI] = .03, .10); CFI = .97; NFI = .96, and PNFI = .48. The model explained 41% of the variance found in PA, 50% in OU, and 71% in IEU.

Study B (UPS): $\chi^2/df = 1.97$ ($p = .008$); TLI = .92; RMSEA = .06 (90% confidence interval [CI] = .03, .09); CFI = .95; NFI = .90, and PNFI = .58. The model explained 9% of the variance found in PA, 33% in OU, and 39% in IEU.

4.2. Review of the hypotheses

Figs. 2 and 3 show the coefficients that reveal the direct and indirect effects between the three constructs. The coefficients that appear between the constructs represent the direct effect of a single determinant variable over one that is endogenous. An indirect effect indicates the effect of a determinant variable onto another one, through its effect on other variables that intervene in the model. The total effect on a single variable is the sum of the respective direct or indirect effects. These effects are shown in Table 4.

In Study A (CPAI), the following hypotheses were confirmed: H1a, H1b, H2, H3a, H3b, H3c, H4a, H5b, H7a, H7b, H8a, H8b, H9, H10a, H11a, and H11b.

In Study B (UPS), the following hypotheses were confirmed: H1a, H1b, H2, H3a, H3b, H3c, H5b, H8a, H9, and H11b.

Thus, the following was confirmed:

1 There is a sequence between the different levels of access and use considered in the study (H1a, H1b and H2), so that the physical access (PA) (proxy variable of the Frequency of use of the Internet) had a strong association with OU ($\beta_{CPAI} = .52$, $\beta_{UPS} = .50$) than with IEU ($\beta_{CPAI} = .50$, $\beta_{UPS} = .36$).
2. In Study A (CPAI), the effect of the PA on the OU and IEU accumulated the direct effects of the variables age ($\beta_{CPAI} = -.23$), level of education ($\beta_{CPAI} = .38$), and income ($\beta_{CPAI} = .20$).
3. In Study B (UPS), the effect of PA on OU and IEU, accumulated the direct effects of the variable level of education ($\beta_{UPS} = .38$).
4. In Study A (CPAI), the effect of the OU on the IEU accumulated the indirect effects of age ($\beta_{CPAI} = -.12$), level of education ($\beta_{CPAI} = .20$), and income ($\beta_{CPAI} = .10$) through PA.
5. In Study B (UPS), the effect of OU on the IEU accumulated indirect effects, through PA, of the level of education ($\beta_{UPS} = .15$) and the direct effects of the employment status ($\beta_{UPS} = .22$).
6 In both studies, age was inversely associated to the employment status ($r_{CPAI} = -.54$, $r_{UPS} = -.36$), income ($r_{UPS} = -.20$, $r_{UPS} = -.17$), and level of education ($r_{CPAI} = -.40$, $r_{UPS} = -.23$). Likewise, in both studies, income and level of education were associated ($r_{CPAI} = .59$, $r_{UPS} = .53$). In study A (CPAI), income and work activity were associated ($r_{CPAI} = .32$).
7 Lastly, the data showed that the influence of the socio-demographic factors on the access to the Internet and its operational use was scarce and weak in study A (CPAI) and in study B (UPS). In study A (CPAI), age ($\beta_{CPAI} = -.23$), the level of education ($\beta_{CPAI} = .38$) and income ($\beta_{CPAI} = .21$) were associated with the PA, and the level of education with the OU ($\beta_{CPAI} = .24$). However, in study B (UPS),

Table 3
Correlation matrix.

Study A. CPAI

	PA	OU	IEU	Age	Gender	EL	Income	WA
PA	1							
OU	.67**	1						
IEU	.78**	.75**	1					
Age	-.43**	-.36**	-.45**	1				
Gender	-.06	-.09	-.10	.07	1			
Level of education (LE)	.60**	.56**	.57**	-.40**	-.12	1		
Income	.49**	.42**	.37**	-.21**	-.24*	.60**	1	
Employment status (ES)	-.39**	-.47**	-.38**	.52**	.08	-.44**	-.39**	1

Study B·UPS

	PA	OU	IEU	Age	Gender	EL	Income	WA
PA	1							
OU	.52**	1						
IEU	.54**	.54**	1					
Age	-.18**	-.27**	-.25**	1				
Gender	-.09	-.09	-.03	-.12	1			
Level of Education (LE)	.29**	.24**	.23**	-.21**	-.05	1		
Income	.23**	.25**	.17**	-.15*	-.13*	.53**	1	
Employment status (ES)	-.02	-.22**	-.08	.39**	-.14*	-.00	-.00	1

**p < .01; *p < .05.

age was not associated to the level of access and use of the Internet. The level of education was associated to the PA (β_{CPAI} = .29), and the employment status with the OU (β_{CPAI} = .22). Thus, H12 was confirmed.

5. Discussion

As shown in some studies (e.g. [46], the group of senior citizens is very diverse, so it cannot be stated or concluded that an advanced age determines a low level of Internet use. Many programs have been designed to promote universal access to the Internet and have facilitated Internet use by older adults.

In this research study, the authors collected and analyzed data from two systems of support that were based on the assisting of older adults on the access, use and mastery of the Internet, for the following purposes: (a) to identify and verify different levels of access and use of the Internet by older adults, and how these levels correlated amongst themselves, (b) to prove that the socio-demographic factors mainly affect the basic levels, and (c) to verify that the DLS moderate (reduce) the effects of advanced age and the socio-demographic differences.

The data from both studies (CPAI and UPS) identified, in agreement with the new approaches (models) on Internet access [3,47], a sequence of cumulative effects in which the physical access to the Internet determines operational use and informative-expressive use [60]. Likewise, the informative-expressive use (more complex) was determined by the physical access to the Internet and its operational use.

The results showed that the socio-demographic factors mainly affected the most-basic levels of access and use of the Internet (physical access and operational use) that were considered in this study. However, they had an indirect influence, through the physical access and operational use, on the informative-expressive use of the Internet.

The data showed that age by itself did not explain the scarcity of access and exploitation of the Internet among those who were of advanced age, except due to its association with the effect of the social status linked with income, level of education and social resources [67]. In both studies (CPAI and UPS), age was inversely associated to

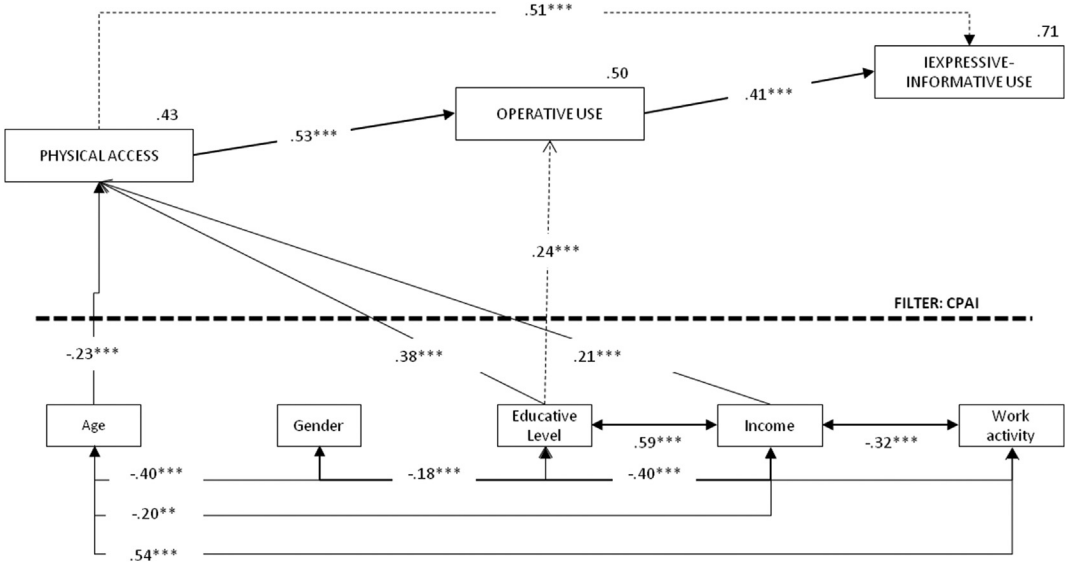

Fig. 2. Study A (CPAI). Direct effects and correlations among variables in the model.

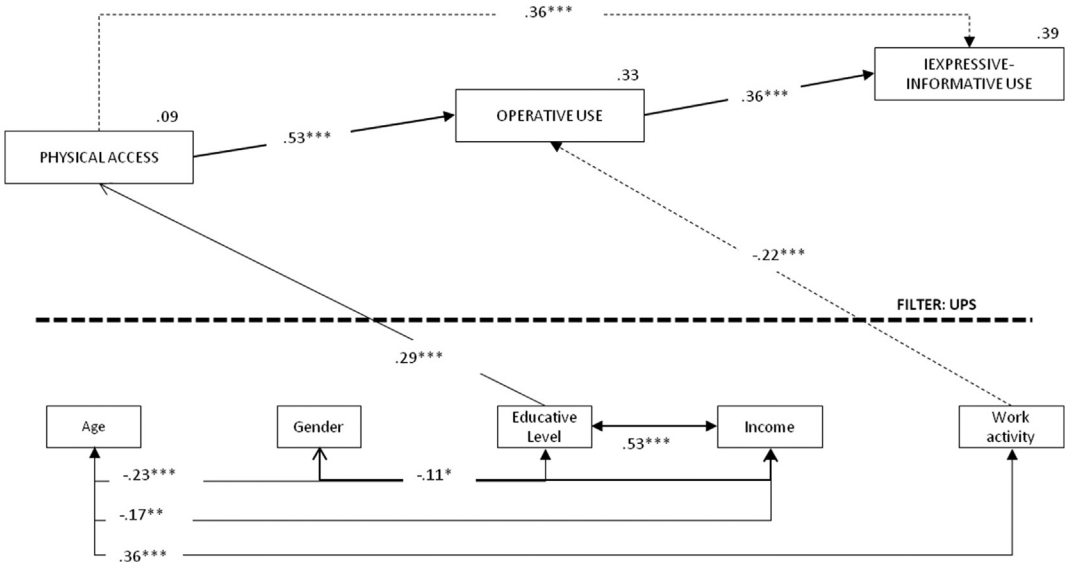

Fig. 3. Study B (UPS) Direct effects and correlations among variables in the model.

employment status, income and level of education. Likewise, in both studies, income and level of education were associated.

Lastly, the results showed that the influence of the socio-demographic factors was more scarce and weak in study B (UPS) than in study A (CPAI). Thus, the authors concluded that the digital literacy support program (CPAI or UPS) acted as a filter for the influence of the socio-demographic variables on the access and operational use of the Internet. This moderation of the influence of the socio-demographic factors was due to the compensating effect of the support system. More specifically, the training conducted systematically in the UPS (as opposed to the CPAI) could help compensate for the education and social capital deficits associated to advanced age.

5.1. Limitations

The present work has some limitations that can guide other researchers in future work. In first place, the study used a limited number of items (activities), so that future studies should use a more exhaustive set of activities in order to better understand the digital activities conducted by older adults in more detail. In second place, the study utilized self-administered questionnaires that were similar to the ones used in other studies, as the use of previous qualitative records that made easier the selection of items (activities) was convenient. And in third place, it would be convenient to delve into the type of support offered by both types of access and digital literacy programs. In this sense, an analysis that incorporates the type of support as an

Table 4
Direct, indirect, and total effects of the Internet access sequence.

Hypotheses and effects of intervening variables	Study A. CPAI				Study B. UPS			
	r	Direct effects *β*	Indirect effects *β*	Total effects *β*	*r*	Direct effects *β*	Indirect effects *β*	Total effects *β*
H1a. PA → OU		.52		.52		.53		.53
H1b. PA → IEU		.50	.21	.71		.36	.18	.54
H2. OU → IEU		.41		.41		.36		.36
H3a. Age ↔ Level of education	-.40				-.23			
H3b. Age ↔ Income	-.20				-.17			
H3c. Age ↔ Employment status (cod. inverse)	-.54				-.38			
H4a. Age → PA		-.23		-.23				
H4b. Age → OU			-.12	-.12				
H5a. Gender ↔ Level of education								
H5b. Gender ↔ Income	-.18				-.11			
H5c. Gender ↔ Employment status (cod. inverse)								
H6a. Gender → PA								
H6b. Gender → OU								
H7a. Level of education↔ Income	.59							
H7b. Level of education ↔ Employment status (cod. inverse)	.39							
H8a. Level of education → PA		.38		.38		.29		.29
H8b. Level of education → OU		.24	.20	.44			.15	.15
H9. Income ↔ Employment status (cod. inverse)	.31				-.53			
H10a. Income → PA		.20		.20				
H10b. Income → OU			.10	.10				
H11a. Employment status (cod. inverse) → PA								
H11b. Employment status (cod. inverse) → OU						.22		.22
Level of education → IEU			.37	.37			.16	.16
Income → IEU			.15	.15				
Age → IEU			-.17	-.17				
Employment status (cod. inverse) → IEU							.07	.07

independent variable would be helpful.

6. Conclusions

The data from this study corroborated the fact that older adults are a heterogeneous collective in relation to the access and use of the Internet.

In first place, this study has allowed for the identification and verification, in agreement with current approaches, of three levels of access and use of the Internet that were correlated amongst themselves, and with cumulative and successive effects: (a) physical, referring to the frequency of use (proxy variable for physical access), (b) operational use, referring to the simpler tasks of everyday life, and (c) informative-expressive use, referring to the more complex activities that require a greater degree of skill.

In second place, the data showed that age was not a factor that within itself predicts the access and use of the Internet, but it was associated to the socio-economic status. Nevertheless, the socio-demographic factors appeared to be associated to basic levels of access and use of the Internet.

In third place, the data support the idea that the obstacles derived from an advanced age and the lack of social and economic resources could be compensated for through support programs such those taken into consideration in this study. In this sense, at present and in Spain, the UPS seemed to offer better support than the CPAI, possibly due to the digital literacy in the CPAI being less systematic than in the UPS.

Funding

This research forms part of the work carried out by the Alfamed group (EuroAmerican Interuniversity Network for Research on Media Competences for Citizens), with the support of the Coordinated I + D + I Project called “Citizens' Media Competences in emerging digital media (smartphones and tablets): innovative practices and educommunication strategies in multiple contexts” (EDU2015-64015-C3-1-R) (MINECO/FEDER), and of the “Media Education Network” of the State Program for the Promotion of Excellence in Scientific-Technical Research, the State Subprogram for Knowledge Generation (EDU2016-81772-REDT), financed by FEDER (European Regional Development Fund) and Spain's Ministry of Economy and Competitiveness.

Appendix

		Study A. CPAI						Study B. UPS					
		Load factor	Mean (*SD*)	α	CR	AVE	Eigenvalue	Load factor	Mean (*SD*)	α	CR	AVE	Eigenvalue
Operational Use (OU)	Talking on the phone	.50	2.90 (1.57)	.84	.85	.50	4.12			.75	.81	.41	2.94
	Use of social networks	.73	1.66 (1.12)					.55	1.85 (1.19)				
	Chat rooms/ WhatsApp	.78	2.08 (1.61)					.63	2.50 (1.67)				
	Participation in forums	.78	1.83 (1.42)					.66	2.14 (1.54)				
	Online banking	.77	1.67 (1.21)					.61	2.16 (1.44)				
	Online purchases	.68	1.43 (0.67)					.72	1.66 (0.80)				
	Contacting authorities	.69	1.65 (1.35)					.67	1.96 (1.53)				
	Social activity	.73	1.49 (1.07)					.66	1.79 (1.31)				
Informative-expressive Use (IEU)	Reading the press online	.78	2.17 (1.42)	.79	.84	.53	2.68	.65	2.65 (1.37)	.65	.78	.42	2.12
	Upload videos to YouTube	.75	1.78 (1.40)					.63	1.92 (1.47)				
	Manage a blog	.67	1.67 (1.32)					.58	1.84 (1.41)				
	Searching information	.82	2.96 (1.77)					.74	4.07 (1.37)				
	Participation in wiki	.60	1.68 (1.31)					.62	2.24 (1.64)				

References

[1] G. Anderson, J. Whalley, Public library internet access in areas of deprivation: the case of glasgow, Telematics Inf. 32 (3) (2015) 521–537, http://dx.doi.org/10.1016/j.tele.2014.12.001.

[2] Y. Barnard, M.D. Bradley, F. Hodgson, A.D. Lloyd, Learning to use new technologies by older adults: perceived difficulties, experimentation behaviour and usability, Comput. Hum. Behav. 29 (4) (2013) 1715–1724 https://doi.org/10.1016/j.chb.2013.02.006.

[3] C. Berrío, H. Rojas, The digital divide in the university: the appropriation of ICT in higher education students from bogota, Colombia, Comunicar 43 (2014) 133–142, http://dx.doi.org/10.3916/C43-2014-13.

[4] J.C. Bertot, C.R. McClure, P.T. Jaeger, The impacts of free public internet access on public library patrons and communities, Library 78 (3) (2008) 285–301, http://dx.doi.org/10.1086/588445.

[6] G. Blank, D. Groselj, Dimensions of internet use: amount, variety, and types, Inf. Commun. Soc. 17 (4) (2014) 417–435, http://dx.doi.org/10.1080/1369118x.2014.

889189.
[7] G.E. Bond, R.L. Burr, F.M. Wolf, K. Feldt, The effects of a web-based intervention on psychosocial well-being among adults aged 60 and older with diabetes, Diabetes Educat. 36 (3) (2010) 446–456 https://doi.org/10.1177/0145721710366758.
[8] T. Broady, A. Chan, P. Caputi, Comparison of older and younger adults' attitudes towards and abilities with computers: implications for training and learning, Br. J. Educ. Technol. 41 (3) (2010) 473–485 https://doi.org/10.1111/j.1467-8535.2008.00914.x.
[9] B.M. Byrne, Structural Equation Modeling with LISREL, PRELIS, and SIMPLIS: Basic Concepts, Applications, and Programming, Psychology Press, 2013.
[10] A.J. Chaffin, C.D. Maddux, Accessibility accommodations for older adults seeking e-health information, J. Gerontol. Nur. 33 (3) (2007) 6–12 https://goo.gl/QEk4LA.
[11] Y. Chen, A. Persson, Internet use among young and older adults: relation to psychological well-being, Educ. Gerontol. 28 (9) (2002) 731–744 https://doi.org/10.1080/03601270290099921.
[12] W. Chen, B. Wellman, Charting Digital Divides: Comparing Socioeconomic, Gender, Life Stage, and Rural-urban Internet Access and Use in Five Countries (Pp. 467–498, MIT Press, Cambridge, MA, 2005.
[13] M. Cimperman, M.M. Brenčič, P. Trkman, Analyzing older users' home telehealth services acceptance behavior—applying an Extended UTAUT model, Int. J. Med. Inf. 90 (2016) 22–31.
[14] P.J. Curran, S.G. West, J.F. Finch, The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis, Psychol. Meth. 1 (1) (1996) 16.
[15] F.D. Davis, R.P. Bagozzi, P.R. Warshaw, User acceptance of computer technology: a comparison of two theoretical models, Manag. Sci. 35 (8) (1989) 982–1003.
[16] T.N. Friemel, The digital divide has grown old: determinants of a digital divide among seniors, N. Media Soc. 18 (2) (2016) 313–331 https://doi.org/10.1177/1461444814538648.
[18] D.J. Gunkel, Second thoughts: toward a critique of the digital divide, N. Media Soc. 5 (4) (2003) 499–522 https://doi.org/10.1177/146144480354003.
[19] S.L. Gatto, S.H. Tak, Computer, internet, and e-mail use among older adults: benefits and barriers, Educ. Gerontol. 34 (9) (2008) 800–811 https://doi.org/10.1080/03601270802243697.
[21] J.F. Hair, W.C. Black, B.J. Babin, R.E. Anderson, R.L. Tatham, Multivariate Data Analysis Vol. 6 Pearson Prentice Hall, Upper Saddle River, NJ, 2006.
[22] P. Hakkarainen, 'No Good for Shovelling Snow and Carrying Firewood': Social Representations of Computers and the Internet by Elderly Finnish Non-users, New Media & Society, 2012, pp. 1198–1215 vol. 14(7) https://doi.org/10.1177/1461444812442663.
[23] I. Hardill, C.W. Olphert, Staying connected: exploring mobile phone use amongst older adults in the UK, Geoforum 43 (6) (2012) 1306–1312 https://doi.org/10.1016/j.geoforum.2012.03.016.
[24] T. Heart, E. Kalderon, Older adults: are they ready to adopt health-related ICT? Int. J. Med. Inf. 82 (11) (2013) e209–e231 https://doi.org/10.1016/j.ijmedinf.2011.03.002.
[25] F. Hirzalla, L. van Zoonen, J. de Ridder, Internet use and political participation: reflections on the mobilization/normalization controversy, Inf. Soc. 27 (1) (2011) 1–15, http://dx.doi.org/10.1080/01972243.2011.534360.
[27] H.F. Kaiser, The application of electronic computers to factor analysis, Educ. Psychol. Meas. 20 (1) (1960) 141–151.
[28] M. Kania-Lundholm, S. Torres, The divide within: older active ICT users position themselves against different 'Others', J. Aging Stud. 35 (2015) 26–36 https://doi.org/10.1016/j.jaging.2015.07.008.
[29] J. Kim, H.Y. Lee, M.C. Christensen, J.R. Merighi, Technology access and use, and their associations with social engagement among older adults: do women and men differ? J. Gerontol. B Psychol. Sci. Soc. Sci. 72 (5) (2016) 836–845 https://doi.org/10.1093/geronb/gbw123.
[30] B. Klimova, I. Simonova, P. Poulova, Z. Truhlarova, K. Kuca, Older people and their attitude to the use of information and communication technologies–a review study with special focus on the Czech Republic (Older people and their attitude to ICT), Educ. Gerontol. 42 (5) (2016) 361–369.
[31] M.D. Lacruz, M.C. Galofré, Sociedades digitales y nuevas alfabetizaciones: Políticas públicas de inclusión y alfabetización digital. In Inclusión digital: perspectivas y experiencias, Prensas Universitarias, Zaragoza, 2011, pp. 253–274.
[32] Q. Ma, A.H. Chan, K. Chen, Personal and other factors affecting acceptance of smartphone technology by older Chinese adults, Appl. Ergon. 54 (2016) 62–71.
[33] D.L. Milioni, V. Doudaki, N. Demertzis, Youth, ethnicity, and a 'reverse digital divide': a study of internet use in a divided country, Convergence 20 (3) (2014) 316–336, http://dx.doi.org/10.1177/1354856513517366.
[34] A.M. Morales, M. Caridad, F. García, Los telecentros españoles: recursos, servicios y propuesta de indicadores para su evaluación, Inf. Res. 14 (4) (2009) 8.
[35] B.B. Neves, F. Amaro, J.R. Fonseca, Coming of (old) age in the digital age: ICT usage and non-usage among older adults, Socio. Res. Online 18 (2) (2013) 1–14 https://doi.org/10.5153/sro.2998.
[36] J.E. Newhagen, E.P. Bucy, Routes to media access, in: J.E. Newhagen, E.P. Bucy (Eds.), Media Access: Social and Psychological Dimensions of New Technology Use, Lawrence Erlbaum Associates, Mahwah, NJ, 2004, https://goo.gl/7LUbn4.
[37] T. Olsson, D. Viscovi, Remaining divides: access to and use of ICTs among elderly citizens, in: L. Kramp, N. Carpentier, A. Hepp, R. Kilborn, R. Kunelius, H. Nieminen, T. Olsson, O. Pruulmann-Vengerfeldt, L. Tomanié Trivundza, S. Tosoni (Eds.), Politics, Civil Society and Participation: Media and Communications in a Transforming Environment, 2016, pp. 273–288 Bremen: edition lumière https://goo.gl/ChV6Tj.
[38] A. Quan-Haase, B. Wellman, J.C. Witte, K.N. Hampton, Capitalizing on the net: social contact, civic engagement, and sense of community, The Internet in Everyday Life (2002) 289–324, http://dx.doi.org/10.1002/9780470774298.ch10.
[39] A. Quan-Haase, K. Martin, K. Schreurs, Interviews with Digital Seniors: ICT Use in the Context of Everyday Life, Information, Communication & Society, 2016, pp. 691–707 vol. 19(5) https://doi.org/10.1080/1369118X.2016.1140217.
[40] P. Rasi, A. Kilpeläinen, Older People's use and learning of new media: a case study on remote rural villages in Finnish lapland, International Conference on Human Aspects of it for the Aged Population, Springer, Switzerland, 2016, pp. 239–247 https://doi.org/10.1007/978-3-319-39949-2_23.
[41] N. Selwyn, Reconsidering political and popular understandings of the digital divide, N. Media Soc. 6 (3) (2004) 341–362 https://doi.org/10.1177/1461444804042519.
[42] A. Smith, Older adults and technology use. Pew research center [internet & american life Project], https://goo.gl/NC7sV1, (2014).
[43] D.E. Sylvester, A.J. McGlynn, The digital divide, political participation, and place, Soc. Sci. Comput. Rev. 28 (1) (2010) 64–74, http://dx.doi.org/10.1177/0894439309335148.
[44] S. Sum, R.M. Mathews, I. Hughes, A. Campbell, Internet use and loneliness in older adults, Cyberpsychol. Behav. 11 (2) (2008) 208–211 https://doi.org/10.1089/cpb.2007.0010.
[45] H.Y.S. Tsai, R. Shillair, S.R. Cotten, V. Winstead, E. Yost, Getting grandma online: are tablets the answer for increasing digital inclusion for older adults in the US? Educ. Gerontol. 41 (10) (2015) 695–709 https://doi.org/10.1080/03601277.2015.1048165.
[46] A.J.A.M. Van Deursen, E.J. Helsper, A nuanced understanding of internet use and non-use amongst the elderly, Eur. J. Commun. 30 (2) (2015) 171–187, http://dx.doi.org/10.1177/0267323115578059.
[47] A.J.A.M. Van Deursen, J.A.G.M. Van Dijk, Internet skills and the digital divide, N. Media Soc. 13 (6) (2011) 893–911, http://dx.doi.org/10.1177/1461444810386774.
[48] A.J.A.M. Van Deursen, J.A.G.M. Van Dijk, The digital divide shifts to differences in usage, N. Media Soc. 16 (3) (2014) 507–526, http://dx.doi.org/10.1177/1461444813487959.
[49] A.J. Van Deursen, J.A. van Dijk, P.M. ten Klooster, Increasing inequalities in what we do online: a longitudinal cross sectional analysis of internet activities among the Dutch population (2010 to 2013) over gender, age, education, and income, Telematics Inf. 32 (2) (2015) 259–272, http://dx.doi.org/10.1016/j.tele.2014.09.003.
[50] V. Venkatesh, M.G. Morris, G.B. Davis, F.D. Davis, User acceptance of Information technology: towards a unified view, MIS Q. 27 (3) (2003) 425e478.
[51] F. Villar, S. Pinazo, C. Triadó, M. Celdrán, C. Solé, Older people's university students in Spain: a comparison of motives and benefits between two models, Ageing Soc. 30 (8) (2010) 1357–1372, http://dx.doi.org/10.1017/s0144686x10000565.
[52] M. Vives, C. Orte, L. Ballester, The effects of university programs for seniors in their social network and social support. The case of the open university for seniors, Pedagog. Soc. 25 (2015) 299–317, http://dx.doi.org/10.7179/PSRI_2015.25.13.
[53] K.G. Vroman, S. Arthanat, C. Lysack, "Who over 65 is online?" Older adults' dispositions toward information communication technology, Comput. Hum. Behav. 43 (2015) 156–166.
[54] N. Wagner, K. Hassanein, M. Head, Computer use by older adults: a multi-disciplinary review, Comput. Hum. Behav. 26 (5) (2010) 870–882 https://doi.org/10.1016/j.chb.2010.03.029.
[55] M. Warschauer, Technology and Social Inclusion: Rethinking the Digital Divide, MIT Press, 2004.
[56] World Health Organization, The World Health Report 2002: Reducing Risks, Promoting Healthy Life, World Health Organization, 2002.
[57] B. Xie, P.T. Jaeger, Older adults and political participation on the Internet: a cross-cultural comparison of the USA and China, J. Cross Cult. Gerontol. 23 (1) (2008) 1–15 https://doi.org/10.1007/s10823-007-9050-6.
[58] N. Zillien, E. Hargittai, Digital distinction: status-specific types of internet use, Soc. Sci. Q. 90 (2) (2009) 274–291, http://dx.doi.org/10.1111/j.1540-6237.2009.00617.x.
[59] R. Tirado-Morueta, Á. Hernando-Gómez, J.I. Aguaded-Gomez, The capacity of elderly citizens to access digital media in Andalusia (Spain), Inf. Commun. Soc. 19 (10) (2016) 1427–1444.
[60] R. Tirado-Morueta, D.M. Mendoza-Zambrano, J.I. Aguaded-Gómez, I. Marín-Gutiérrez, Empirical study of a sequence of access to internet use in Ecuador, Telematics Inf. 34 (4) (2017) 171–183.
[61] R. Tirado-Morueta, D. Mendoza-Zambrano, I. Marín-Gutiérrez, M. Mendoza-Zambrano, The Relativity of sociodemographic determinism on the digital divide in high school students in Ecuador, Int. J. Commun. 11 (2017) 24.
[62] L.J. Servon, Bridging the Digital Divide: Technology, Community and Public Policy, John Wiley & Sons, 2008.
[63] B.B. Neves, F. Amaro, Too old for technology? How the elderly of Lisbon use and perceive ICT, J. Commun Inf. 8 (1) (2012).
[64] A. Bhatnagar, S. Ghose, Segmenting consumers based on the benefits and risks of Internet shopping, J. Bus. Res. 57 (12) (2004) 1352–1360.
[65] J.M. Hogarth, J. Kolodinsky, T. Gabor, Consumer payment choices: paper, plastic, or electrons? Int. J. Electron. Bank. 1 (1) (2008) 16–35.
[66] G. Zhang, Q. Wang, J. Kolodinsky, The digital divide in internet information searching: a double-hurdle model analysis of household data from Vermont, First Monday 15 (11) (2010).
[67] J. Schradie, The digital production gap: the digital divide and web 2.0 collide, Poetics 39 (2) (2011) 145–168.