

The pursuit of online misinformation literacy: Understanding age-varying competence for misinformation recognition

Junyeong Lee^a, Jung Lee^{b,*}, Jinyoung Min^{c,*}

^a Department of Management Information System, Chungbuk National University, Chungdae-ro 1, Seowon-gu, Cheongju, Chungbuk 28644, South Korea

^b Division of Global Business & Technology, Hankuk University of Foreign Studies, 81 Oedae-ro, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17035, South Korea

^c Department of Industrial Security, Chung-Ang University, 84 Heukseok-Ro, Dongjak-Gu, Seoul 06974, South Korea

ARTICLE INFO

Keywords:

Misinformation literacy
Misinformation recognition
Age-varying competence
Smart device usage capability
Critical attitudes towards media

ABSTRACT

Addressing online misinformation has become increasingly critical due to the widespread use of the Internet and social media. However, studies show conflicting results regarding competencies in recognizing misinformation across different age groups; thus, initiatives for misinformation literacy have not been as effective as anticipated. To reconcile this conflict and provide a strategy for supporting misinformation literacy, this study aims to explore how perceived competence in recognizing misinformation—comprising confidence and endeavor—varies among age groups and what factors influence this competence. Using data from a media panel survey in South Korea involving 9,060 participants, we found that younger adults exhibit higher confidence and endeavors in recognizing misinformation compared to older adults. Additionally, factors such as smart device usage capability and critical attitudes toward media content significantly influence misinformation recognition across all age groups, with varying impacts. Notably, social media use has contrasting effects as it decreases younger adults' confidence and endeavors in misinformation recognition but enhances older adults' confidence. Our findings provide key insights into the age-specific challenges and factors shaping misinformation literacy, emphasizing the importance of tailored educational programs that consider the diverse needs and behaviors of various age groups. These insights can help enhance the effectiveness of misinformation literacy initiatives in the digital age.

1. Introduction

With the permeation of the Internet into daily life, vast amounts of information are openly shared online (Ratchford et al., 2001). The advent of social media has further facilitated information access due to its enabling of rapid information dissemination (Bode and Vraga, 2015; Fernández-Luque and Bau, 2015). However, the Internet and social media have also exacerbated the spread of misinformation, making users more susceptible to false content (Bode and Vraga, 2015; Choudrie et al., 2021; Fernández-Luque and Bau, 2015). For example, social media has become a primary channel for disseminating inaccurate information about vaccines, escalating anti-vaccine sentiments (Rutschman, 2019). While people rely heavily on information from social media, it often blends truth and falsehoods (WHO, 2020) and its sources are often unverified (Shrestha and Spezzano, 2019). Therefore, users may struggle to

* Corresponding authors.

E-mail addresses: junyeong.lee@cbnu.ac.kr (J. Lee), jung.lee@hufs.ac.kr (J. Lee), jymin@cau.ac.kr (J. Min).

<https://doi.org/10.1016/j.tele.2024.102228>

Received 1 September 2024; Received in revised form 18 November 2024; Accepted 17 December 2024

Available online 19 December 2024

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differentiate between accurate and false information (Kumar et al., 2016; Ott et al., 2011) and engage more with misinformation than the truth (Shearer and Gottfried, 2017). Misinformation refers to information initially perceived as accurate but eventually proven false (Lewandowsky et al., 2013). Exposure to misinformation negatively affects readers' memories, knowledge, and beliefs (Greenspan and Loftus, 2021). The social consequences of consuming misinformation include worsening ideological polarization (Au et al., 2022), eroding public trust in science and official institutions (Irving et al., 2022), questioning democratic processes (Shin and Thorson, 2017; Silverman, 2015), and damaging social stability (Allcott and Gentzkow, 2017). Given the crucial role of well-informed citizens in upholding a healthy democracy (Seo et al., 2021), educational institutions and civic organizations are bolstering digital and information literacy alongside online information providers and social media platforms (Moore and Hancock, 2022). These efforts focus on empowering individuals to effectively assess the credibility of online information, such as using fact-checking sites (Anderson and Rainie, 2017; Connaway et al., 2017; Tharoor, 2018), strengthening their ability to navigate the digital landscape and make informed decisions based on reliable sources.

Previous studies have suggested that these efforts should be considered based on age as information literacy differs across age groups (e.g., Gurgun et al., 2024; Moore and Hancock, 2022). However, how to facilitate misinformation literacy within certain age groups is still vague as related studies have shown conflicting results. For example, some studies suggest that older adults are often less proficient in internet navigation (Ofcom, 2021), less skilled in evaluating the veracity of online news (Gottfried and Grieco, 2018), and are significantly more prone to disseminating fake news compared to younger adults (Guess et al., 2019). Consequently, they frequently fall victim to online misinformation, especially in health-related areas (Guess et al., 2019; Seo et al., 2021). Conversely, other studies have shown that due to older adults' accumulated general knowledge, they are more skilled at discerning fake political news and false statements (Brashier et al., 2017; Pennycook and Rand, 2019), while such skills are not observed in younger adults (Fazio et al., 2015). These conflicting results suggest the need to examine differences in information literacy across age groups and investigate the factors influencing this literacy and how these factors affect each age group differently. Without a clear understanding of these differences, efforts to improve information literacy will be less effective.

Therefore, this study takes an explorative perspective to reconcile the conflicting results of previous studies by learning how different age groups regard their information literacy and what factors influence it. Unlike the existing literature that focuses on the actual recognition of misinformation, we study how individuals perceive their abilities and efforts in recognizing misinformation. Namely, we refer to this as perceived competence for misinformation recognition, consisting of individuals' perceptions of their confidence in recognizing misinformation and their endeavors towards it. 'Confidence' and 'endeavor' were chosen as key components as they represent the essential cognitive and behavioral dimensions required for misinformation recognition competence (Moore and Hancock, 2022). In the context of this study, confidence refers to an individual's belief in their ability to distinguish between true and false information, which can influence whether they actively engage with content veracity. Meanwhile, individuals' endeavors capture the behavioral efforts they invest in verifying information accuracy, reflecting their proactive engagement in combating misinformation (Moore and Hancock, 2022). Together, these elements provide a holistic view of the internal perceptions and external actions shaping effective misinformation literacy (Flanagin and Metzger, 2007). Furthermore, while actual misinformation recognition varies depending on the situation, such as the topic addressed and the characteristics of information channels (Bode and Vraga, 2015; Scott et al., 2017; Gurgun et al., 2024) individuals' confidence in and efforts toward recognizing misinformation are the basic steps for achieving misinformation literacy (Moore and Hancock, 2022). Therefore, we attempt to answer the following research questions:

RQ1: How do confidence and endeavors toward recognizing misinformation differ across age groups?

RQ2: What factors influence individuals' confidence and endeavors toward recognizing misinformation differently across age groups?

To answer these questions, we employed the Media Panel Survey, a government-led survey from South Korea targeting 9,060 individuals. Analyzing this large dataset allows insights into the controversial findings of previous studies, enabling us to better understand individuals' perceived competence in recognizing online misinformation. We chose South Korea as our research context due to its high Internet and smart device penetration, increasing the likelihood of information being delivered through digital media and online platforms (Korea Press Foundation, 2021). As society continues to transform digitally, this context allows us to prominently show how perceived competence in recognizing misinformation differs and is affected by technology and media use behaviors across age groups.

Our findings provide important implications for the literature on misinformation literacy and its practice. First, this study considers confidence and endeavor toward recognizing misinformation and shows how these vary across age groups. Second, it highlights the role of individual-level factors, particularly related to technology and media usage, in influencing confidence and endeavor by age group. Furthermore, we emphasize the importance of technology and media use behaviors along with a critical attitude toward media content in impacting confidence and endeavor. Practically, this study helps develop education programs to enhance misinformation literacy.

2. Theoretical development

2.1. Competence in online misinformation Recognition: Confidence and endeavor

The concept of 'literacy' in the Cambridge Dictionary refers to "knowledge of a particular subject, or a particular type of knowledge." Various types of digital media literacy exist, such as news literacy (Bago et al., 2020; Khan and Idris, 2019; Pennycook and Rand, 2019), information literacy (Khan and Idris, 2019), digital literacy (Brashier and Schacter, 2020), media literacy (Livingstone et al., 2019; Vraga et al., 2015) and internet literacy (Ye et al., 2018). In this study, we particularly examine misinformation literacy, which

encompasses evaluating and verifying content and identifying misinformation to combat it online.

Lăzăroiu et al. (2021) view ‘misinformation literacy’ as the ability to recognize, understand, and counter false or misleading information. They focused on misinformation regarding COVID-19 vaccines, emphasizing the necessity of critical attitudes for evaluating sources and resisting misinformation’s impact on behavior. Cunliffe-Jones et al. (2021) conceptualize it as a specialized branch of media literacy focused on equipping individuals with skills for assessing information credibility. Anthonysamy and Sivakumar (2022) situate misinformation literacy within digital literacy, highlighting the importance of recognizing and mitigating misinformation on social media, especially for young adults. Building on these perspectives, this study defines misinformation literacy as the capacity to identify, evaluate, and resist false information in online media by applying psychological and behavioral skills. This dual focus makes it particularly relevant for media studies, addressing individuals’ perceptions and attitudes as well as the actions they take in response to misinformation, offering a more comprehensive framework for analyzing media engagement.

We propose two key factors for understanding misinformation literacy—confidence in distinguishing information credibility online and endeavors to verify it—as they are the basic building blocks of this literacy type (Moore and Hancock, 2022).

Confidence in distinguishing credible information reflects an individual’s subjective ability to differentiate between true and false information. This confidence, developed through constant engagement with contradictory data (Burke, 2010), is essential for curbing the spread of misinformation (Nyilasy, 2019) as it can predict how willing individuals are to try to distinguish fact from fiction (Vraga et al., 2015). Therefore, leveraging this confidence can be beneficial for recognizing and correcting false content (Soon and Goh, 2020). In this sense, confidence is often used as an indicator for identifying misinformation (Hinsley, 2021; Khan and Idris, 2019).

Endeavors to verify information veracity refer to the actions individuals take to determine the accuracy of information through additional research, described as the “likelihood of researching online to inform their judgments about information veracity” (Moore and Hancock, 2022). Although the terms differ, many researchers have found that efforts to verify information veracity are also key for recognizing misinformation. For example, Metzger (2007) discussed ‘critical evaluation skills,’ which involve using search engines to establish information credibility. Kuhlthau (1991) also argued the importance of information-seeking behavior, which aims to find meaning and expand knowledge on a topic and is used to measure information literacy (Khan and Idris, 2019). Coping behavior involves making special efforts to verify ambiguous information by seeking additional information across multiple sources (Chang, 2021; Khan and Idris, 2019; Xiao, 2024), which is crucial for recognizing and correcting misinformation. Other forms of recognizing misinformation include civic online reasoning, which suggests “the ability to effectively search for, evaluate, and verify social and political information online (McGrew et al., 2018), p.165), and lateral reading, which means “searching for external corroborating or contradictory information” (Wineburg and McGrew, 2019).

These two factors collectively emphasize that determining information veracity is vital in an environment where online information credibility is undermined by a lack of specialized gatekeepers to monitor content (Flanagan and Metzger, 2007).

2.2. Age-Varying competence in recognizing misinformation

Previous studies have presented controversial findings on the effect of age in identifying misinformation. For instance, most existing studies state that older adults generally lack the ability to differentiate between true and false information (Ruffman et al., 2012). They identify misinformation less frequently (Stanley and Blanchard-Fields, 2008) and are less successful in evaluating the veracity of online news (Gottfried and Grieco, 2018). However, this contradicts the stream of research presenting that older adults are better at distinguishing truth from misinformation. Cohen and Faulkner (1989) exposed older (aged 62 to 82) and younger (aged 25 to 45) participants to both accurate and misleading information and found that the older ones were more capable of recognizing misinformation. Notably, older adults may possess accumulated knowledge, preventing them from accepting repeated false statements as the truth (Brashier et al., 2017). This is not observed in younger adults (Fazio et al., 2015), who tend to engage in fewer political discussions and experience less conflict over politics (Anderson and Stephenson, 2018; Delli Carpini, 2000; Ekström, 2016). Similarly, older adults are likelier to challenge misinformation, including questioning its veracity (Gurgun et al., 2024). For example, Vijaykumar et al. (2021) show that older adults are less likely to believe in the medicinal properties of garlic for treating COVID-19.

Given that older adults tend to have accumulated more knowledge from a wider range of experiences over a longer period, why do they still struggle to distinguish misinformation? Prior studies have suggested that cognitive decline, a lack of digital literacy (Brashier and Schacter, 2020), activity in the anterior insula (Castle et al., 2012), and source-memory deficits (Brashier and Schacter, 2020; Rahhal et al., 2002) may affect older adults’ abilities and confidence in distinguishing misinformation.

Do younger adults who do not exhibit these deficits have higher confidence in their ability to identify misinformation? Indeed, Singapore’s information-savvy youth are confident in their ability to spot misinformation, perceiving themselves as less likely to be misled (Soon and Goh, 2020). The finding that younger people are more confident in recognizing misinformation has been replicated in other studies, including Hinsley (2021). However, younger adults’ high confidence does not always mean resistance to misinformation. A 2018 survey in Singapore also found that young people are likelier to be misled by misinformation due to optimism bias (Ipsos, 2018). This false sense of confidence in their informedness can increase their inability to distinguish misinformation (Ng and Neyazi, 2023). Moreover, younger adults’ intensive social media use is associated with their confidence in recognizing misinformation; however, this can inadvertently affect the effort they apply to determining information veracity. The confidence associated with information overload on social media can hinder their capacity to thoroughly process and critically assess content, potentially leading to a greater tendency to avoid engaging with the content’s veracity (Goyanes et al., 2023; Tandoc Jr. and Kim, 2023).

Additionally, younger adults often lack the critical literacy skills to understand the vast information on new media sources (Livingstone et al., 2019). There are suspicions that the younger generation’s heavy usage of social networks may lessen their skepticism towards information on these platforms (Ye et al., 2018), which is crucial for critical media consumption and combating

misinformation (Vraga and Tully, 2021). This suspicion is somewhat validated by research, which discovered that those who used social networking sites frequently were less adept at identifying the real intent of media messages (Yildiz Durak and Saritepeci, 2019). Although young adults are often considered less vulnerable to online misinformation due to their higher levels of digital literacy, when they fail to consciously contemplate what they see online, they are likelier to fall for misinformation (Bago et al., 2020; Khan and Idris, 2019; Pennycook and Rand, 2019).

As the literature presents mixed findings, efforts are needed to reconcile these contradictions. We address this by suggesting that misinformation-related confidence is lower in older adults, but misinformation-related efforts are lower in younger adults.

Confidence is crucial in recognizing misinformation, as it reflects individuals' beliefs in their ability to differentiate between true and false information (Nyilasy, 2019; Vraga et al., 2015). Considering the conflicting findings in the literature, we suggest that younger adults, who tend to have been exposed to digital media from an early age and thus have better digital literacy and familiarity with online environments (Soon and Goh, 2020), may show more confidence than older adults as their exposure tends to increase their self-assurance when evaluating online content including misinformation. In contrast, despite having broader life experience, older adults may struggle with the rapid evolution of digital platforms, leading to lower self-assessed confidence in discerning misinformation (Brashier and Schacter, 2020). Therefore, we propose the following hypothesis:

H1: Younger adults are more confident in distinguishing credible information than older adults.

Based on the contradictory findings of the existing literature, we suggest that while younger adults may be more confident, their effort in verifying information accuracy can be limited. This may result from their higher reliance on social media, where information is often consumed passively or accepted at face value (Goyanes et al., 2023; Tandoc Jr. and Kim, 2023). Furthermore, optimism bias, where individuals overestimate their ability to avoid misinformation, is also more prevalent among younger adults, potentially reducing their motivation to verify information (Ipsos, 2018). Conversely, older adults may compensate for their lower confidence by investing more effort in confirming information validity, particularly on topics related to health and politics (Vijaykumar et al., 2021). Thus, we propose the following hypothesis:

H2: Younger adults make fewer endeavors to determine information veracity than older adults.

2.3. Factors affecting Age-Varying competence for misinformation recognition

To answer our second research question on the factors influencing competence in recognizing misinformation across age groups, we identified individual-level factors such as gender, education, income, attitude, and technology and social media use. We adopted a comprehensive framework with those factors to identify the individual characteristics that drive the dissemination of online misinformation, as suggested by Morosoli et al. (2022).

First, we consider technology and digital media-related capability and usage factors to understand individuals' competence in recognizing misinformation in their digital environment. Given the ease with which misinformation spreads via technology and social media, it is essential to consider users' digital behaviors when assessing their likelihood of recognizing inaccurate or deceptive content (Buchanan, 2020). Accordingly, some interventions aimed at combating misinformation susceptibility have focused on enhancing digital capabilities and related skills (Guess et al., 2019; Khan and Idris, 2019). This perspective, often referred to as the deficit hypothesis, suggests that the reason for believing misinformation is a lack of digital capability in distinguishing between true and false information (Scherer and Pennycook, 2020). Therefore, we consider factors related to technology and media usage for recognizing misinformation, such as smart device usage capabilities, digital media usage levels, social network services (SNS) use, and news consumption channels. News consumption is a traditional information source that is increasingly consumed online rather than in paper form. There are several channels for consuming online news, such as through newspaper homepages, SNS newsfeeds, or portal sites. Particularly, portal sites are major news consumption channels in South Korea (Korea Press Foundation, 2021). Therefore, news consumption channels are included as they relate to digital media capability.

Second, we included a critical attitude toward media content in our research model. A critical attitude toward media refers to an individual's tendency to engage with media content analytically and skeptically, questioning the credibility and intent behind the information presented (Machete and Turpin, 2020). As a critical attitude can be part of analytical information processing and learning mechanisms to critically engage with online information (Bronstein et al., 2019; Escolà-Gascón et al., 2021), equipping individuals with critical attitudes will help prevent them from falling prey to misinformation (Boonprakong et al., 2023). For example, people with high analytical reasoning skills can better discern fake news headlines from real ones (Pennycook and Rand, 2019). In contrast, a lack of a critical attitude can be linked to the inability to distinguish between accurate and false information (Machete and Turpin, 2020). For example, an individual's belief in a fake news item has been linked to a lack of critical attitude and a skeptical mindset (Jackson, 2019).

Third, this study considers demographic and socioeconomic status. Age, gender, and education are important sociodemographic factors associated with misinformation recognition (Brashier and Schacter, 2020; Chadwick and Vaccari, 2019; Grinberg et al., 2016; Guess et al., 2019; Pop and Ene, 2019). Income is included because individuals from different socioeconomic statuses exhibit distinct patterns in their information-seeking behaviors and connections (Kwak, 1999; Wang and Yu, 2022). Those with higher socioeconomic statuses are often more equipped to access digital devices and tend to be more informed about emerging informational platforms (Barthel et al., 2020; Norris, 2001).

Considering the aforementioned variables, we aimed to identify the effects of these factors on the confidence and efforts toward recognizing misinformation for each age group. Our research questions are illustrated in Fig. 1.

3. Method

3.1. Data Acquisition

We acquired data from the 2020 Korea Media Panel Survey from the Korea Information Society Development Institute (KISDI), which provides statistics on cross-media usage behavior in the convergence and multimedia environments of broadcasting and telecommunications in South Korea by conducting pencil and paper interviews during household visits. This survey has been conducted annually with subtle variations in questionnaires and samples since 2010. We used data from 2020, as confidence and effort were only measured in this year. Considering the estimated five billion people with smart devices globally, South Korea has the highest smartphone penetration rate in the world (more than 95 % since 2019 and 96 % in 2022), and mobile phone use is nearly ubiquitous (Silver, 2019). The dataset provides the use behavior for various smart devices and related services as well as individuals' online activities. As this survey is government-led and represents the total population of South Korea, a stratified two-stage sampling was used to make a sample proportional to the size of the population and housing consensus of administrative districts and households.

This study uses data from 9,060 individuals over 20 years old from June to July 2020 (around ten weeks). As this study focuses on the difference in age groups' competence in recognizing misinformation and which factors affect this competence, we needed to distinguish between older and younger adults in our sample. According to previous studies, adults over 65 (i.e., 65 +) are considered older adults (Bartol et al., 2022; Elueze and Quan-Haase, 2018; Quan-Haase and Ho, 2020). Furthermore, to enhance our understanding of senior groups, we used the additional categorization of pre-seniors (aged 50–64 years) (Choudrie et al., 2021; Whitford, 1998). Thus, we distinguished pre-seniors (50–64 years) and older adults (65 + years) from younger adults (20–49 years) and attempted to identify how their competence in recognizing misinformation differed and what factors caused such difference. The respondents' information is provided in Table 1.

3.2. Measurement development

Our data examines competence in recognizing misinformation and the possible factors affecting it. Such factors are either explicitly coded or inferred using exploratory factor analysis. The measurement items for the inferred constructs using exploratory factor analysis are described in Appendix A.

3.3. Competence in recognizing misinformation

We measured individuals' competence in recognizing misinformation using their confidence in distinguishing credible information and efforts to determine information veracity. The former and the latter are measured using five-point Likert scales of six and ten items, respectively (See Appendix A).

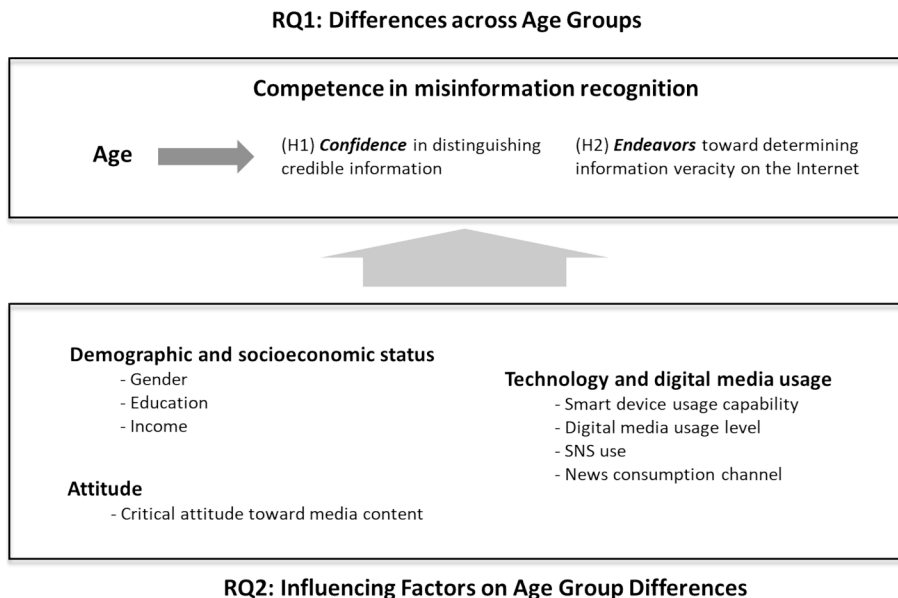


Fig. 1. Research Framework.

Table 1
Respondent demographics.

	Younger adults (20–49 years)		Pre-seniors (50–64 years)		Older adults (65 + years)		Total respondents	
	Frequency	Proportion	Frequency	Proportion	Frequency	Proportion	Frequency	Proportion
Gender								
Male	1,835	46.5 %	1,354	47.8 %	933	40.9 %	4,122	45.5 %
Female	2,114	53.5 %	1,476	52.2 %	1,348	59.1 %	4,938	54.5 %
Total	3,949	100 %	2,830	100 %	2,281	100 %	9,060	100 %
Education								
Middle school or below	25	0.6 %	317	11.2 %	1,695	74.3 %	2,037	22.5 %
High school	940	23.8 %	1,576	55.7 %	497	21.8 %	3,013	33.2 %
Undergrad or higher	2,984	75.6 %	937	33.1 %	89	3.9 %	4,010	44.3 %
Total	3,949	100 %	2,830	100 %	2,281	100 %	9,060	100 %

3.4. Factors affecting competence in recognizing misinformation

We examined several factors to identify possible influences on competence in misinformation recognition. For technology and media use, we examined *smart device usage capability*, *digital media usage level* (See [Appendix A](#) for the scale and detailed items), and *SNS use* (binary). We also measured the *news consumption channel* to control for how respondents consume information. For attitude, we measured a *critical attitude toward media content* as a possible influential factor, using a four-point Likert scale with six items. For sociodemographic and socioeconomic factors, we measured *gender* (male = 1, female = 0), *education* (categorical variable: middle school or below, high school, undergraduate or higher), and *income* (continuous variable). Descriptions of all variables are presented in [Table 2](#). All variables except categorical and binary ones were standardized to conduct further analysis.

3.5. Analytical Approaches

To answer RQ1, we conduct a one-way analysis of variance (ANOVA) and the Scheffe post-hoc test to determine whether the means of confidence and endeavors toward recognizing misinformation differ between age groups. To identify the factors influencing confidence and endeavors toward recognizing misinformation (i.e., to answer RQ2), we estimate the following equation using multiple linear regressions for each age group: (1) confidence in distinguishing credible information and (2) endeavors toward determining information veracity on the Internet = $\alpha + \beta \bullet X + \gamma \bullet \text{demographics} + \varepsilon$; where X indicates smart device usage capability, digital media usage level, SNS use (binary), news consumption channel, and critical attitude toward media content, and the demographics include gender, income, and education.

In addition, as this study takes an explorative approach to providing rich insights about misinformation literacy, we further examine how the factors that influence competence are associated with varying levels of confidence and endeavors across age groups. For this purpose, we first divide respondents into groups depending on their confidence and endeavor levels (i.e., four competence groups: high confidence and high endeavor (H/H), high confidence and low endeavor (H/L), low confidence and high endeavor (L/H), and low confidence and low endeavor (L/L)). Then, we investigate how these groups differ within each age group in terms of the factors. We then again explore how age groups differ within each competence group in relation to these factors.

Table 2
Variable descriptions.

Category	Variables	Descriptions	Range
Competence in misinformation recognition	Confidence in distinguishing credible information	The perceived capability to distinguish information veracity (i.e., misinformation) on the Internet	[1,5]
	Endeavors toward determining information veracity on the Internet	Attempts to search for information to judge information veracity (i.e., misinformation) on the Internet	[1,5]
Technology and digital media usage	Smart device usage capability	The ability to use the Internet, device settings, and applications on smart devices	[1,5]
	Digital media usage level	The number of media services a respondent uses among e-mail, instant messenger, blog management, and over-the-top (OTT) services	[0,4]
	SNS use	Whether the individual uses SNS or not (binary)	[0,1]
	News consumption channel	The channel for news consumption (i.e., no consumption, paper subscription, news company homepage, portal sites, and SNS news feed) (categorical)	[0,4]
Attitude	Critical attitude toward media content	An individual's critical attitude toward information on the Internet	[1,4]
Demographic and socioeconomic status	Gender	Male = 1, Female = 0	[0,1]
	Education	Highest level of education (middle school or below, high school, undergraduate or above)	
	Income	Amount of monthly income (ordinal scale); Each scale indicates (N-2) 500 K to (N-1)500 K KRW while N ranges from 1 to 18 (e.g., 1 indicates no income, 8 indicates 3 M ~ 3.5 M KRW)	[1,18]

4. Results

4.1. Descriptive study

The descriptive statistics of all variables for each age group are described in Table 3. Ages range from 20 to 105, with the average age for young adults, pre-seniors, and older adults slightly older than 36, 56, and 75, respectively. The young adult group uses almost three digital media services on average, and the pre-senior group uses more than two on average. This number decreases below one for the older adult group, as the responses reveal that most do not use digital media services at all. Particularly regarding SNS use, while more than half of young adults and almost half of pre-seniors use these services, only 7.8 % of the older adult group use them, suggesting a digital divide across ages.

Regarding income, while younger adults and pre-seniors scored over 5 (around 2 M KRW; 1,460 USD) for monthly income, older adults scored around 3 (below 300 K KRW; 220 USD). News consumption channels show that young adults mainly consume news through portal sites (almost 60 %), while over 20 % indicated no news consumption. Pre-seniors show a similar pattern to young adults, while the no-consumption rate is higher. For older adults, most respondents marked no consumption (over 80 %).

4.2. Measurement model

We checked the validity of the measurement model for multi-item variables, namely, confidence in distinguishing credible information, endeavor toward determining information veracity, smart device usage capability, and critical attitude toward media content. First, we checked the reliability of the constructs using Cronbach's alpha and composite reliability. The two reliability measures were greater than 0.7 for all constructs, indicating high reliability (see Appendix B). Next, we conducted a validity test using exploratory factor analysis based on principal component analysis with varimax rotation using SPSS 28 software. The Kaiser-Meyer Olkin measure of sampling adequacy (KMO) is 0.971, which is higher than the threshold (Hair et al., 2006), and Bartlett's test of sphericity is significant at $p < 0.001$ (Field, 2013). The result shows that the factor loadings on constructs are greater than 0.6, and the cross-loadings are sufficiently low, indicating convergent and discriminant validity; thus, the measurement models are satisfactory (Hair et al., 2006) (see Appendix B). We also checked validity using the average variance extracted (AVE) and found that all AVEs are higher than 0.5 and the square roots of the AVEs are greater than the inter-construct correlations, demonstrating sufficient convergent and discriminant validity (Fornell and Larcker, 1981) (see Appendix B and Table 4). Taken together, our measures for the multi-item constructs have a sufficient level of reliability and convergent and discriminant validity. Additionally, we conducted a multi-collinearity test for the variables and control variables. The biggest variance inflation factor (VIF) value is 2.40, which is lower than the threshold. This indicates multicollinearity is not a serious concern in our study (Hair et al., 2006).

Lastly, we tested for possible common method bias. Following Harman's single-factor test, we found that the first factor captured 42.8 % of the variance in data, indicating no single factor explains more than half of the variance (Podsakoff et al., 2003). Additionally, we tested a PLS model with a common method factor and calculated each indicator's variances, as suggested by Liang et al. (2007). The results show that the average variance of indicators explained by the construct is 0.757, while the average variance explained by the method factor is 0.008. The ratio between the two is 89.9:1 (see Appendix C). Taken together, we conclude that common method bias is not a serious concern in our study.

4.3. Hypothesis testing

4.3.1. Confidence and endeavor differences across age groups (RQ1)

A one-way ANOVA was performed to compare the effects of age groups on confidence and endeavors toward recognizing misinformation. The results of the one-way ANOVA indicate a significant difference between age groups in confidence in distinguishing credible information ($F(2, 9057) = 1,706.89$ ($p < 0.001$)) and for endeavors toward determining information veracity ($F(2, 9057) = 1,821.93$ ($p < 0.001$)). The post-hoc analysis was implemented using the Scheffe test to examine multiple comparisons of the differences between groups, as shown in Table 5. The result suggests that Hypothesis 1, which argues that older adults are less confident in distinguishing credible information than younger ones, is supported (between younger adults and pre-seniors ($p < 0.001$, 95 % C.I.

Table 3

Descriptive statistics for each age group.

Variables	Younger adults (20–49)		Pre-seniors (50–64)		Older adults (65 +)	
	Mean	SD	Mean	SD	Mean	SD
Confidence in distinguishing credible information	3.822	0.788	3.410	0.837	2.548	0.891
Endeavor toward determining information veracity on the Internet	3.352	0.725	3.028	0.813	2.082	0.925
Smart device usage capability	4.064	0.844	2.857	1.149	1.324	0.646
Digital media usage level	2.916	0.631	2.258	0.934	0.683	0.931
SNS use	0.733	0.443	0.421	0.494	0.078	0.269
Critical attitude toward media content	2.970	0.490	2.808	0.525	2.470	0.663
Gender	0.465	0.499	0.478	0.500	0.409	0.492
Income	5.133	3.332	5.476	3.623	2.876	1.910
N	3949		2830		2281	

Table 4
Correlation matrix.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Confidence in distinguishing credible information	0.88						
(2) Endeavor toward determining information veracity on the Internet	0.66*	0.86					
(3) Smart device usage capability	0.61*	0.60*	0.91				
(4) Digital media usage level	0.53*	0.56*	0.73*				
(5) SNS use	0.35*	0.33*	0.55*	0.59*			
(6) Critical attitude toward media content	0.56*	0.52*	0.38*	0.38*	0.25*	0.78	
(7) Gender	0.12*	0.12*	0.13*	0.10*	0.01	0.08*	
(8) Income	0.24*	0.25*	0.31*	0.27*	0.12*	0.15*	0.39*

Note. The categorical variables of news consumption channel and education were excluded. Bold values on the diagonal indicate the square roots of AVE for constructs, inferred using exploratory factor analysis. * $p < 0.01$.

Table 5
One-way ANOVA of competence in misinformation recognition between age groups.

Group 1 vs Group 2		Group 1 Mean	Group 2 Mean	Mean difference	Std. Error	95 % C. I.	
						Lower	Upper
Confidence in distinguishing credible information							
Younger adults	Pre-seniors	3.822	3.410	0.413*	0.020	0.362	0.463
Younger adults	Older adults	3.822	2.548	1.274*	0.022	1.220	1.327
Pre-seniors	Older adults	3.410	2.548	0.861*	0.023	0.804	0.918
Endeavor toward determining information veracity							
Younger adults	Pre-seniors	3.352	3.028	0.324*	0.020	0.275	0.373
Younger adults	Older adults	3.352	2.082	1.270*	0.021	1.218	1.322
Pre-seniors	Older adults	3.028	2.082	0.946*	0.023	0.890	1.002

* indicates the mean difference is significant at the 0.05 level.

Table 6
Regression analysis results.

		Confidence in distinguishing credible information			Endeavor toward determining information veracity		
		Younger adults	Pre-seniors	Older adults	Younger adults	Pre-seniors	Older adults
Smart device usage capability		0.383*** (0.022)	0.341*** (0.022)	0.289*** (0.049)	0.312*** (0.021)	0.320*** (0.022)	0.284*** (0.054)
		−0.011 (0.023)	0.025 (0.022)	0.181*** (0.032)	0.026 (0.024)	0.136*** (0.022)	0.275*** (0.033)
SNS use (binary)		−0.083*** (0.026)	−0.055 (0.029)	0.135 (0.070)	−0.084** (0.026)	−0.116*** (0.029)	−0.107 (0.069)
News consumption channel (baseline = no subscription)	Paper subscription	0.109 (0.115)	0.129 (0.070)	0.351*** (0.078)	0.238* (0.115)	0.154* (0.075)	0.161* (0.077)
	Newspaper homepage	0.012 (0.084)	0.156 (0.108)	−0.015 (0.273)	0.286** (0.094)	0.211* (0.100)	−0.039 (0.180)
	Portal site	−0.031 (0.026)	−0.023 (0.032)	−0.047 (0.055)	0.065** (0.027)	0.057 (0.033)	0.148* (0.058)
	SNS newsfeed	0.131* (0.059)	−0.018 (0.152)	— (0.152)	0.248*** (0.060)	0.201* (0.096)	— (0.096)
Critical attitude toward media content		0.433*** (0.015)	0.387*** (0.017)	0.258*** (0.015)	0.319*** (0.014)	0.323*** (0.016)	0.255*** (0.015)
Gender (binary)		−0.012 (0.023)	−0.029 (0.034)	0.117*** (0.037)	−0.009 (0.023)	0.022 (0.034)	0.070 (0.040)
Income		0.046*** (0.011)	0.053** (0.017)	0.034 (0.035)	0.031** (0.012)	0.011 (0.016)	0.064 (0.036)
Education (baseline = middle school or below)	High school	0.212 (0.131)	0.096* (0.048)	0.219*** (0.044)	0.078 (0.140)	−0.011 (0.049)	0.198*** (0.048)
	Undergrad or above	0.234 (0.132)	0.092 (0.056)	0.277** (0.087)	0.131 (0.140)	0.009 (0.055)	0.224* (0.089)
Constant		−0.120 (0.130)	−0.013 (0.052)	−0.262*** (0.071)	−0.035 (0.139)	0.100 (0.053)	−0.157* (0.077)
N		3949	2830	2281	3949	2830	2281
adj. R-sq		0.337	0.368	0.330	0.240	0.341	0.345

Note. Robust standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

= [0.362, 0.463]), between younger adults and older adults ($p < 0.001$, 95 % C.I. = [1.220, 1.327]), and between pre-seniors and older adults ($p < 0.001$, 95 % C.I. = [0.804, 0.918]). However, Hypothesis 2, which proposes that endeavors toward determining information veracity are lower in younger adults than older ones, is not supported. Both confidence and effort increase as the age group gets younger (i.e., younger adults > pre-seniors > older adults) (between younger adults and pre-seniors ($p < 0.001$, 95 % C.I. = [0.275, 0.373]), between younger adults and older adults ($p < 0.001$, 95 % C.I. = [1.218, 1.322]), and between pre-seniors and older adults ($p < 0.001$, 95 % C.I. = [0.890, 1.002])).

4.3.2. The influence of Technology, media Use, and demographics (RQ2)

Table 6 provides the results of the multiple linear regression. Regarding confidence, smart device usage capability positively affects confidence across all age groups ($\beta = 0.383$, 0.341, and 0.289 (all $p < 0.001$) for younger adults, pre-seniors, and older adults, respectively). Digital media usage level does not significantly affect confidence in younger adults and pre-seniors but positively affects older adults ($\beta = 0.181$, $p < 0.001$). SNS use negatively impacts younger adults' confidence ($\beta = -0.083$, $p < 0.001$) but only marginally positively affects older adults ($\beta = 0.135$, $p = 0.056$) and shows no effect on pre-seniors. News consumption via SNS feed is significant only for younger adults ($\beta = 0.131$, $p < 0.05$), and paper subscription is significant for older adults ($\beta = 0.351$, $p < 0.001$); no significant effect is observed for the other age group. A critical attitude positively affects confidence across all age groups ($\beta = 0.433$, 0.387, and 0.258 (all $p < 0.001$) for younger adults, pre-seniors, and older adults, respectively). Gender is only associated with confidence in older adults ($\beta = 0.117$, $p < 0.001$), with male seniors showing higher confidence. Income is positively associated with confidence in younger adults ($\beta = 0.046$, $p < 0.001$) and pre-seniors ($\beta = 0.053$, $p < 0.01$), but not older adults. High school education is positively linked to confidence and endeavors for older adults ($\beta = 0.219$, $p < 0.001$) and pre-seniors ($\beta = 0.096$, $p < 0.05$).

Regarding endeavors, smart device usage capability also positively impacts endeavors toward verifying information for all age groups ($\beta = 0.312$, 0.320, and 0.284 (all $p < 0.001$) for younger adults, pre-seniors, and older adults, respectively). The digital media usage level positively influences endeavors in recognizing misinformation for pre-seniors ($\beta = 0.135$, $p < 0.001$) and older adults ($\beta = 0.275$, $p < 0.001$) but not younger adults. SNS use negatively affects misinformation recognition endeavors for younger adults ($\beta = -0.084$, $p < 0.01$) and pre-seniors ($\beta = -0.116$, $p < 0.001$) but shows no effect for older adults. News subscriptions positively affect endeavors for younger adults via all sources ($\beta = 0.238$ ($p < 0.05$) for paper subscriptions, $\beta = 0.286$ ($p < 0.01$) for homepages, $\beta = 0.065$ ($p < 0.01$) for portal sites, and $\beta = 0.248$ ($p < 0.001$) for SNS newsfeed). Pre-seniors are impacted through paper subscriptions ($\beta = 0.154$ ($p < 0.05$)), homepages ($\beta = 0.211$ ($p < 0.05$)), and SNS newsfeed ($\beta = 0.201$ ($p < 0.05$)). Older adults are affected through paper subscriptions and portal sites ($\beta = 0.161$ ($p < 0.05$) for paper subscriptions and $\beta = 0.148$ ($p < 0.05$) for portal sites). Gender is not associated with endeavors to recognize misinformation for any age group. Income is positively associated with endeavors for younger adults ($\beta = 0.031$, $p < 0.01$) only. Conversely, high school education is positively associated with endeavors of older adults ($\beta = 0.198$, $p < 0.001$) only.

4.4. Additional analysis: comparison among groups with varying confidence and endeavor levels

We illustrated how age groups differ in terms of confidence and endeavors toward recognizing misinformation in Fig. 2. This figure

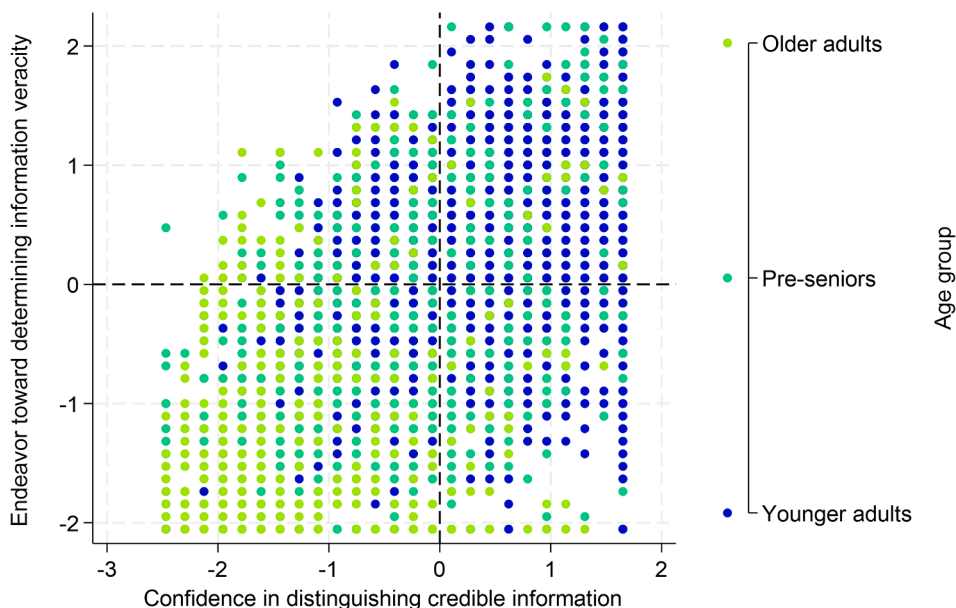


Fig. 2. Association between age groups, confidence, and endeavors toward recognizing misinformation. Note. Variables on the axes are standardized.

shows that younger adults tend to show both high confidence and endeavor, while older adults tend to show the opposite.

Fig. 2 can be viewed in four quadrants, in which each quadrant represents one of four competence groups: high confidence and high endeavor (H/H), high confidence and low endeavor (H/L), low confidence and high endeavor (L/H), and low confidence and low endeavor (L/L). Each group represents certain characteristics that help recognize misinformation. The high-confidence and high-end endeavor group is confident and puts significant effort into recognizing misinformation. In contrast, the low-confidence and low-end endeavor group does attempt to recognize misinformation and is not confident. From the perspective of misinformation literacy, the pairings within these competence groups may appear natural; thus, simply finding more ways to increase their efforts toward recognizing misinformation may be an effective strategy.

However, the two other competence groups tell a different story. The high-confidence and low-end endeavor group represents those who do not attempt to recognize misinformation but remain confident in their capability to distinguish it. The low-confidence and high-end endeavor group may signify those who work hard to recognize misinformation but are not confident in their ability to distinguish it. The low-end endeavor but high-confidence group may exist due to individuals' already high ability in distinguishing credible information that requires no further efforts toward finding additional evidence but also may come from an opinionated or unconditional belief that the information they encounter is undoubtedly true. Similarly, the high-effort but low-confidence group may result from failed attempts to determine misinformation, but it may also simply be due to an imbalance between endeavor and confidence due to the time and work individuals put into determining and distinguishing misinformation. Therefore, a possible strategy should be granulated rather than simply providing means to increase their efforts. To articulate these strategies, there is a need for further analysis to understand how each competence group differs in terms of various devices, media, and content usage.

To this end, we conducted additional analysis to examine how groups with varying confidence and endeavor levels differ. First, we divided the responses into the four competence groups using the averages for confidence and endeavor from all responses (confidence = 3.37, endeavor = 2.93). Table 7 indicates the means and standard deviations of the four competence groups.

Second, we conducted a one-way ANOVA to check the statistical significance of how technology and media use factors differ among the competence groups. The results indicate a significant difference between competence groups for smart device usage capability ($F(3, 9056) = 1,609.84$ ($p < 0.001$)), digital media usage level ($F(3, 9056) = 1,254.08$ ($p < 0.001$)), SNS use ($F(3, 9056) = 418.46$ ($p < 0.001$)), and critical attitude toward media content ($F(3, 9056) = 1,083.21$ ($p < 0.001$)). News consumption channels and education, which are categorical variables, were excluded. Next, we conducted the Scheffe post-hoc test to determine whether the differences in factors by competence group are statistically significant. The results are shown in Table 8.

Third, to understand the behavior patterns of the four competence groups combined with age, we checked the competence group difference within each age group by conducting an ANOVA and the Scheffe post-hoc test.

As shown in Table 9, the H/H group shows the highest values, while the L/L group shows the lowest values across all factors. The results of the one-way ANOVA indicate a significant difference between competence groups within each age group, as the F -statistics are all significant, at least at the 0.01 significance level.

Regarding the Scheffe post-hoc test, no significant difference exists between the H/L and L/H groups across age groups ($p = 0.854$) for smart device usage capability. Regarding a critical attitude toward media content, there is a significant difference between the H/L and L/H groups only for younger adults ($p < 0.001$ for younger adults, $p = 0.138$ for pre-seniors, and $p = 0.948$ for older adults). For digital media usage level, a significant difference exists between the H/L and L/H groups only among pre-seniors ($p < 0.05$ for pre-seniors but $p = 0.993$ for younger adults and $p = 0.931$ for older adults), with the L/H group showing higher usage (H/L group mean = 2.192 vs. L/H group mean = 2.425).

Fourth, to interpret the result from a different angle, we tested age group differences within each competence group. The detailed ANOVA results are provided in Appendix D. The findings indicate that the ANOVA F -statistics are all statistically significant. As shown in Fig. 3, within the same competence group, younger adults exhibit significantly higher smart device capability and digital media usage levels than pre-seniors and older adults (all $p < 0.001$). SNS use follows the same pattern (all $p < 0.001$). Regarding a critical attitude toward media content in the H/H group, younger adults have higher critical attitudes than pre-seniors ($p < 0.001$) and older adults ($p = 0.028$), while no significant difference exists between older adults and pre-seniors ($p = 0.837$). In the L/H group, older adults show values similar to or higher than those of younger adults and pre-seniors. However, the differences are not statistically significant (the means of younger adults, pre-seniors, and older adults are 2.761, 2.774, and 2.804, respectively).

5. Discussions of key findings

This study explores how confidence and endeavors toward recognizing misinformation differ across age groups from an explorative

Table 7

The means and standard deviations of the four competence groups.

	High Confidence /High Endeavor (n = 3,597)		High Confidence /Low Endeavor (n = 1,035)		Low Confidence /High Endeavor (n = 1,351)		Low Confidence /Low Endeavor (n = 3,077)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Confidence in distinguishing credible information	4.195	0.497	4.019	0.456	2.954	0.358	2.377	0.615
Endeavor toward determining information veracity on the Internet	3.748	0.487	2.349	0.513	3.347	0.322	1.989	0.645

Table 8

One-way ANOVA of factor differences by competence group.

Group 1 vs Group 2		Group 1 Mean	Group 2 Mean	Mean difference	Std. Error	95 % C. I. Lower	Upper
Smart device usage capability							
H/H	H/H	3.852	3.133	0.719*	0.041	0.605	0.832
H/H	H/H	3.852	3.130	0.721*	0.037	0.618	0.824
H/H	H/H	3.852	1.894	1.957*	0.028	1.878	2.037
H/L	H/L	3.133	3.130	0.003	0.048	-0.130	0.136
H/L	H/L	3.133	1.894	1.239*	0.041	1.123	1.355
L/H	L/H	3.130	1.894	1.236*	0.038	1.131	1.341
Digital media usage level							
H/H	H/L	2.756	2.342	0.414*	0.036	0.314	0.515
H/H	L/H	2.756	2.409	0.347*	0.032	0.256	0.438
H/H	L/L	2.756	1.258	1.498*	0.025	1.428	1.568
H/L	L/H	2.342	2.409	-0.067	0.042	-0.185	0.050
H/L	L/L	2.342	1.258	1.084*	0.037	0.981	1.186
L/H	L/L	2.409	1.258	1.151*	0.033	1.058	1.244
SNS use							
H/H	H/L	0.633	0.553	-0.080*	0.017	-0.126	-0.034
H/H	L/H	0.633	0.513	-0.120*	0.015	-0.162	-0.078
H/H	L/L	0.633	0.235	-0.398*	0.011	-0.430	-0.366
H/L	L/H	0.553	0.513	-0.040	0.019	-0.094	0.014
H/L	L/L	0.553	0.235	-0.318*	0.017	-0.365	-0.271
L/H	L/L	0.513	0.235	-0.278*	0.015	-0.321	-0.235
Critical attitude toward media content							
H/H	H/L	3.100	2.908	0.192*	0.018	0.143	0.241
H/H	L/H	3.100	2.773	0.327*	0.016	0.282	0.372
H/H	L/L	3.100	2.405	0.695*	0.012	0.661	0.730
H/L	L/H	2.908	2.773	0.1348*	0.021	0.077	0.193
H/L	L/L	2.908	2.405	0.5031*	0.018	0.453	0.553
L/H	L/L	2.773	2.405	0.368*	0.016	0.323	0.414

Note. All variables in this table were not standardized.

*Indicates the mean difference is significant at the 0.05 level.

perspective. The hypothesis testing and additional analysis findings reveal meaningful age-related patterns in how individuals address online misinformation. These results also highlight the roles of technology, media consumption, critical attitudes, and demographic factors in competence toward recognizing misinformation. Below, we elaborate on the key findings: differences in confidence and endeavor levels across age groups, the influence of technology and media use, and the dynamics within the H/L and L/H groups.

5.1. Confidence and endeavor differences across age groups

The results confirm that both confidence and endeavors toward recognizing misinformation are higher among younger adults than older ones. While the hypothesis that younger adults exhibit greater confidence is supported, the expectation that older adults exert more effort to determine the credibility of information is not. Younger adults not only demonstrate higher confidence but also invest more efforts toward recognizing misinformation.

A possible explanation for these findings lies in the content types that younger adults engage with. Previous research has shown that younger individuals tend to participate more actively in discussions about widely relevant topics, such as COVID-19, which increases their engagement with misinformation (Vijaykumar et al., 2021). They also use interactive media platforms like messaging apps or social media, which encourage direct interaction with content (Bode and Vraga, 2015; Scott et al., 2017; Gurgun et al., 2024). In contrast, older adults tend to use social media primarily for social purposes rather than information gathering (Brashier and Schacter, 2020). As a result, the motivation to identify misinformation may be lower among older adults.

These findings suggest that younger adults' higher engagement levels may be topic-dependent and shaped by their social media behavior. For older adults, lower confidence and effort reflect their reduced participation in online information-seeking activities, particularly when social media is used mainly for interpersonal connections.

5.2. The influence of technology, media use, and demographics

Smart device usage capability significantly enhances both confidence and endeavors to recognize misinformation across all age groups, emphasizing the importance of technological competence in navigating digital information landscapes (Bronstein et al., 2019; Escolà-Gascón et al., 2021; Kahne and Bowyer, 2017; Machete and Turpin, 2020). A critical attitude toward media content is also significant, as individuals who scrutinize media content tend to be more confident and proactive in recognizing misinformation (Machete and Turpin, 2020).

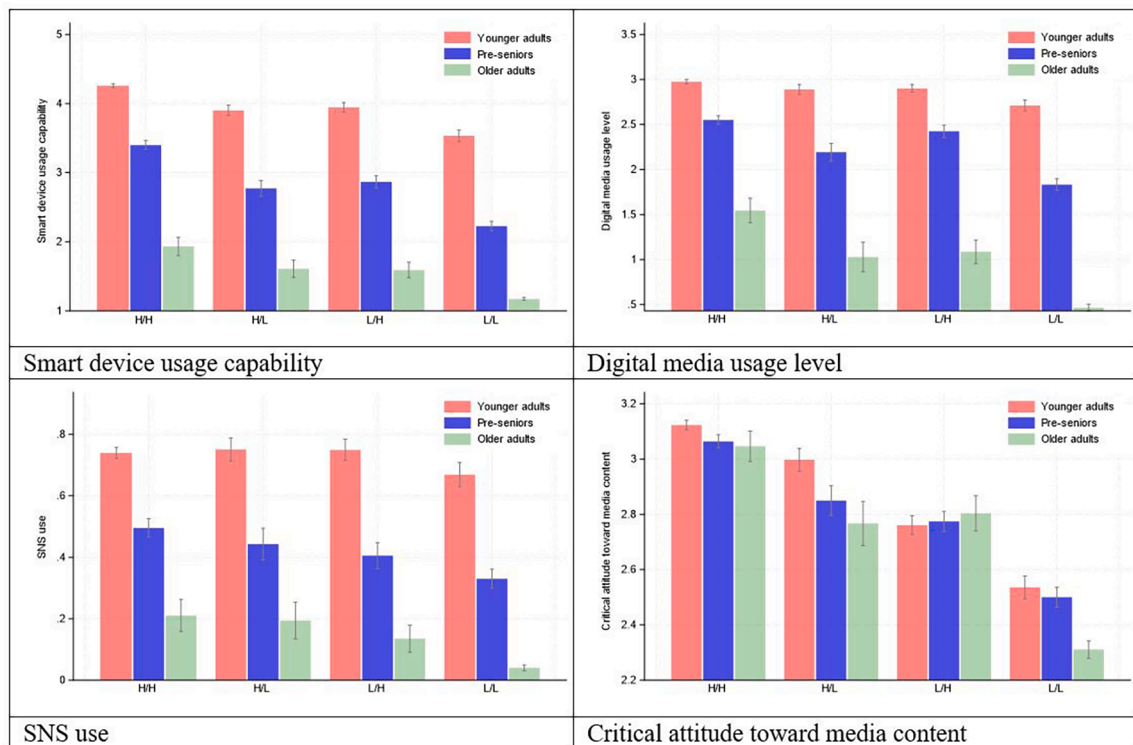
Digital media usage levels influence confidence and endeavors differently by age group. For older adults, more digital media use

Table 9

ANOVA and Scheffe test results for factor differences by competence group within age groups.

Group1 (G1)	Group2 (G2)	Younger adults			Std. err.	95 % C. I.		Pre-seniors			Std. err.	95 % C. I.		Older adults			Std. err.	95 % C. I.	
		Mean (G1)	Mean (G2)	Mean difference		Lower	Upper	Mean (G1)	Mean (G2)	Mean difference		Lower	Upper	Mean (G1)	Mean (G2)	Mean difference		Lower	Upper
Smart device usage capability																			
		(F(3,3945) = 135.18, p < 0.001)						(F(3,2826) = 204.96, p < 0.001)						(F(3,2277) = 146.53, p < 0.001)					
H/H	H/L	4.258	3.902	0.356*	0.040	0.246	0.467	3.399	2.771	0.628*	0.064	0.451	0.806	1.931	1.609	0.323*	0.060	0.156	0.490
H/H	L/H	4.258	3.945	0.313*	0.037	0.210	0.416	3.399	2.866	0.533*	0.056	0.377	0.689	1.931	1.591	0.341*	0.055	0.187	0.495
H/H	L/L	4.258	3.533	0.725*	0.038	0.618	0.832	3.399	2.228	1.172*	0.047	1.039	1.304	1.931	1.172	0.759*	0.041	0.643	0.875
H/L	L/H	3.902	3.945	-0.043	0.048	-0.179	0.093	2.771	2.866	-0.095	0.072	-0.295	0.105	1.609	1.591	0.018	0.060	-0.150	0.186
H/L	L/L	3.902	3.533	0.369*	0.050	0.230	0.508	2.771	2.228	0.544*	0.065	0.361	0.726	1.609	1.172	0.437*	0.048	0.303	0.570
L/H	L/L	3.945	3.533	0.412*	0.047	0.279	0.544	2.866	2.228	0.639*	0.058	0.477	0.800	1.591	1.172	0.419*	0.042	0.302	0.535
Critical attitude toward media content																			
		(F(3,3945) = 315.71, p < 0.001)						(F(3,2826) = 233.23, p < 0.001)						(F(3,2277) = 143.82, p < 0.001)					
H/H	H/L	3.123	2.997	0.126*	0.022	0.065	0.186	3.064	2.850	0.214*	0.029	0.133	0.294	3.046	2.767	0.279*	0.061	0.108	0.451
H/H	L/H	3.123	2.761	0.362*	0.020	0.305	0.418	3.064	2.774	0.290*	0.025	0.219	0.360	3.046	2.804	0.242*	0.057	0.084	0.400
H/H	L/L	3.123	2.535	0.587*	0.021	0.529	0.646	3.064	2.500	0.564*	0.021	0.504	0.624	3.046	2.311	0.735*	0.043	0.616	0.854
H/L	L/H	2.997	2.761	0.236*	0.027	0.162	0.310	2.850	2.774	0.076	0.032	-0.014	0.166	2.767	2.804	-0.037	0.062	-0.209	0.135
H/L	L/L	2.997	2.535	0.461*	0.027	0.385	0.537	2.850	2.500	0.350*	0.029	0.268	0.432	2.767	2.311	0.456*	0.049	0.319	0.593
L/H	L/L	2.761	2.535	0.226*	0.026	0.153	0.298	2.774	2.500	0.274*	0.026	0.201	0.347	2.804	2.311	0.493*	0.043	0.373	0.612
Digital media usage level																			
		(F(3,3945) = 27.00, p < 0.001)						(F(3,2826) = 113.93, p < 0.001)						(F(3,2277) = 139.74, p < 0.001)					
H/H	H/L	2.976	2.889	0.086*	0.031	0.000	0.172	2.550	2.192	0.358*	0.054	0.207	0.508	1.545	1.029	0.516*	0.086	0.274	0.757
H/H	L/H	2.976	2.901	0.075	0.029	-0.005	0.155	2.550	2.425	0.125	0.047	-0.007	0.257	1.545	1.087	0.458*	0.080	0.236	0.681
H/H	L/L	2.976	2.711	0.264*	0.030	0.181	0.348	2.550	1.833	0.717*	0.040	0.604	0.829	1.545	0.468	1.077*	0.060	0.909	1.244
H/L	L/H	2.889	2.901	-0.011	0.038	-0.116	0.094	2.192	2.425	-0.233*	0.061	-0.402	-0.063	1.029	1.087	-0.058	0.087	-0.300	0.185
H/L	L/L	2.889	2.711	0.178*	0.039	0.070	0.286	2.192	1.833	0.359*	0.055	0.204	0.513	1.029	0.468	0.561*	0.069	0.368	0.754
L/H	L/L	2.901	2.711	0.189*	0.037	0.086	0.292	2.425	1.833	0.591*	0.049	0.455	0.728	1.087	0.468	0.619*	0.060	0.450	0.787
SNS use																			
		(F(3,3945) = 4.55, p < 0.01)						(F(3,2826) = 18.95, p < 0.001)						(F(3,2277) = 46.31, p < 0.001)					
H/H	H/L	0.740	0.751	0.011	0.022	-0.049	0.072	0.496	0.443	-0.053	0.030	-0.136	0.031	0.210	0.194	-0.016	0.026	-0.090	0.058
H/H	L/H	0.740	0.750	0.010	0.020	-0.047	0.067	0.496	0.405	-0.090*	0.026	-0.164	-0.017	0.210	0.135	-0.076*	0.024	-0.143	-0.008
H/H	L/L	0.740	0.669	-0.071*	0.021	-0.129	-0.012	0.496	0.330	-0.166*	0.022	-0.228	-0.104	0.210	0.040	-0.170*	0.018	-0.221	-0.119
H/L	L/H	0.751	0.750	-0.001	0.027	-0.076	0.073	0.443	0.405	-0.037	0.034	-0.131	0.056	0.194	0.135	-0.059	0.026	-0.133	0.015
H/L	L/L	0.751	0.669	-0.082*	0.027	-0.158	-0.006	0.443	0.330	-0.113*	0.031	-0.199	-0.027	0.194	0.040	-0.154*	0.021	-0.213	-0.095
L/H	L/L	0.750	0.669	-0.080*	0.026	-0.153	-0.008	0.405	0.330	-0.075	0.027	-0.151	0.000	0.135	0.040	-0.095*	0.018	-0.146	-0.043

*Indicates the mean difference is significant at the 0.05 level.



Note. H/H, H/L, L/H, and L/L indicate the high-confidence/high-endavor, high-confidence/low-endavor, low-confidence/high-endavor, and low-confidence/low-endavor groups, respectively.

Fig. 3. The mean differences for each factor across age groups within the same competence group. Note. H/H, H/L, L/H, and L/L indicate the high-confidence/high-endavor, high-confidence/low-endavor, low-confidence/high-endavor, and low-confidence/low-endavor groups, respectively.

correlates with increased confidence, likely due to their broader access to online information. More media use in pre-seniors and older adults also translates into greater endeavors toward verifying information. This pattern suggests that older generations benefit from media exposure when actively engaging with digital content, despite younger adults not exhibiting the same relationship between media use and confidence.

The use of SNS can have varying effects across generations. For younger adults, SNS use reduces both confidence and endeavors toward recognizing misinformation, possibly due to information overload or passive consumption patterns (Goyanes et al., 2023; Tandoc Jr. and Kim, 2023). Conversely, SNS use does not affect confidence and endeavors among older adult groups. For pre-seniors, SNS use adversely impacts endeavors while it does not influence confidence. The distinctly different impacts of SNS use across age groups are suggested to stem from significant differences in the amount of SNS usage and the age at which individuals start using SNS.

News consumption patterns further illustrate generational differences. Younger adults rely on SNS feeds for news, and those who engage with such sources show higher confidence and greater endeavors in recognizing misinformation. In contrast, older adults benefit more from traditional media, such as paper subscriptions, enhancing both their confidence and endeavors. Pre-seniors exhibit a preference for news sources other than portal sites, reinforcing the notion that they are selective in their media consumption.

Demographics and socioeconomic factors also shape misinformation recognition. Gender is associated with older adults' confidence, with male seniors reporting higher confidence than their female counterparts. Furthermore, income is positively associated with confidence and endeavors among younger adults, suggesting that access to financial resources facilitates digital engagement and literacy (Barthel et al., 2020; Norris, 2001). However, this relationship is absent for older adults, possibly due to retirement reducing the relationship between income and their confidence and endeavors. Education is positively associated with older adults' confidence, while for pre-seniors, only those with a high school education show higher confidence. These results reflect how access to education and economic resources are associated with effective information practices across age groups.

5.3. Comparison among groups with varying confidence and endeavor levels

The post-hoc analysis reveals meaningful differences, especially between the H/L and L/H groups across generations. As expected, the H/H group scores the highest on both dimensions, while the L/L group scores the lowest. Groups with either high confidence or high endeavors to recognize misinformation fall between these two extremes.

Smart device usage capability does not differ significantly between the H/L and L/H groups across age groups. However, a critical

attitude toward media content shows significant variations among younger adults: the H/L group exhibits more critical attitudes than the L/H group. This finding suggests that, for younger adults, critical attitudes align more closely with confidence than effort. No similar pattern emerges for pre-seniors or older adults, indicating that critical attitudes may play different roles in shaping information behavior across generations.

Among pre-seniors, the L/H group shows higher digital media usage levels than the H/L group, suggesting that increased media use can drive effort but does not necessarily translate into higher confidence. This highlights the need to foster both confidence and effort to effectively combat misinformation.

While most of the analyses show probable results with plausible interpretations or non-significant results, there are significant differences that need further insinuations regarding the critical attitudes of the younger adult group and digital media usage levels in the pre-senior group. For example, among the three groups, only the younger adult group shows significant differences in critical attitudes between the H/L group and the L/H group (i.e., the H/L group has a more critical attitude than the L/H group). This largely implies that critical attitudes more closely relate to confidence than effort, especially among young adults (Allcott and Gentzkow, 2017).

Furthermore, among the three groups, only the pre-senior group shows significant differences in digital media usage levels between the H/L group and the L/H group (i.e., the H/L group has lower media usage levels than the L/H group). As pre-seniors are the generation who most actively accepted and used social media when it was first introduced in the early 2000 s (Livingstone et al., 2019; Vraga et al., 2015), the significant difference between the H/L group and the L/H group is somewhat understandable in terms of social media usage levels. While young people consistently use social media, pre-seniors are divided into active or passive users, showing differences among the groups.

6. Implications and conclusion

6.1. Theoretical contributions

This study makes academic contributions in three key areas. First, the study proposes a conceptual framework for online misinformation recognition competence, which consists of two dimensions: confidence in distinguishing credible information and efforts to verify the veracity of this information. By framing competence within these two dimensions, this study provides a comprehensive understanding of users' capabilities in recognizing misinformation. While past research has thoroughly examined each of these aspects individually, considering them as a set of capabilities is rare. Confidence and effort are effective and complementary partners in this framework, which significantly advances the academic understanding of misinformation literacy, an increasingly important field due to the rise of fake news (Bago et al., 2020; Khan and Idris, 2019; Pennycook and Rand, 2019).

Second, this study enhances the understanding of age factors and their relationship with misinformation recognition capabilities by analyzing large-scale, nationwide survey data from South Korea. While previous studies have also noted who is susceptible to misinformation by focusing on age, this study verified the influential factors that differ depending on age group. Age has been repeatedly cited as a key factor determining information management behavioral patterns in various circumstances. However, our results show that age alone is not a definitive predictor of vulnerability to misinformation, as there is a significant difference in the ability to recognize misinformation between age groups: older adults generally have fewer capabilities than younger ones. As the involvement of older adults increases due to a globally aging society (Eglit, 2004; Seo et al., 2021; Shrestha and Heisler, 2011), our findings present how to enhance the ability to recognize misinformation across age groups, especially for older adults.

Lastly, our findings enhance the understanding of misinformation recognition by highlighting the role of individual factors (in addition to age) and suggesting how online information providers and social media platforms can improve misinformation recognition (Ho et al., 2022; Khan and Idris, 2019). While age is a major factor that differentiates misinformation recognition capabilities, this study largely investigates related factors such as technology and social media use to comprehend the surrounding context. For example, our findings show that smart device usage capabilities and critical attitudes toward media content significantly affect capabilities in recognizing misinformation for all age groups. As such, media use behaviors are intrinsically linked with online (mis) information mainly provided in digital format; it should be noted that it has effects regardless of their direction (i.e., positive or negative). Understanding media use behaviors can clarify how to inhibit the spread of misinformation and address vulnerability.

6.2. Practical implications

This study's practical implications can be elaborated as follows. First, the proposed competence in misinformation recognition framework provides a foundation for understanding user behaviors in practice. The two competencies of confidence and endeavor are theoretically distinct but, in practice, closely interconnected. For example, people with more internet experience and stronger digital literacy may be overconfident in their ability to recognize misinformation and unknowingly fall for unverified information (Bago et al., 2020; Khan and Idris, 2019; Pennycook and Rand, 2019). Moreover, these two competencies together can influence the likelihood of sharing fake news (Khan and Idris, 2019). Understanding user behaviors has been challenging due to these complicated interrelations behind the constructs. In this sense, the proposed framework clarifies the understanding of behavioral mechanisms online and can guide relevant businesses in managing users of different ages and backgrounds experiencing misinformation on online platforms.

Second, the study's empirical power is strengthened by supporting the arguments with large-scale, government-led national survey data. Scale-wise, this study verified the hypothesis based on responses from ten thousand people, making our findings highly generalizable. Furthermore, the government guarantees the reliability of the data, making these findings more consistent and

trustworthy. While numerous studies have used data from targeted focus groups and shown conflicting results (Au et al., 2022), this study provides a comprehensive understanding of information literacy supported by large-scale data analysis. We believe it paints a more nuanced picture of misinformation recognition across age groups.

Lastly, our findings can contribute to developing educational content or programs aimed at improving misinformation literacy at a societal level. As the social harm caused by fake news on social media becomes more severe, individuals increasingly need to identify fake news and avoid its negative influence (Khan and Idris, 2019). For example, this study demonstrates that enhancing smart device usage skills and attitudes toward media content can help individuals distinguish misinformation and improve their ability to assess information veracity. Furthermore, our findings offer a valuable example of how to strengthen misinformation recognition, particularly among older adults (Guess et al., 2019; Seo et al., 2021). As the Internet and social media have been in use for over a quarter of a century, we are encountering the first generation of actively online seniors. To ensure this generation can create and use online information in a healthy way, it is essential to provide them with educational programs that bolster their misinformation recognition capabilities on a societal scale. In this context, our study offers significant practical implications.

6.3. Limitations and future studies

While we provide insights into misinformation recognition, several limitations call for future research. First, although we presented reliable findings and implications based on data from a national population survey in South Korea, we used data from a single year, as some key variables of the research model were only collected that year. Considering longitudinal or panel data in future studies can provide more comprehensive findings on misinformation recognition, such as tendency changes and associations with certain devices or services. Second, future studies should refine the items for greater academic rigor. We used secondary data to achieve universality, which was guaranteed by a large sample of national survey data. However, using primary data developed by the researchers would enhance academic rigor and increase the value of the study.

6.4. Conclusion

The spread of inaccurate information poses individual risks and broader social and political challenges. As a result, the ability to recognize misinformation has become increasingly vital. This study examines the core concepts of information literacy, offering a comprehensive analysis of the ability to assess information veracity. Our research is grounded in nationwide survey data conducted by government agencies, strengthening the findings' validity. The analysis highlights significant age-related differences in misinformation recognition, with associated variables showing varying effects across age groups. These differences are attributed to the rapid proliferation of online misinformation literacy across generations over the past 25 years. In addition to age, the study also examines related factors such as the use of smart devices, critical attitudes, gender, and education levels. By considering these variables, the research aims to provide practical suggestions for enhancing misinformation recognition. Ultimately, this study contributes to the broader goal of promoting information veracity and fostering online information literacy, offering valuable insights that support the development of strategies to combat misinformation for business organizations across diverse contexts.

CRediT authorship contribution statement

Junyeong Lee: Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jung Lee:** Writing – review & editing, Writing – original draft, Conceptualization. **Jinyoung Min:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgment

This research was supported by the MSIT (Ministry of Science and ICT), Korea, under the Convergence security core talent training business support program (No. IITP-2024-RS-2023-00266605) supervised by the IITP (Institute for Information & Communications Technology Planning & Evaluation).

Appendix A. Measurement items

Variable	Items	Scale
Confidence in distinguishing credible information(CDCI)	I can distinguish between news and advertisements. I can distinguish between news and article-type advertisements (advertisements written like an article). I can distinguish between news and publicity. I can distinguish between news from internet newspapers and blog posts. I can distinguish between TV programs produced by broadcasters and videos produced by individuals (such as by BJs). I can distinguish between commercial and non-commercial websites.	1 Strongly disagree2 Disagree3 Neither agree nor disagree4 Agree5 Strongly agree
Endeavor toward determining information veracity on the Internet(EDIV)	I examine whether the information I received is true or not. I check the source of the information I receive. I try to judge whether the source of the information I receive is reliable. I examine whether the information I have received is based on valid evidence. I try to judge whether the information I receive contains commercial intentions. I try to judge whether the information I receive contains political intentions. I try to determine whether the information I receive is intentionally advocating only one position. I try to judge whether the information I receive is useful to me. I look for additional information to better understand the situation related to the information I received on the Internet. I look for additional information to learn about various positions regarding information on the Internet.	1 Never2 Occasionally3 Quite often4 Very often5 Always
Smart device usage capability (SDUA)	I can conduct financial transactions, including mobile banking, on my smart device. I can use my smart device to shop or book tickets for movies, shows, etc. I know how to protect my personal information and privacy on my smart device. I know what to do if my personal information is leaked on a smart device (e.g., report it). I can set preferences such as the display (screen), sound, security, alarms, and input methods on my smart device. I can move files (photos, documents, etc.) from my smart device to my computer. I can find, install, delete, and update my smart device applications. I can use my smart device to create necessary documents or materials. I can scan and remediate my smart device for malware (viruses, spyware, etc.). I can identify and block dangerous texts (such as spam or phishing) on my smart device. I can recognize and report dangerous texts (such as spam or phishing) on my smart device.	1 Strongly disagree2 Disagree3 Neither agree nor disagree4 Agree5 Strongly agree
Critical attitude toward media content (AMC)	Media content is a processed product that contains the intention of the creator. Media messages are organized differently depending on the type of media (TV, newspaper, portal site, YouTube, etc.). Media messages contain elements that encourage consumption. Media messages contain bias against certain groups (women, elderly, those with disabilities, etc.). Media messages influence the thoughts and attitudes of viewers. News influences the formation of people's opinions on certain issues.	1 Completely disagree2 Generally disagree3 Generally agree4 Completely agree

Appendix B. Exploratory factor, reliability, and validity analyses

Variable	Items	Factor Loadings				Cronbach's alpha	Composite reliability	AVE
		CDCI	EDIV	SDUA	AMC			
Confidence in distinguishing credible information(CDCI)	CDCI1	0.755	0.250	0.174	0.268	0.942	0.954	0.776
	CDCI2	0.764	0.295	0.221	0.234			
	CDCI3	0.750	0.292	0.227	0.248			
	CDCI4	0.725	0.316	0.322	0.193			
	CDCI5	0.693	0.324	0.359	0.196			
	CDCI6	0.672	0.352	0.366	0.181			
Endeavor toward determining information veracity on the Internet(EDIV)	EDIV1	0.195	0.797	0.219	0.170	0.962	0.967	0.744
	EDIV2	0.164	0.799	0.213	0.158			
	EDIV3	0.173	0.788	0.208	0.191			
	EDIV4	0.178	0.783	0.231	0.180			
	EDIV5	0.174	0.776	0.231	0.169			
	EDIV6	0.150	0.783	0.213	0.155			
	EDIV7	0.165	0.780	0.232	0.177			
	EDIV8	0.209	0.740	0.224	0.222			
	EDIV9	0.209	0.739	0.312	0.158			
	EDIV10	0.191	0.760	0.310	0.161			
Smart device usage capability (SDUA)	SDUA1	0.166	0.214	0.732	0.113	0.978	0.981	0.821
	SDUA2	0.185	0.237	0.781	0.112			
	SDUA3	0.166	0.269	0.834	0.090			
	SDUA4	0.163	0.265	0.831	0.078			
	SDUA5	0.156	0.247	0.691	0.191			
	SDUA6	0.156	0.257	0.825	0.131			
	SDUA7	0.168	0.245	0.813	0.134			
	SDUA8	0.168	0.224	0.868	0.093			
	SDUA9	0.143	0.219	0.872	0.096			
	SDUA10	0.181	0.242	0.858	0.101			
	SDUA11	0.167	0.233	0.868	0.092			
Critical attitude toward media content (AMC)	AMC1	0.278	0.274	0.123	0.682	0.87	0.902	0.607
	AMC2	0.224	0.235	0.140	0.673			
	AMC3	0.118	0.179	0.085	0.723			
	AMC4	0.026	0.115	0.085	0.695			
	AMC5	0.184	0.188	0.103	0.761			
	AMC6	0.154	0.196	0.122	0.784			

Appendix C. Common method bias analysis

Variable	Indicator	Substantivefactor loading (R1)	R-sq.	Methodfactor loading (R2)	R-sq.
Confidence in distinguishing credible information	CDCI1	0.962***	0.925	−0.134***	0.018
	CDCI2	0.95***	0.903	−0.078***	0.006
	CDCI3	0.935***	0.874	−0.068***	0.005
	CDCI4	0.855***	0.731	0.055***	0.003
	CDCI5	0.811***	0.658	0.093***	0.009
	CDCI6	0.777***	0.604	0.126***	0.016
Endeavor toward determining information veracity on the Internet	EDIV1	0.896***	0.803	−0.015	0.000
	EDIV2	0.923***	0.852	−0.066***	0.004
	EDIV3	0.906***	0.821	−0.046***	0.002
	EDIV4	0.877***	0.769	−0.009	0.000
	EDIV5	0.877***	0.769	−0.026**	0.001
	EDIV6	0.911***	0.830	−0.079***	0.006
	EDIV7	0.884***	0.781	−0.029**	0.001
	EDIV8	0.808***	0.653	0.048***	0.002
	EDIV9	0.754***	0.569	0.124***	0.015
	EDIV10	0.792***	0.627	0.095***	0.009
Smart device usage capability	SDUA1	0.81***	0.656	0.051***	0.003
	SDUA2	0.86***	0.740	0.047***	0.002
	SDUA3	0.949***	0.901	−0.04***	0.002
	SDUA4	0.59***	0.348	0.295***	0.087
	SDUA5	0.843***	0.711	0.083***	0.007
	SDUA6	0.939***	0.882	−0.012	0.000
	SDUA7	1.043***	1.088	−0.146***	0.021
	SDUA8	0.979***	0.958	−0.068***	0.005
	SDUA9	1.018***	1.036	−0.116***	0.013
	SDUA10	1.017***	1.034	−0.101***	0.010

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Variable	Indicator	Substantivefactor loading (R1)	R-sq.	Methodfactor loading (R2)	R-sq.
Critical attitude toward media content	SDUA11	0.897***	0.805	0.031***	0.001
	AMC1	0.747***	0.558	0.099***	0.010
	AMC2	0.732***	0.536	0.082***	0.007
	AMC3	0.782***	0.612	−0.041***	0.002
	AMC4	0.735***	0.540	−0.094***	0.009
	AMC5	0.834***	0.696	−0.033***	0.001
Average	AMC6	0.852***	0.726	−0.033***	0.001
			0.757		0.008

Notes. *p < 0.5; **p < 0.01; ***p < 0.001.

Appendix D. ANOVA and Scheffe test results of each factor across age groups within the same competence group.

	Group1 (G1)	Group2 (G2)	H/H Mean (G1)	Mean (G2)	Mean difference	Std. err.	95 % C. I. Lower	Upper	H/L Mean (G1)	Mean (G2)	Mean difference	Std. err.	95 % C. I. Lower	Upper
Smart device usage capability			(F(2,3594) = 1,001.72, p < 0.001)						(F(2,1032) = 408.50, p < 0.001)					
	Younger adults	Pre-seniors	4.258	3.399	0.859*	0.032	0.782	0.936	3.902	2.771	1.131*	0.066	0.970	1.292
	Younger adults	Older adults	4.258	1.931	2.327*	0.059	2.183	2.470	3.902	1.609	2.294*	0.084	2.087	2.501
Critical attitude toward media content			(F(2,3594) = 9.33, p < 0.001)						(F(2,1032) = 17.17, p < 0.001)					
	Younger adults	Pre-seniors	3.123	3.064	0.059*	0.015	0.021	0.097	2.997	2.850	0.147*	0.034	0.062	0.231
	Younger adults	Older adults	3.123	3.046	0.077*	0.029	0.006	0.147	2.997	2.767	0.230*	0.044	0.121	0.339
Digital media usage level			(F(2,3594) = 491.00, p < 0.001)						(F(2,1032) = 317.96, p < 0.001)					
	Younger adults	Pre-seniors	2.976	2.550	0.426*	0.026	0.361	0.490	2.889	2.192	0.697*	0.058	0.554	0.840
	Younger adults	Older adults	2.976	1.545	1.431*	0.049	1.311	1.550	2.889	1.029	1.860*	0.075	1.677	2.043
SNS use			(F(2,3594) = 211.10, p < 0.001)						(F(2,1032) = 113.34, p < 0.001)					
	Younger adults	Pre-seniors	0.740	0.496	−0.244*	0.017	−0.285	−0.202	0.751	0.443	−0.308*	0.031	−0.384	−0.232
	Younger adults	Older adults	0.740	0.210	−0.529*	0.031	−0.606	−0.453	0.751	0.194	−0.557*	0.040	−0.655	−0.459
Smart device usage capability			(F(2,1348) = 566.59, p < 0.001)						(F(2,3074) = 2,196.70, p < 0.001)					
	Younger adults	Pre-seniors	3.945	2.866	1.079*	0.056	0.942	1.216	3.533	2.228	1.306*	0.040	1.207	1.405
	Younger adults	Older adults	3.945	1.591	2.354*	0.072	2.178	2.531	3.533	1.172	2.361*	0.037	2.272	2.451
Critical attitude toward media content			(F(2,1348) = 0.80, p = 0.449)						(F(2,3074) = 44.85, p < 0.001)					
	Younger adults	Pre-seniors	2.761	2.774	−0.013	0.026	−0.077	0.051	2.535	2.500	0.035	0.032	−0.044	0.115
	Younger adults	Older adults	2.761	2.804	−0.043	0.034	−0.125	0.040	2.535	2.311	0.224*	0.029	0.152	0.296
Digital media usage level			(F(2,1348) = 501.06, p < 0.001)						(F(2,3074) = 1,797.98, p < 0.001)					
	Younger adults	Pre-seniors	2.901	2.425	0.476*	0.044	0.367	0.584	2.711	1.833	0.878*	0.045	0.767	0.988
	Younger adults	Older adults	2.901	1.087	1.814*	0.057	1.673	1.954	2.711	0.468	2.243*	0.041	2.142	2.343

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	Group1 (G1)	Group2 (G2)	H/H Mean (G1)	Mean (G2)	Mean difference	Std. err.	95 % C. I.		H/L Mean (G1)	Mean (G2)	Mean difference	Std. err.	95 % C. I.	
							Lower	Upper					Lower	Upper
SNS use	Pre-seniors	Older adults	2.425	1.087	1.338*	0.059	1.194	1.481	1.833	0.468	1.365*	0.035	1.280	1.450
			(F(2,1348) = 184.86, p < 0.001)						(F(2,3074) = 703.43, p < 0.001)					
	Younger adults	Pre-seniors	0.750	0.405	-0.344*	0.027	-0.409	-0.279	0.669	0.330	-0.339*	0.019	-0.386	-0.292
	Younger adults	Older adults	0.750	0.135	-0.615*	0.034	-0.699	-0.531	0.669	0.040	-0.629*	0.017	-0.672	-0.587
	Pre-seniors	Older adults	0.405	0.135	-0.271*	0.035	-0.357	-0.185	0.330	0.040	-0.290*	0.015	-0.326	-0.254

* indicates the mean difference is significant at the 0.05 level.

Data availability

Data will be made available on request.

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