

# LEVELS OF DIGITAL IDENTITY FOR OLDER-ADULTS LEARNERS. A VALIDATED SCALE FOR THEIR DIGITAL INCLUSION

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## Abstract

This paper presents the outcomes of a research study on the validation of a scale based on a theoretical proposal of three levels for the digital identity construction and development in older-adult learners. Age barriers for learning in our hyperconnected societies involve several gaps for the adults' lifelong learning and their full inclusion. Digital gaps include the motives and uses of older-adult learners for using digital platforms and resources, for this reason, in this paper the analysis of digital identity is associated with their Internet activity performances, aiming to analyse the relationship among the digital uses with their level of digital identity and digital inclusion. The scale was validated with a sample of senior learners (N = 659) aged 55 years old and over who already are involved in active aging programs of Adult Education in Spain. Twenty Likert-type items were used to measure the agreement with the relevance of the digital identity factors for the three levels, along with two other validated scales for the evaluation of their Internet uses and motivations. Exploratory and confirmatory analysis confirmed a factorial structure of three levels based on the location, access, and significance of digital identity. Results showed that uses and motives correlated with the digital identity of the older-adult learners, with key considerations for the design of digital literacy proposals in Lifelong Learning Programs.

Keywords: Digital Inclusion, Older-Adults, Learning age barriers, Digital Gaps, Digital identity Innovation, technology, research projects.

## 1 INTRODUCTION

The digital barriers in our hyper-connected societies suppose multiple gaps in adults' permanent learning and their full inclusion, among which we can find the limitations in the uses and motives to use different digital platforms and resources. For this reason, this work analyses the digital identity of older people in the context of technology-mediated actions, associated with different uses and representations of the Internet. Specifically, the work presents a scale for the analysis of digital self-representation in adult and elderly learners, based on a theoretical proposal of three levels, its validation and the connections of the digital identity levels with the actual uses and motives the older people have for using the Internet.

We seek to expand the understanding of the relationship between the subjects with their technology-mediated environments, where if we only considering aesthetic, visual or functional aspects is insufficient. We need indicators that have an educational value, that build bridges, ties of belonging and wellbeing, in new spaces of action. We therefore need to know the process and the levels at which this group face their access the digital world, understanding the ways in which their digital identity is built and rebuilt, tuning into a culture that imposes appropriation of uses and motives on them. In the case of older adults, these aspects should be seen as social problems with effects on their individual and collective, and civic, inclusion; from ethical and responsible use of technology and the processes of digital inclusion. In this way we will build a bridge between the construction of digital identity and its benefits and the effective inclusion of all adults and older adults in a digital culture.

## 2 DIGITAL IDENTITY IN ADULTS AND OLDER ADULTS

While the youngest generations are growing up within our hyper-connected society, which translates to the ease in which they carry out technology-based activities, without straining their identity structure, older adults do not identify so much with these tools, due to the fact that their culture, values and relationships have developed, mainly, in a time before digital culture existed. Some older people have had to or have to go through a period of a reconstruction of their identity, where the use of technology

for different activities or interactions forces them to develop and build a digital identity, that modifies the interpretation of their actions and social relationships.

In this sense, many studies can be found on the usability of devices, resources or digital spaces for adults and older adults, but there are hardly any investigations into the relationship with the complex web of variables and dimensions that characterise digital identity, bearing in mind that on top of assimilating various psycho-biological and social changes found in this maturity stage, they are expected to tune into a digital culture for the recreation of their personal and collective idiosyncrasy.

To establish a first line of research on this matter, we draw from the idea of pedagogical identity initially written by Foucault [1], who critiqued the tendency in certain pedagogical programs to take the identity of a learner for granted, or consider it as a univocal dimension, without taking into account that identities are constituted as positions of the subject, in the process of change, where the subjective interpretation of the culture that allows identification and participation determines the action and interaction.

Therefore, a single identity does not exist, rather multiple and varied identities, changes and dispositions from which the subjects are and act. Identity is a widely studied concept, including the construction and development of identity in virtual environments, although there is not so much research regarding the demographic of adults and older adults; even though recent studies such as that of Astell, MacGrath and Dove [2] have begun to consider digital identity as part of the decisions in accepting technology, especially assistive technology, although not for the specific use of Internet use for training actions, as this study proposes.

In this study digital identity is understood as the set of aspects, characteristics and traits of an individual in a digital environment, with the possibility or need to use a variety of accessible tools and channels. It encompasses a series of processes, mechanisms and actions, both individual and social, that a person builds or develops when using the Internet, for various purposes. Depending on the different purposes and multiple reasons why an older person can use the Internet and its different resources and platforms, we can present three levels of digital identity. Considering at the out point that the concept of digital identity implies multidimensionality, understanding identity as individual (self-identity), behavioural (personal identity) and social (social identity). Levels are based on practices, so the term "identification practices" is sometimes preferred over the term "identity", because two main reasons. On the one hand, these practices give meaning to the behaviour and life of the subject; on the other hand, the process of "being" is determined by how and where the individual transits and lives in spaces and, consequently, in virtual spaces [3].

According to Muñoz, Hernández and Tabernero [4] the first level can be conceived through the uses and reasons from which the elderly feel located (level of Location). The second level from the digital performances in which they interrelation, communicate or participate with others (level of Action). And the third level from the experience of feelings, the evocation of memories and expectations of action based on previous experiences (level of Significance).

Based on the explanation of the three levels, this study discusses the relationship between the identity practices of the elderly in virtual environments and secondly, the different uses and motivations for using the Internet.

## **2.1 Older-adults uses of the internet**

Several studies have analysed the older people uses of the internet, in terms of frequency and type of applications used and confirm types, profiles, or levels of users. In the context of Spain, which is the population of the present study. Álvarez-Dardet, Lara, & Padilla [5] have recently found three profiles for adoption of personal computers: active, passive and moderate. Martínez-Heredia [6] showed how digital competences have been not acquired through a technological immersion of older users and it is necessary to learn. Ramírez, González, & Sedeño [7] determined how sociodemographic variables were linked with three levels of media literacy in elderly. Casado & Lezcano [8] found five types of attitudes towards digital social networks: absolute positive, positive, critical positive, negative and disinterest.

In our study the categories found by Llorente-Barroso, Viñarás-Abad, and Sánchez-Valle [9] were used for the analysis of older-adults use of the Internet: information, communication, transactions and administration, together with leisure and entertainment. These are the main uses that via different technologies, digital applications, or resources older-adults could perform when using the internet. According to the theoretical framework proposed in this study, the performances under these Internet uses would be related with the construction or development of one of the three levels of digital identity.

Therefore, we hypothesize that the greater or lesser frequency of these uses of the Internet would be related to the construction or development of one of the three levels of digital identity (Location, Action or Significance).

## 2.2 Older-adults motives for using the internet

Literature on Internet uses have been reinforced by psycho-sociological studies in which attitudes are key predictors to face the uses, especially when barriers or aging limitations are considered, lead to marginalization and even digital exclusion. Several studies [10, 11, among others] showed the highly interaction between attitudes and final uses in older-adults. Chopik, Rikard, & Cotten [12] highlighted four predictors of ICT use in older adulthood: cognition, mastery, optimism, and cynical hostility. Other studies, such as Álvarez-Dardet, Lara, & Padilla [13] used the Computer Attitude Scale (CAS) [14] consisted of 22 statements with a Likert scale ranging from 0 (strongly disagree) to 3 (strongly agree).

In our study the Internet Motivation Scale developed by Wolfradt and Doll [15] was used to evaluate older learners' main motivations for going online. The scale consists of 20 items that evaluate the three fundamental reasons that people have for connecting to the Internet: motivation for information (eight items with a good reliability, Alpha = .87, e.g., "I consider the Internet as an additional mass medium"), motivation for interpersonal communication (seven items which have good reliability, Alpha = .86, e.g., "I use the Internet to express myself"), and motivation for entertainment (five items with good reliability, Alpha = .84, e.g., "The Internet stimulates my curiosity").

Also according to the theoretical framework proposed in this study, we hypothesize that the reasons for using the Internet as information would be related to the lowest level of digital identity, while the reasons associated for entertainment or interpersonal communication were related to the other two most advanced levels.

## 3 METHODOLOGY

A Likert scale was designed and was validated in a previous study [4] with descriptive analysis and exploratory factorial analysis (AFE) to identify subscales within the items which could build the three different levels of digital identity for the elderly. This scale was administered in conjunction with two other scales that took into account the uses and motivations for using the internet of the elderly (based on the studies of Llorente-Barroso, Viñarás-Abad, & Sánchez-Valle [9] and Wolfradt & Doll [15]).

This study presents the description of the three levels of digital identity found, and their relationship to the different uses and motivations. Two hypotheses are contrasted through descriptive and correlation methods.

### 3.1 Sample

The three scales were administered to a sample of students from universities for adults and older adults in Spain (No = 659). The gender distribution of the sample was balanced (50.7% male, 49.3% female). The age of participants was distributed among different ranges (11.5% less than 60 years, 34.6% between 61 and 65 years, 34.7% between 66 and 70 years, 14.9% between 71 and 75 years, 2.7% between 76 and 80 years, and 1.5% older than 81 years). In residential status, 75.6% live in towns or cities of more than 50,000 citizens. There were no statistically significant differences by gender or age depending on the distribution of adult universities.

7.6% of the sample had been using the Internet for less than 1 year, 14.7% between 1 and 5 years, and 77.7% over 5 years. It must be specified that in the latter percentage there is a statistically significant difference between women and men ( $p < 0.000$ ) being mostly male, possibly by job requirement, since they also correspond to the ranges that would add up from 55 to 65 years. As for the use of devices, to connect to the internet, based on the average (range I don't have, 1 I have but not use, 2 use ever and 3 use frequently), we can observe that mainly adults and older adults use the mobile phone to connect (average 3.74) while they do not use e-game console (1.14) or smartwatches (1.39).

## 4 RESULTS

Regarding the connection frequency for different purposes (see Table 1), according to the 12 purposes analyzed by Llorente-Barroso, Viñarás-Abad, and Sánchez-Valle [9], our results reveal that there are

notable differences between the frequencies extreme (never and continuously) according to age that are statistically significant ( $p < 0.000$ ).

Table 1. Frequency of connection purposes continuously and never, by age ranges.

	Frequency	Less than 61 years	From 61 to 65 years	from 66 to 70 years	from 71 to 75 years	from 76 to 80 years	More than 80 years	Total
<b>Search for information</b>	Continuously	<b>52,60%</b>	46,10%	40,60%	37,80%	38,90%	40,00%	<b>43,40%</b>
	Never	0,00%	0,40%	0,00%	5,10%	5,60%	<b>20,00%</b>	1,40%
<b>Communication</b>	Continuously	<b>55,30%</b>	49,10%	37,60%	46,90%	33,30%	40,00%	<b>44,90%</b>
	Never	0,00%	1,30%	0,90%	3,10%	<b>11,10%</b>	10,00%	1,70%
<b>Transactions</b>	Continuously	<b>23,70%</b>	16,70%	8,30%	12,20%	11,10%	10,00%	13,70%
	Never	10,50%	14,50%	14,40%	16,30%	27,80%	<b>50,00%</b>	15,20%
<b>Administrative management</b>	Continuously	<b>13,20%</b>	12,30%	5,70%	8,20%	11,10%	10,00%	9,40%
	Never	6,60%	12,70%	12,70%	18,40%	22,20%	<b>50,00%</b>	13,70%
<b>Shopping</b>	Continuously	3,90%	3,50%	1,30%	4,10%	<b>11,10%</b>	10,00%	3,20%
	Never	27,60%	26,80%	39,30%	42,90%	44,40%	<b>50,00%</b>	<b>34,40%</b>
<b>Leisure</b>	Continuously	3,90%	4,80%	1,30%	5,10%	5,60%	0,00%	3,50%
	Never	47,40%	53,90%	61,60%	57,10%	66,70%	<b>80,00%</b>	<b>57,10%</b>
<b>Entertainment</b>	Continuously	15,80%	13,20%	7,40%	7,10%	0,00%	10,00%	10,20%
	Never	18,40%	21,50%	24,90%	29,60%	33,30%	<b>40,00%</b>	24,10%
<b>Reading press, books</b>	Continuously	31,60%	30,30%	24,90%	28,60%	22,20%	20,00%	27,90%
	Never	7,90%	7,90%	10,00%	14,30%	22,20%	<b>30,00%</b>	10,30%
<b>Sharing content</b>	Continuously	<b>14,50%</b>	13,60%	9,60%	13,30%	11,10%	10,00%	12,10%
	Never	17,10%	14,00%	21,00%	<b>22,40%</b>	11,10%	30,00%	18,20%
<b>Opinion</b>	Continuously	<b>9,20%</b>	6,10%	3,90%	6,10%	0,00%	0,00%	5,50%
	Never	39,50%	38,20%	51,10%	45,90%	61,10%	<b>60,00%</b>	<b>44,90%</b>
<b>Update profiles</b>	Continuously	<b>6,60%</b>	3,10%	2,60%	3,10%	0,00%	0,00%	3,20%
	Never	22,40%	27,60%	41,00%	43,90%	<b>66,70%</b>	50,00%	<b>35,50%</b>
<b>Receive information</b>	Continuously	10,50%	7,00%	2,60%	7,10%	<b>11,10%</b>	0,00%	5,90%
	Never	32,90%	37,30%	43,70%	53,10%	44,40%	<b>70,00%</b>	<b>42,00%</b>

Source. Author's own creation

The Highest frequencies (continuously) are focused on the purposes of: searching for information and communicating; while the lowest (never) are related to online shopping, updating profiles, giving opinions or receiving training. The percentages of higher frequencies among adults under 61 years of age stand out (first column of Table 1), specifically they are those who carry out administrative procedures, share content, and even update their profiles on social networks. In contrast to those over 76 years of age, or 80, among which the percentages "never" are more frequent for activities such as giving their opinion, reading the press or books, online leisure or even carrying out banking transactions.

To evaluate the purposes to which each participant connects to the Internet, 12 items were generated to ask the frequency with which it is used for different activities (e.g., "frequency with which you are connected to find information"). Participants answered using a four-point Likert scale (1 = never, 2 = few occasions, 3 = frequently, 4 = continuously). An exploratory factor analysis with Varimax rotation showed that three principal components explained 59.21% of variance. The first factor, transactional purpose, is based on the digital actions of banking, managing, buying, and entertainment (39.69% variance, reliability index  $\alpha = .78$ ). The second factor, active participation purpose, is based on the digital actions of information sharing, giving opinions, keeping updated, and training (11.10% variance, reliability index  $\alpha = .72$ ). The third factor, *informational* purpose, is based on searching for information, receiving communications by email, and reading newspapers online (8.42% variance, reliability index  $\alpha = .70$ ).

Similarly, following the factorial structure from the three dimensions of Internet Motivation Scale proposed by Wolfradt and Doll [15], an exploratory factor analysis was carried out with Varimax rotation that showed the three components. The first was adjusted to the motivation for information (22.35% variance, reliability index  $\alpha = .87$ ). The second was the motivation for interpersonal communication (18.24% variance, reliability index  $\alpha = 0.86$ ). And the third to entertainment motivation (17.85% variance, reliability index  $\alpha = 0.84$ ).

The correlation between the three factors of each of the scales was high, finding that those who had an information motivation, also connected more frequently to be informed (Pearson's  $r = .545$   $p < .000$ ). And that those who had a motivation oriented to interpersonal communication also connected more frequently to participate and give their opinions (Pearson's  $r = .437$   $p < .000$ ).

According to the three factors extracted from the two scales and the three levels of digital identity proposed in the theoretical framework, results confirm the interactions among frequency of use, purpose and motives for using the Internet. Firstly, regarding the connecting purposes and actions there were significant correlations among the three purpose components and the three levels of digital identity (See Table 2). The first motive, using the Internet to seek out information, seems to have a clear relation to the location digital identity level, a clear purpose based on the reception of information (Pearson's  $r = .34$   $p < .0000$ ). The highest correlation was found in between the second level, action, and the frequency of connecting for active participation and giving opinion (Pearson's  $r = .46$   $p < .000$ ).

Table 2. Correlations among Levels of Digital Identity and Purposes.

Levels of Digital Identity in adults and elderly			Purposes-actions of internet connexion		
			1 Receive information	2 Carry out managements	3 Participate and giving opinion
1 Identity location level	Pearson correlation		,340**	,301**	,260**
	Sig. (bilateral)		0,000	0,000	0,000
2 Identity action level	Pearson correlation		,242**	,210**	,464**
	Sig. (bilateral)		0,000	0,000	0,000
3 Identity Significance level	Pearson correlation		,279**	,257**	,243**
	Sig. (bilateral)		0,000	0,000	0,000

Source. Author's own creation

Secondly, regarding motivations for using the internet there were also significant correlations among the three purpose components and the three levels of digital identity (See Table 3).

The results showed that digital identity factors play a different role depending on the motivation for using the Internet. Only the first level of digital identity, location, has a direct effect when the main reason for using the Internet is informative. However, when the reason for using the Internet is entertainment, in addition to location-based digital identity, the significance level also had a direct effect. Finally, when the reason for the use of the Internet was interpersonal communication, all three factors of digital identity—location, action and significance—played a relevant role and explained significant differences.

Table 3. Correlations among Levels of Digital Identity and Purposes.

Levels of Digital Identity in adults and elderly			Motivations for using the internet		
			1 Informative	2 Interpersonal communication	3 Entertainment
1 Identity location level	Pearson correlation		,544**	,694**	,720**
	Sig. (bilateral)		0,000	0,000	0,000
2 Identity action level	Pearson correlation		,430**	,714**	,613**
	Sig. (bilateral)		0,000	0,000	0,000
3 Identity Significance level	Pearson correlation		,462**	,668**	,698**
	Sig. (bilateral)		0,000	0,000	0,000

Source. Author's own creation

According to the results from the analysis of correlations, most older adults would understand the events of digital culture externally, from level 1 of digital identity, Location. At level 2, Action identity, the perception of otherness would imply a change of position that means openness and favors the possibility of more immersive participation, that is, entering the second level of identity construction brings more possibilities to participate, relate and become more involvement in the virtual environment. This level would imply the assumption of a social role from which the "social self" exposed to the perception of others would begin, and most importantly, towards the beginning of the management of social actions mediated by technologies.

Finally, at level three, more advanced, is where older adults would build discourses, scripts and memories that would bring them affection and meanings, from which they would also recreate and transform digital culture, understood as a conglomeration of activities, relationships and communications in constant interaction. Older people who would be at this level have learned to decipher some of the multiple hypermedia formats, where meanings, objects, actions and people that converge in the Network are intermingled. They come to interpret themselves and others. They adjust to the circumstances of the environment not only autonomously, but also creatively, acquiring natural habits immersed in schemes that guarantee significance, and that is why we called this level "identity significance level", because it incorporates a meaning on which one depends, and which is part of one's identity.

## 5 DISCUSSION AND CONCLUSIONS

Results from this study showed that the uses and motives for using technologies by older adults determine at least three levels of digital self-representation, which can be used to promote technological literacy programs, in order to develop different media skills, and ultimately allow adults and older people an effective empowerment towards their full digital inclusion.

When considering the width in uses and the diversity in motives for using the Internet the older-adults surpassed the progressing levels for their digital identity, since e.g. the third-level of digital identity was only visible among those older-adults who had used a range of digital devices frequently and over a long period of time. As a result, the naturalness, calm, necessity, or rewards proper to the third level is acquired by wider technological uses and possibilities.

Conversely, when older-adults do not have such possibilities and needs for using the Internet, their digital identity remains in the first level, even in a zero level, considering that frustration could be the initial barrier for using, and thus, creating their digital identity.

Despite the fact that statistically strong correlations were found among the three digital identity levels proposed, this study that associate levels with uses and motives would lead us to understand a certain progression among the levels. However, according to the sample, it can be concluded that the majority of the older-adults participating in the study are in the level one of Location, that is, they see, pass through, and probably act in environments with static patterns, such as reception of digital information that has the use with higher frequencies.

Design of online environments for potential older users, even virtual learning environments, would need to provide possibilities for the development of their digital identity. Changes would include the complex dispersion of goals and needs that the purposes of using the Internet are frequent for older-adults, as key skills to acquire in digital literacy and inclusion agendas.

This is relevant from the perspective of digital inclusivity, as it allows us to approach the modalities of perception, comprehension and understanding with others through technologies and actions in relation to our beliefs and goals (values and aspirations). Our brains, as a social organ in interaction [16] requires the understanding of others, and their actions - in the face-to-face and digital - for the shaping and evolution of social relations. In this sense, digital environments for communication, management, attention and learning could be designed more effectively if we consider the dynamic interaction between brain and computer.

Our study highlights the relevance of social variables and the interactions that need to be provided in virtual environments for the sense of sociability, as other studies reported [17-19]. For example, Czaja and Sharit [17] also found challenges presented by this very heterogeneous group of older adults that varies tremendously in backgrounds, skills, knowledge, and abilities, requiring the analysis of the differential uses. Also, Nimrod [18] demonstrated varying levels of technophobia among users and significant associations between technophobia and Internet use patterns, including type and complexity of use, like in this study, the uses and motives provides different levees. Finally, as, Vroman, Arthanat

and Lysack stated [19] older adults valued their ICT activities as important in their lives, however, their motives and uses are different in age, as our study found, since the older adults aged 55-65 were more likely to use the internet for diverse uses. Other recent studies support the conclusions from this study too [20-22]. Internet use is becoming increasingly important for the daily lives of older adults, considering that the variety of online activities they are get use to do it is also broadening, however, older adults often struggle to adapt to the rapid changes in the digitizing media landscape, and one of the most important reasons are the motivations toward Internet use, which determine the variety of online uses, so that engaging in various online activities could reduce the digital gaps and reduces the sense of social exclusion, towards the digital inclusion.

As a limitation, the older adults who participated in the study were probably relatively digitally literate, as the study required potential digital learners; further research will need to target a wider range of active older-adults or senior learners, without ignoring the different digital divides.

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## REFERENCES

- [1] M. Foucault. "La arqueología del saber". Madrid. Siglo xxi, 1997.
- [2] A.J. Astell, C. McGrath and E. Dove. "'That's for old so and so's!': does identity influence older adults' technology adoption decisions?", *Ageing and Society*, pp. 1-27, 2019.
- [3] A. Kay. "Erikson Online: Identity and Pseudospeciation in the Internet Age", *Identity. An International Journal of Theory and Research*, vol. 18, no. 4, pp. 264-273, 2018.
- [4] J.M. Muñoz-Rodríguez, M.J. Hernández-Serrano and C. Tabernero. "Digital Identity Levels in Older Learners: A New Focus for Sustainable Lifelong Education and Inclusion", *Sustainability*, 12, 10657, 2020.
- [5] S. M. Álvarez-Dardet, B. L. Lara and J. Pérez-Padilla. "Older adults and ICT adoption: Analysis of the use and attitudes toward computers in elderly Spanish people", *Computers in Human Behavior*, 106377, 2020, <https://doi.org/10.1016/j.chb.106377>.
- [6] N. Martínez-Heredia. "Desafíos en la era digital actual: TIC y personas seniors de la Universidad de Granada (España)/Current challenge in the digital age: ICT and the elderly at University of Granada (Spain)", *Texto Livre: Linguagem e Tecnologia*, vol.13, no. 1, pp. 82-95, 2020.
- [7] A. Ramírez, N. González and M. Sedeño. "Media Literacy in the Elderly Population. Diagnosis of the Spanish Reality", *Signo y Pensamiento*, vol. 36, no. 70, pp. 94-111. 2017.
- [8] R. Casado and F. Lezcano. "Inclusion digital y envejecimiento activo: La participación de los mayores en las redes sociales", *Aula Abierta*, vol. 47, no. 1, pp. 113-122, 2018, <https://doi.org/10.17811/rifie.47.1.2018.113-122>.
- [9] C. Llorente-Barroso, M. Viñarás-Abad and M. Sánchez-Valle. "Internet and the elderly: enhancing active ageing" *Comunicar*, vol. 23, no. 45, pp. 29-36, 2015.
- [10] T. Broady, A. Chan and P. Caputi. "Comparison of older and younger adults' attitudes towards and abilities with computers: Implications for training and learning", *British Journal of Educational Technology*, vol. 41, no. 3, pp. 473-485, 2010, <https://doi.org/10.1111/j.1467-8535.2008.00914>.

- [11] L. Lagana, T. Oliver, A. Ainsworth and M. Edwards. "Enhancing computer self efficacy and attitudes in multi-ethnic older adults: A randomised controlled study", *Ageing and Society*, vol. 31, no. 6, pp. 911–933, 2011, <https://doi.org/10.1017/S0144686X10001340>.
- [12] W. J. Chopik, R.V. Rikard and S.R. Cotten. "Individual difference predictors of ICT use in older adulthood: A study of 17 candidate characteristics", *Computers in Human Behavior*, 76, pp. 526-533, 2017, <https://doi.org/10.1016/j.chb.2017.08.014>.
- [13] S. M. Álvarez-Dardet, B. L. Lara and J. Pérez-Padilla. "Older adults and ICT adoption: Analysis of the use and attitudes toward computers in elderly Spanish people", *Computers in Human Behavior*, 106377, 2020, <https://doi.org/10.1016/j.chb>.
- [14] N. Selwyn. "Students' attitudes toward computers: Validation of a computer attitude scale for 16-19 education", *Computers & Education*, vol. 28, no. 1, pp. 35–41, 1997.
- [15] U. Wolfradt and J. Doll. "Motives of adolescents to use the Internet as a function of personality traits, personal and social factors", *Journal of Educational Computing Research*, vol. 24, no. 1, pp. 13-27, 2001, <https://doi.org/10.2190/ANPM-LN97-AUT2-D2EJ>.
- [16] L. Cozolino, L. The Social Neuroscience of Education: Optimizing Attachment and Learning in the Classroom. NY: Norton & Company, 2013.
- [17] S.J Czaja; J. Sharit, *Designing Training and Instructional Programs for Older Adults*; CRC Press: New York, NY, USA, 2012.
- [18] Nimrod, G. Technophobia among older Internet users. *Educ. Gerontol.* 2018, 44, 148–162.
- [19] K.G. Vroman; S. Arthanat C. Lysack, Who over 65 is online? Older adults' dispositions toward information communication technology. *Comput. Hum. Behav.* 2015, 43, 156–166.
- [20] A. Seifert, Hofer, M., & Rössel, J. (2018). Older adults' perceived sense of social exclusion from the digital world. *Educational Gerontology*, 44(12), 775-785.
- [21] B. Schehl J. Leukel, & V Sugumaran. Understanding differentiated internet use in older adults: A study of informational, social, and instrumental online activities. *Computers in Human Behavior*, 2019, 97, 222-230.
- [22] E. Hage, M. van Offenbeek, & A Boonstra. New Rules of Engagement: How Adaptation To Online Media Changes Older Adults' Social Connectedness. *Journal of Computer-Mediated Communication*, 2020, 25(2), 182-197.