Digital Literacy of Older Persons in Hanoi, Vietnam

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Abstract

Digital literacy theory which holds that the digital revolution has had a massive influence on economies in several aspects has now become contested, as the world is entering aging population; the benefits of such innovations are not evenly distributed, especially among elderlies. In response to the problem, this study employed a cross-sectional dataset of 400 older persons from Hanoi, Vietnam. SPSS was used to analyze the data. The dataset was examined by applying parametric statistical tools, including the T-test, analysis of variance (ANOVA), and structural equation modeling (SEM). The finding suggested that motivated elderlies were more likely to indulge in digital literacy and were capable of assessing information relating to their health and finances. Further, the result indicated that individuals with proper digital literacy indeed experienced that they were socially connected and were cognitively flexible.

Keywords: Digital literacy, older persons, life satisfaction, Hanoi Vietnam, digital health literacy, digital financial literacy, cognitive flexibility.

Introduction

It is infallible that the digital revolution has brought substantial changes in several aspects of daily life since 1980. All the economic activities that are embedded in a social structure (Kuchler, 2019) are now inextricably tied to digital technology. However, it is imperative to note that such benefits of technology are not evenly distributed. This has spawned a digital divide precluding many individuals and communities, especially elderly individuals, from enjoying the perks and privileges of the digital world. According to Lee et al. (2019), whereas the younger generation can assess the digital world without much difficulty, it is the elderly who find it hard to comprehend all the nooks and crannies of digital technology.

Vietnam currently is going through a substantial change in the past few years. The digital economy is projected to have linear growth at a rate of 30 percent between 2020 and 2025. As evidenced by the recently approved National Digital Transformation Programme by 2025, with a vision towards 2030 (Samuel, 2021), the country is undergoing a transformative digital shift. Although Vietnam has embarked on a new digital age, the country is on the verge of experiencing a substantial population aging trend, which is occurring more quickly and is pervasive as compared to other developing nations (Glinskaya et al., 2021).

Past studies conducted in Vietnam only have accentuated the growing population of older persons and mainly focused on their health status, healthcare needs, mental health, and social support (Bang et al., 2017; Dao et al., 2018; Truong et al., 1997). Hence, the purposes of this research are in four folds. First, it highlights the status of digital literacy among older persons in Hanoi, Vietnam. Second, it investigates the factors that influence the digital literacy of older persons. Third, it investigates the relationship between the digital literacy of older persons and their self-perceived life satisfaction. Finally, it investigates the mediating roles of digital health literacy, digital financial literacy, social connectedness, and cognitive flexibility on the relationship between the digital literacy of older persons and their life satisfaction.

Theoretical Frameworks and Conceptual Framework

In the words of Paul Gilster, "Digital literacy is the ability to understand and use information in multiple formats from a wide variety of sources when it is presented via computers." Further, digital

literacy is the ability to effectively use technology for multiple purposes such as reading, writing, and navigation in the digital era (Bawden, 2008, p. 28). However, such a widespread phenomenon, since 1980, has caused a digital divide. According to van Dijk (2020), the digital divide is a gap between those who have access to and use digital media and those who do not. Trinder et al. (2008) labeled those generations born during and after the rise of digital technology as "digital natives". Since older people were raised prior to the advent of digital technologies; unlike "digital natives", they face difficulty in navigating new technologies and are compelled to educate themselves (Prensky, 2001). From their empirical study, Jones and Fox (2009) found that the percentage of individuals who do not have access to computers or the Internet is substantially higher among those over the age of 60 than among those in younger age groups. In order to understand the importance of digital literacy on elderly people, the conceptual framework is constructed by combining Williamson's ecological theory of information behavior and Chen and Chan's Senior Technology Acceptance Model (STAM).

Williamson's perspective on digital literacy which assumes that people acquire information from their daily lives is derived from Bronfenbrenner's ecological theory. This theory argues that the literacy development of an individual is influenced by four different systems or environments (Bronfenbrenner, 1979). According to Williamson (2005), the individual is at the center, surrounded by concentric circles representing different sources of information. Personal networks and media are considered limited sources of intentional information acquisition, while institutional sources beyond personal networks and media are frequent sources of incidental information acquisition. The model considers various factors, such as lifestyle, values, socio-economic circumstances, and physical environment, that influence information acquisition. Family and friends are found to be the primary sources of information, with interpersonal sources being more important than media or institutional sources. Overall, individuals tend to seek information from familiar sources but may encounter information incidentally from other sources, which shapes their understanding of the world.

Based on the Technology Acceptance Model (TAM) (Davis et al., 1989) Chen and Chan's STAM assumes users' acceptance of technology is influenced by their perception of its ease of use and usefulness. This model, which is rooted in psychological theories of reasonable action and planned behavior, has played a significant role in explaining how users interact with technology. Later in their study, Chen and Chan (2011) accentuated the need to consider age-specific factors and suggested expanding the technology acceptance model with additional variables related to elderly individuals'

characteristics and challenges and developed STAM. The same model was used in Hong Kong China to explain the acceptance of technology by older persons (Chen & Chan, 2014).

Williamson's ecological theory provides insights into how an individual's environment impacts their development, including literacy. This theory is adopted to understand the various levels of influence which shape individuals' information-seeking behavior. In addition, TAM focuses on perceived ease of use and usefulness as determinants of acceptance, while STAM recognizes the need to consider age-specific factors and additional variables related to the characteristics and challenges faced by older adults. In sum, both perspectives contribute to a more thorough understanding of various factors that affect digital literacy among the elderly in Vietnam and contribute to the development of effective strategies to promote digital inclusion.

Hypotheses of the Study

Studies in the past have identified variables that can determine the digital literacy of the elderly in diverse countries. As shown in Figure 3.1, the conceptual framework exhibits these dimensions that assimilates a variety of components that contribute to their digital literacy levels. The framework sheds light on the multifaceted nature of digital literacy and shows relationship among multiple variables.
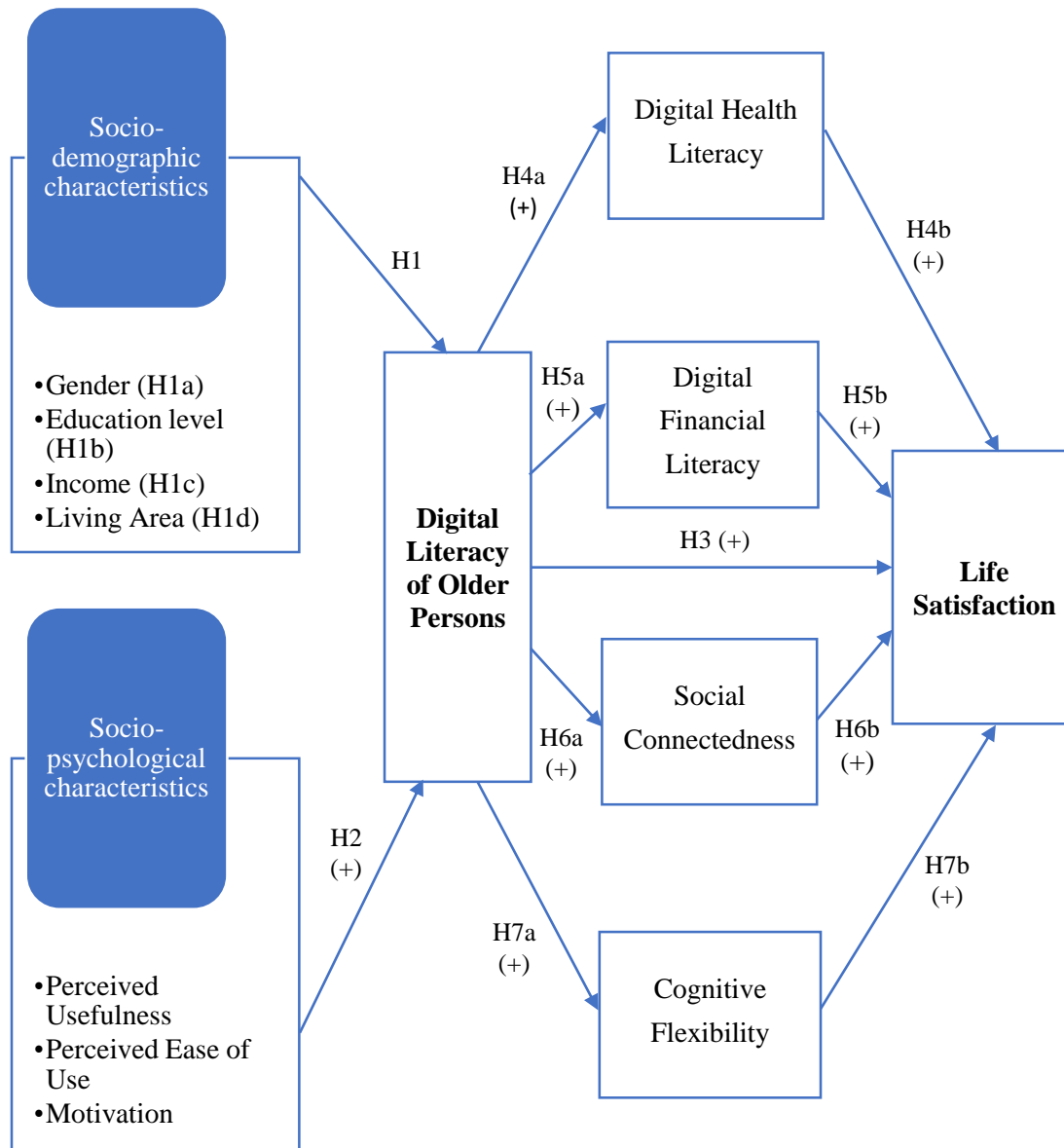
Figure 1. Conceptual Framework

Literature Review

The Role of Socio-Demographic Characteristics on Digital Literacy of Older Persons

Socio-demographic characteristics constitute four dimensions. The first dimension is gender. It has been argued that women are less likely to have access to facilities than men do. Schmidt-Hertha and Strobel-Dümer (2013), in their study, found that, in Germany, a major predictor of computer use was gender, as males have more access to digital resources than women have.

Digital literacy is determined by literacy in the normative sense. Hence, the second dimension is education. Prior studies in Germany identified that educational level is a major qualifier for computer learning (Schmidt-Hertha & Strobel-Dümer, 2013). According to Arthanat et al. (2019), income plays a significant role as elderly individuals with lower incomes have less access to digital devices as compared to those with higher incomes. Chandra (2019) found that people who have a job or are receiving a pension are more likely to have higher odds of using the Web. Hence, the third aspect of socio-demographic characteristics is income.

Finally, the fourth aspect that has a determining effect on digital literacy is the living area. Anderson et al. (2019) found that Internet usage is minimal among ethnic minorities, especially those with poor educational attainment living mostly in rural areas. Likewise, according to Perrin and Atske (2021), the percentage of internet users will differ for people with varied levels of education, different places of residence, varied incomes, and different races.

Based on the above arguments, the digital literacy of Vietnamese older persons is also expected to be affected by sociodemographic characteristics. Thus, the following hypotheses are proposed:

H1a: Older persons who are males have higher digital literacy than older persons who are females.

H1b: The education level of older persons is positively associated with digital literacy.

H1c: Older persons with an income (salaries or pensions) are more likely to be digitally literate than older persons who are retired or dependent on their families.

H1d: Older persons who live in urban areas have higher digital literacy.

The Role of Socio-Psychological Characteristics on Digital Literacy of Older Persons

Attitudes toward digital literacy are often perceived as a determining factor causing the elderly to use digital devices (Wagner et al., 2010). Saunders (2004) found that elderlies were less likely to use the Internet when they expressed anxiety or unfamiliarity with Information and Communication Technology (ICT). Moreover, past studies on digital literacy have argued that one of the primary elements explaining the elderly's demeanor to use of the Internet is their attitude toward its usage in their daily lives (Heart & Kalderon, 2013; Tsai et al., 2015).

The TAM identifies two key factors that influence an individual's inclination to adopt new technology. The first is perceived usefulness which is measured by the degree to which a person thinks employing a certain system will improve his or her performance at work. The second is perceived ease of use; the degree to which a person thinks utilizing a certain technology will be simple and effortless (Davis et al., 1989). Therefore, based on the above literature, the following hypothesis is proposed:

H2: Socio-psychological characteristics have positive significant correlation with digital literacy of older persons.

The Role of Digital Literacy on the Life Satisfaction of Older Persons

One of the key goals of digital literacy is to ensure the well-being of the elderly population and that they are satisfied with their life. Digital literacy could play a significant role in several of these areas, especially in the modern age. Elderlies capable of using digital devices can stay in touch with their friends and families through various means of digital communication applications. Hence, it is imperative to identify the impact of digital literacy on the life satisfaction of elderly individuals.

In terms of the effect of digital literacy on elderly individuals and their self-perceived life satisfaction, past studies have shown a positive link in countries such as Korea (Bae, 2022), Thailand (Ractham et al., 2022), Italy (Sala et al., 2023) and overall Europe (Gaia et al., 2021). These studies identified several reasons supporting the relationship. First, Karavidas et al. (2005) identified that elderly individuals with computer skills tend to be satisfied with their lives due to increased self-efficacy and reduced computer anxiety. Second, digital literacy is a tool to create new social connections and sustain existing ones, which may have a positive impact on elderlies' quality of life. Likewise, Gaia et al. (2021), from their empirical study, argued that there is a positive relationship between the use of social networking sites and life satisfaction among elderlies. Hence in line with the above arguments, the following hypothesis is proposed:

H3: Digital Literacy of elderly individuals has a positive impact on their self-perceived life satisfaction.

The Role of Mediating Variables in the Relationship between Digital Literacy of Older Persons and Life Satisfaction

Digital Health Literacy

There is a growing correlation between health literacy and digital usage. The usage of digital technology by elderly individuals is significantly underrepresented, and they are seen as a vulnerable demographic (Lee et al., 2021). In the words of Kemp et al. (2021), digital health literacy is defined as "the abilities and resources required for individuals to use and benefit from digital health resources".

It was found that there is a negative correlation between digital technology and depression symptoms. Lee et al. (2021), from their empirical study, found that elderly individual with proper digital literacy would engage themselves in distant relationships which further improved their psychological health, even during the pandemic. Hence, based on the above arguments following hypotheses are proposed:

H4a: Digital literacy of older persons has a positive impact on their health.
H4b: Better health leads to higher life satisfaction in older persons.

Digital Financial Literacy

As Vietnam is undergoing a transformative digital shift, most of the services, related to monetary exchanges, will be conducted digitally. This could be a bigger challenge for the state if the majority of the elderly population are digitally illiterate. As majority of elderlies are deprived of proper access to a digital domain that allows transactions to be conducted digitally such as money transfers and applying for government social benefits; for many, lengthy travel and long queues are the only options (Delivala, 2022).

The elderly should not only be aware of digital financial services (DFS) but also be able to weigh the advantages and disadvantages of the many DFS that are widely available. (Morgan et al., 2019). Thus, the following hypotheses are proposed:

H5a: Digital literacy of older persons has a positive impact on their finances.
H5b: Better finances lead to higher life satisfaction in older persons.

Social Connectedness

A yearlong lockdown during the pandemic has provided substantial evidence concerning the lack of digital adaptability by elderlies. Past studies have identified that loneliness or social isolation are contributing factors to depression, high blood pressure, sleep disorders, and decline in cognitive function (Courtin & Knapp, 2017). Moreover, such challenges have forced elderly folks to advance intermediate level of digital literacy, and use it as a means to battle social isolation and loneliness during the pandemic (Martínez-Alcalá et al., 2021). The various communication platforms provided by ICT have been substantially helpful in socially connecting elderlies to their loved ones and their work colleagues during lockdowns (Anderson & Perrin, 2017; Baym, 2015). Thus, the following hypotheses are proposed:

H6a: Digital literacy of older persons has a positive impact on their connection.

H6b: Better social connection leads to higher life satisfaction for elderly individuals.

Cognitive Flexibility

Cognitive flexibility is an ability that facilitates multitasking, complicated task performance, and contextual adaptation (Martin & Anderson, 1998). According to Sagar (2021), cognitive flexibility is assessed by looking at an individual's propensity to develop possibilities by making suggestions, to perceive a broad range of options, and to see circumstances that are considered challenging as manageable. While some depend more on logical principles and address every issue impartially and thoroughly, others handle events and circumstances more instinctively and less rationally (Epstein, 2008).

Flexibility is a crucial element of communication ability (Martin & Rubin, 1994). As people go through social cognition processes that make them aware of options and alternatives before deciding to change their behavior (Roloff & Berger, 1982), this study argues that elderly individuals are more likely to improve their cognitive flexibility as they attain digital literacy. Thus, the following hypotheses are proposed:

H7a: Digital literacy of elderly individuals has a positive impact on their cognitive flexibility.

H7b: Better cognitive flexibility leads to higher life satisfaction in elderly individuals.

Methodology

This study was carried out with a cross-sectional design in which the data was collected at one point in time. The researcher applied a quantitative approach to explore the effect of both social demographical and social psychological factors on digital literacy, and the effect of digital literacy on life satisfaction through the mediating roles of various facets of literacies, and social connectedness in Hanoi, Vietnam. For testing the research model, hypotheses from H2 to H7 were tested empirically using analysis of covariance or casual modeling software known as AMOS. This statistical software is specially used for SEM, path analysis, and confirmatory factor analysis. For testing hypothesis H1a, a T-test was applied, as it is most commonly used for comparing mean scores of two different groups. Hypothesis 1b to Hypothesis 1d were tested using ANOVA.

Measurement

This study used a questionnaire as the primary instrument of data collection, derived from literature reviews and past studies. The questionnaires were sent directly to elderly individuals in retired homes as well as government offices. Each theoretical construct was made up of three or more up to 78 items using a six-point Likert scale, with endpoints of "strongly disagree" and "strongly agree" to measure the items.

Under the construct of socio-demographic characteristics, respondents are categorized according to their a) gender, b) education level, c) income, and d) employment (General Statistics Office, 2020). These variables were coded for measurement purposes. Hence, Gender was coded 1 for male and 2 for female. Education level was coded as 1 for "no technical qualifications"; 2 for "primary"; 3 for "secondary"; 4 for "college"; and 5 for "university and higher". Income level was coded as 1 for "no income"; 2 for "pension"; 3 for "salaries"; and 4 for "other". Employment status was coded as 1 for "public sector"; 2 for "private sector"; 3 for "self-employed"; 4 for "no work"; and 5 for "others".

Socio-psychological characteristics refer to the extent to which the respondents are motivated to attain digital literacy through their digital devices (Perdigoto & Picoto, 2012). This construct was measured using three aspects: a) perceived usefulness b) perceived ease of use, and c) motivation. These three dimensions were measured by using items developed by Perdigoto and Picoto (2012).

According to the literature review, there are two major devices that matter the most in determining the digital literacy of an individual: A smartphone and a computer. Each device has seven sub-heads. A total of 78 items under 14 sub-heads were adopted from the Mobile Device Proficiency Questionnaire (MDPQ) and Computer Proficiency Questionnaire (CPQ) (Roque & Boot, 2018). The sub-head "mobile device basic" was operationalized through a nine-item scale that measured respondents' ability to operate cell phones. "Mobile for communication" was measured using a nine-item scale that measured respondents' ability to use mobile for communication through its various modes. Data and file storage were operationalized through a three-item scale that measured respondents' ability to save files on mobile devices. Mobile for Internet constituted an eight-item scale to measure the elderly individual's ability to use the Internet on their mobile devices. Mobile for entertainment was measured using a five-item scale that measured respondents' ability to use mobile for watching videos, and other entertainment purposes. Mobile for calendar constituted a three-item scale that measured elderly individuals' ability to use mark calendar on their mobile phones. Mobile for troubleshooting was operationalized using a five-item scale that measured respondents' ability to fix their mobile or update operating software whenever required. Likewise, computer basic was operationalized using a five-item scale which determined respondents' basic computer knowledge such as turning a computer on and off, knowledge about using a keyboard, and adjusting computer volume and font size. The variable "use of printer" constituted a five-item scale that measured the ability of respondents' awareness of printer functions. Computer for communication was operationalized using a nine-item scale which determined the ability of respondents to write emails, open emails, send emails, chat in Messenger, view attached files etc. Computer for internet constituted a seven-item scale which measured respondents' ability to make proper use of internet facilities. The computer for the calendar was operationalized using a three-item scale that measured the ability of respondents to mark their calendars on a computer. Computer for entertainment was measured using a three-item scale that determined the ability of respondents' ability to use computers for watching movies and short videos on YouTube, listening to music, and playing games.

The mediating variables between digital literacy and life satisfaction are reflected by digital health literacy, digital financial literacy, social connectedness, and cognitive flexibility. Digital health literacy, for the purpose of this study, is defined as the extent to which the respondents with their digital skills are capable of scouring different sites that are related to their health. It also assumes that elderly individuals are able to use their devices to communicate with their doctors, health consultants, friends,

and families for various health information. The eight-item measurement was derived from Norman and Skinner (2006); Mitsutake et al. (2011); Luo et al. (2018); Shiferaw et al. (2020).

Digital financial literacy, for this study, is defined as the extent to which individuals are capable of seeking various information relating to financial management. Digital financial literacy was operationalized using a ten-item scale measuring the extent to which elderly individuals are capable of using their digital devices to scour various information related to savings, investments, remittance, opening bank accounts, and other related information (Lyons & Kass‑Hanna, 2021). This study also argues that once elderly individuals have reached a certain level of digital literacy, they are most likely to improve their cognitive flexibility. Hence, cognitive flexibility is defined as an ability that facilitates multitasking, complicated task performance, and contextual adaptation (Martin & Anderson, 1998). The twelve-item measurement was derived from the study of Martin and Rubin (1995). Social connectedness refers to the extent to which elderly individuals with their digital devices can connect to their loved ones. The four-item measurement was adopted from the study of Barbosa Neves et al. (2019). Finally, self-perceived life satisfaction was measured by a six-item scale derived from the study of Taskin and Ok (2022). For purposes of this study, it is defined as the extent to which elderly individuals are content with their personal relationships, work, health condition, consumption activities, leisure time, and life achievement.

Population and Samples of the Study

The target population for this study is elderly individuals (aged 60 years old and above) in Hanoi, Vietnam. According to the General Statistics Office of Vietnam (2019), the total population of elderly in Hanoi from age 60 to 85 and above is 1.014 million (12 percent) out of which 511,939 (50.5 percent) reside in urban districts and 502,297 (49 percent) reside in rural districts. In urban areas, the elderly male population constitutes 45.5 percent, whereas the elderly female population constitutes 54.5 percent of total population. Likewise, in rural districts, the elderly male population constitutes 41 percent as compared to 59 percent of the elderly female population. Hence, the sample population, according to Yamane (1967), at a confidence level of 95 percent, with an allowable error of 0.05, is 400.

This study used a multi-stage stratified sampling method by sub-dividing the urban and rural districts. The sample included 50.0 percent elderly from urban districts and 49.5 percent of the elderly from rural districts. From urban, the survey was conducted in two districts: Hoan Kiem and Long Bien.

The sample included 45.5 percent male and 54.5 percent female. Likewise, in rural, the survey was conducted in two districts: Ba Vi and Soc Son. The sample included 41 percent of males and 59 percent of females. The survey was also conducted in Son Tay, a district-level town. The sample population included 45.5 percent male and 54.5 percent female in Son Tay urban, and 41 percent male and 59 percent female in Son Tay rural.

Data Analysis Procedure

T-test for Hypothesis 1a

Hypothesis 1a postulated that males have higher digital literacy than females do. T-test was applied to examine whether males and females, derived from the same population, differ significantly in terms of their digital literacy. Table 1 provides the group statistics, table 2 provides an independent sample test, and table 3 provides the mean difference.

Table 1. T-test Group Statistic.

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Total digital literacy of older person	Male	173	269.1445	92.43204	7.02748
	Female	227	255.5551	82.79439	5.49526

Table 2. Independent Sample Testing.

		Levene's Test for Equality of Variances				
		F	Sig.	t	df	Sig. (2-tailed)
Total digital literacy of older person	Equal variances assumed	6.198	.013	1.546	398	.123
	Equal variances not assumed			1.523	347.712	.129

Table 3. The Mean Difference at 95 Percent Confidence.

Mean Difference	Std. Error Difference	95 percent Confidence Interval of the Difference (CI)	
		Lower	Upper
13.58944	8.78950	-3.69021	30.86909
13.58944	8.92095	-3.95636	31.13525

The result from the T-test showed no significant difference in scores for males (M = 269, SD = 92.4) and females (M = 256, SD 82.79; t (347) = 1.52, p = .129, two-tailed). The magnitude of the difference in the means (mean difference = 13.58 CI: -3.69 to -3.95) was very small (eta squared = 0.00577152). Based on the above results, it is concluded that hypothesis 1a is rejected.

ANOVA for Hypothesis 1b to Hypothesis 1d

Hypothesis 1b postulated that education level is positively associated with digital literacy. Table 4 shows an ANOVA analysis of education level.

Table 4. ANOVA Between Groups in Terms of Education Level.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1314357.269	4	328589.317	75.352	.000
Within Groups	1722496.909	395	4360.752		
Total	3036854.178	399			

There was a statistically significant difference at the p < .05 level in digital literacy scores for the five groups f (4,395) = 75.35, p = .000. Amid reaching statistical significance, the actual difference in mean score between groups was quite large. The effect size, calculated using eta squared, was .43, which was significantly large as compared to the recommended range (Pallant, 2020), thus confirming hypothesis 1b.

Hypothesis 1c assumes that older persons with (salaries or pensions) are more likely to be digitally literate than elderly individuals who are retired or dependent on their families. Table 5 provides an ANOVA analysis of income level.

Table 5. ANOVA Between Groups in Terms of Income Level.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	520357.583	3	173452.528	27.295	.000
Within Groups	2516496.594	396	6354.789		
Total	3036854.177	399			

There was a statistically significant difference at the p < .05 level in digital literacy scores for the four groups f (3, 396) = 27.29, p = .000. Amid reaching statistical significance, the actual difference in mean score between group was quite large as compared to recommended range, thus confirming hypothesis 1c.

Hypothesis 1d postulated that people residing in urban districts are more likely to have higher access to digital technology than those residing in rural districts. Table 6 shows an ANOVA analysis of residence level.

Table 6: ANOVA Between Groups in Terms of Residence Level.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	639975.602	2	319987.801	53.000	.000
Within Groups	2396878.576	397	6037.478		
Total	3036854.178	399			

There was a statistically significant difference at the p < .05 level in digital literacy scores for the four groups f (2, 397) = 53.00 p = .000. Amid reaching statistically significant, the actual difference in mean score between groups was significantly large. The effect size, calculated using eta squared, was .21, which is large as compared to the recommended range, thus confirming hypothesis 1d.

Structural Equation Modeling

The first step in structural equation modeling is to examine the overall model fit regarding one or more goodness-of-fit measures. The model fit was assessed using six indices of fit as shown in Figure 2 and summarized in the table accordingly.
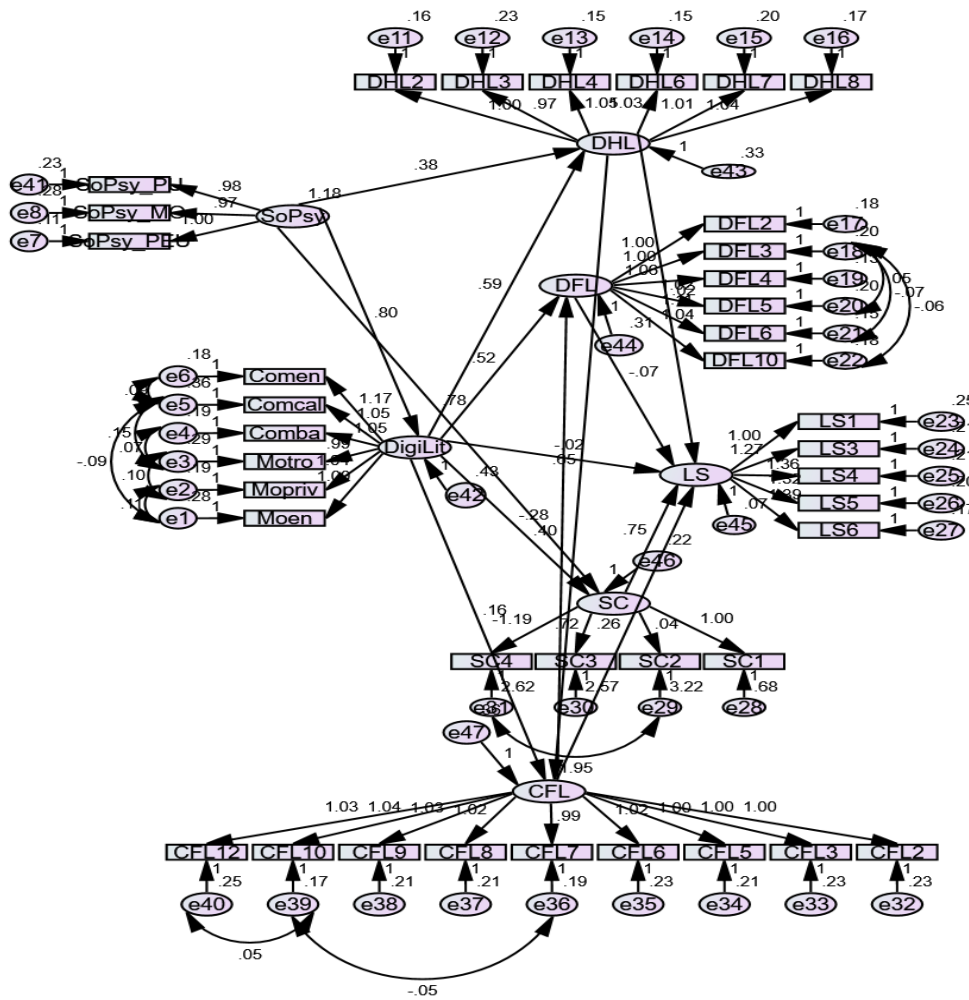
Figure 2. The Overall Results of the Analytical Model.

Notes : * $p < 0.05$; x^2 = 2112.591, df = 676, p = .000, CMIN/DF = 3.125

GFI = 0.787, RMSEA = 0.073

Table 7. Statistical Result of Full Latent Variable Model.

Indices	Criteria	Statistical result
Chi-square	P ≥ 0.05	.000
CMIN/DF	≤ 3 good; ≤ 5 acceptable	3.125
RMR	< 0.05 well fitted;	.048
GFI	≥ 0.90 well fitted; close to 0.9 average fit	.787
CFI	≥ 0.90 well fitted; close to 0.9 average fit	.939
RMSEA	< 0.08 average fit; < 0.05 good fit	.073

The first set of indices is CMIN (minimum discrepancy), also known as x^2 represents the likelihood Ratio Test. Higher the x^2 value the more likely the possibility of model fit. The model achieved the x^2 value less than 0.05 i.e., p = .000, this implies that the hypothesized model is inadequate (Byrne, 2013). However, the x^2 value tends to inflate when the sample size too large (Jöreskog & Sörbom, 1993). The second goodness-of-fit that addresses the inadequacy of x^2, which also takes a more pragmatic approach is x^2/DF (Byrne, 2013). If the model is to deliver a satisfactory representation of data, x^2/DF value must be at p ≤ 5. The model achieved a p-value of 3.125. The third is RMR, which stands for root mean residual and is the measure of the variance and covariance that are unexplained in the model. The value should be less than .05 for a good model fit (Hu & Bentler, 1999). The model achieved the value at p = 0.048 indicating a good fit.

The next fit indices is GFI which measures the relative amount of variance and covariance in sample covariance that is jointly explained by the population covariance matrix (Byrne, 2013). A value close to 10 indicates a good fit. In this model, the GFI was .787 indicating a mediocre fit. The fifth fit index is CFI which stands for comparative fit index. A value close to 0.9 indicates a good fit (Hu & Bentler, 1999). The model achieved a p-value of .939 indicating that the hypothesized substantially explained the sample population. Finally, RMSEA stands for root mean square error of approximation and is an estimate of the discrepancy between the observed and estimated covariance matrices in the population. RMSEA value ranging from .08 to 1.00 indicates mediocre fit, a value above .10 indicates poor fit and a value less than .08 represents good fit (MacCallum et al., 1996). The model achieved an RMSEA value of .073 indicating a good fit. Thus, it can be concluded that the overall model fit of the study is consistent with the empirical data as presented in Figure 2 and Table 7.

Referring to the findings, the model tested in this study has verified the importance of socio-demographical and socio-psychological characteristics on digital literacy and the effect of digital literacy on four mediating variables and life satisfaction. Out of ten hypotheses, six were confirmed, and the total direct and indirect effect with their significant correlations is summarized in the table below.

Table 8: The Path Coefficient among Variables in Terms of Total Direct and Indirect Effect

	Effects	SPC**	DL	DHL	CFL	SC	DFL	LS
Digital Literacy (DL)	DE	.800*	-	-	-	-	-	-
	IE	-	-	-	-	-	-	-
	TE	.800	-	-	-	-	-	-
Digital Health Literacy (DHL)	DE	.379	.589*	-	-	-	-	-
	IE	.471	-	-	-	-	-	-
	TE	.850	.589	-	-	-	-	-
Cognitive Flexibility (CFL)	DE	-	.156*	.650	-	-	-	-
	IE	.677	.383	-	-	-	-	-
	TE	.677	.539	.650	-	-	-	-
Social Connectedness (SC)	DE	.781	-.278	-	-	-	-	-
	IE	-.222	-	-	-	-	-	-
	TE	.558	-.278	-	-	-	-	-
Digital Financial Literacy (DFL)	DE	-	.524*	-	.404	-	-	-
	IE	.692	.218	.262	-	-	-	-
	TE	.692	.742	.262	.404	-	-	-
Life Satisfaction (LS)	DE	-	-.017	.016	.257*	.755*	-.072	-
	IE	.547	-.115	.149	-.029	-	-	-
	TE	.547	-.131	.165	.229	.755	-.072	-

**SPC is an acronym for Social Psychological characteristics

Note: Significant at * $p < 0.05$

The structural model and hypothesis testing were performed. Six out of ten hypotheses were confirmed. Overall, in the proposed model, the construct of digital literacy had a considerable effect on all mediating variables. However, two mediating variables "Cognitive flexibility" and "Social connectedness" had a positive effect on the variable "Life satisfaction." Thus, it can be concluded that

H2, H4a, H5a, H6b, H7a, and H7b were found statistically significant at the 0.05 level in their direct causal relationship four of them, consisting of H3, H4b, H5b, and H6a were rejected. Hypothesis 2 which postulated the direct effect of social psychological factors on digital literacy was found statistically significant H2 (β= -.800; ρ= < .05). Thus, confirming H2.

The standard coefficient for the relationship presented by H4a (β= .589; ρ= < .05), confirmed H4a which postulated a direct positive effect of digital literacy on digital health literacy. Likewise, for H5a the standard coefficient for the relationship between digital literacy and finance was statistically supported (β= .524; ρ= < .05). The path leading from social connectedness to life satisfaction (β= .755; ρ= < .05) was found statistically significant. Thus, confirming H6b. H7a and H7b which postulated the positive direct effect of digital literacy on cognitive flexibility and the positive effect of cognitive flexibility on life satisfaction respectively were found statistically significant H7a (β= .156; ρ= < .05), and H7b (β= .257; ρ= < .05). Thus, confirming H7a and H7b.

Contrary to the expectation, the path leading from digital literacy to social connection was found negative but statistically significant (β= -.278; ρ= < .05), thus rejecting H6a. Likewise, H5b postulated a positive direct effect of digital financial literacy on life satisfaction. However, the result indicated a negative effect (β= -.072; ρ= > .05), thus rejecting H5b. Hypothesis 4b assumes that better digital health literacy has direct effect on self-perceived life satisfaction. However, the standard coefficient for the relationship presented by H4b (β= .016; ρ= > .05) rejected H4b. Lastly, H3 which postulated a direct relationship between digital literacy and life satisfaction, in contrary the path leading from digital literacy to life satisfaction was found negative (β= -.017; ρ= > .05) and statistically insignificant, thus rejecting H3.

Discussion and Conclusion

From the empirical evidence, this study demonstrated the current level of digital literacy of elderly individuals and the factors associated with the digital literacy of elderly individuals in Hanoi, Vietnam, which addresses the first and second objectives of this study. The study also assessed the relationship between the level of digital literacy of elderly individuals and their self-perceived life satisfaction, this addresses the third objective of the study. Finally, it examined the role of mediating

variables in the relationship between digital literacy and life satisfaction, addressing the fourth objective of the study.

Hypothesis 3 postulated that elderly people with high digital literacy can have a higher level of self-perceived life satisfaction, our third objective of this study. However, in contrary to our prediction, the path leading from the variable digital literacy to life satisfaction was found negative. There could be two possible reasons for the undesired result. First, digital literacy alone cannot determine the self-perceived life satisfaction. There could be other factors that can have a positive effect on life. Second, there is less possibility that digital literacy will have a direct impact on life satisfaction. The presence of mediating variables such as digital health literacy, digital financial literacy, cognitive flexibility, and social connectedness can have a significant effect on life satisfaction.

In this study, two mediating variables, "digital health literacy" and "digital financial literacy" were assumed to have a direct effect on life satisfaction, our fourth objective. However, contrary to our expectation, the relationship between the two relationships was not statistically supported, thus rejecting hypothesis 4b and hypothesis 5b. It can be concluded that digital literacy on finance and health alone cannot encourage elderly individual to perceive their life in a positive manner. Indeed, such literacy can also have a negative effect, as individuals learn more, they are more likely to be unsatisfied or even troubled by the gamut of information that they are exposed to. For example, from ICT an individual can have access to a multitude of information about a single topic. Imagining the least educated individuals learning about sophisticated financial opportunities, such information can disparage them. Likewise, too much literacy in health can also trouble the elderly as they learn the disadvantages of the lifestyle they have been living so far.

Apart from the undesired result that rejected H3, H4b, H5b, and H6a, this study confirmed that social psychological characteristics have a positive impact on digital literacy and that digital literacy has a positive impact on health, finance and cognitive flexibility Also, two mediating variables, "cognitive flexibility" and "social connectedness" had positive impact on self-perceived life satisfaction. It is important to note that it requires motivation to learn about the digital world. Hence, from this study, it is confirmed that elderly individuals, in Hanoi, are indeed motivated and perceive digital devices as useful tools to learn about the digital world. As ICT provides an influx of information about any topic, digitally literate elderly can have access to all the information they see as necessary. Hence, there was

a positive relationship between digital literacy and digital financial literacy, digital literacy and digital health literacy. With proper digital knowledge, the elderly in Vietnam have become more aware of various social networking apps such as Facebook, WhatsApp, and Viber. They can connect to their friends and loved ones even without physically visiting them, such connectedness has indeed had a positive impact on their self-perceived life satisfaction. Elderly individuals who were socially connected responded that they were quite complacent with their lives. Finally, digital literacy has a positive impact on cognitive flexibility, as the elderly become more adept in terms of available ICT, they are aware of the environment and can discern the influx of information that digitally surrounds them.

Hence, it is concluded that digital literacy plays a significant role in developing the lives of people especially the elderly. As the world is entering an aging population, Vietnam is no exception. With digital literacy, a nation can build a better society by improving the skills and knowledge of elderly individuals who still constitute the majority of the workforce.

Limitations of the Study

For statistical analysis, this study relied on a quantitative research design with cross-sectional data to test the relationship among variables. As put forth by Rokeach (1973) and Bordens and Abbot (2007), the beliefs, attitudes, and demeanor of individuals are more general and only stable for collecting the data in a short period but the same is not qualified to establish a cause-and-effect relationship amongst the variable. Furthermore, the generalizability of the study is limited as the data was collected from Hanoi city only, hence other cities of Vietnam may show different results in terms of digital literacy.

Suggestion for Further Study

It is recommended that future studies should explore the extent to which the effect of digital literacy changes in various organizational settings. Future studies, in terms of empirical evidence, should be inclusive to other major cities in Vietnam as well. Secondly, digital literacy is a universal topic, hence the efficacy of digital literacy should not be limited to other aspects of literacy only but also to job performance and job fit. The construct can be linked to job fit in public sector motivation. Moreover, the study tried to establish the argument that older persons who are males had higher digital literacy than older persons who are women, but this hypothesis was rejected. However, future studies can explore such differences in different organizational settings as digital literacy among older persons who

are males in some organizations could be higher than older persons who are females. There is a possibility that due to glass ceiling in many organizations could deprive women of digital training as compared to their male counterparts.

In terms of practical implication, this study is suggestive to managerial implication. Managers and department heads in public organizations can benefit from this study, as this study covers the broad spectrum of digital literacy and its effect on other factors. Managers can identify the need for particular digital literacy that can benefit the elderly staff in their department.

From the perspective of policy recommendation, this study implies the importance of digital literacy among the elderly generation. In an assumption of a growing aging population, it becomes imperative for policymakers to focus more on enhancing all the aspects of literacy among the elderly generation. The importance should be given to digital literacy as it has become one of the significant knowledges that one can apply to circumvent various challenges and problems in daily life. Hence, it is recommended for policymakers to draft policies that are more favorable to the elderly generation in terms of digital literacy.

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