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The impact of literacy on intention to use digital technology for learning: A comparative study of Korea and Finland

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Abstract

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Keywords: Education; technology; Edu-tech; COVID-19; digital literacy; information literacy

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Abstract

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1. Introduction

Information and communications technology (ICT) and digital technologies are being actively used for education, and the ICT-enabled education market continues to grow. The size of the so-called "Edu-tech" market is around 142 billion US dollars globally, and this figure will rise to 342 billion US dollars in 2025 (Holon IQ, 2019). Moreover, the recent COVID-19 pandemic has fundamentally affected the educational environments. This change affects not only students but also teachers (Adnan and Anwar, 2020; König et al., 2020). The period is undoubtedly very stressful, because within a short period, all teaching and learning activities, such as classes, meetings, seminars, supervision and examinations have been forced to move online (Dhawan, 2020; Dwivedi et al., 2020). For instance, an international study compared the pandemic situations in Indonesia, Malaysia, Philippines, Ireland, and Finland (Teräs et al., 2020). The results show that the pandemic situations in these countries have introduced complex set of challenges, from access to digital technologies and digital divide to pedagogy and academic practice. In the Finnish context, specifically, the authors argue that although many Finnish teachers were very experienced in online learning, even before COVID-19, for many it was the first time to navigate the terrain of digital learning tools, environments and pedagogies on such a wide scale (Teräs et al., 2020). In Korea, the use of technology in teaching has been implemented for almost two decades (HUFS, 2020) but due to COVID-19, moving to fully online teaching was new to many lecturers and students. In Korea, lecturers in higher education were encouraged to use a mixed mode of different teaching modes to deliver online lectures (Crawford et al., 2020). Therefore, it can be concluded that to keep pace with this rapid change and to bring their businesses up to par, educational institutions need to be flexible and adapt quickly. Many researchers have studied how to develop educational technologies and use them effectively in education. For instance, Pablo et al. (2018, p. 7) argue that educational institutions must next to a strategy to deal with digitalisation, also should have a coherent strategy that includes a plan to reskill their workforces. In particular, some scholars have investigated how digital literacy influences individuals' intention to use digital technology (e.g., Nikou et al., 2018; Ribble and Bailey, 2007) or how information literacy helps individuals to find information (Nikou et al. 2019).

Digital literacy has been increasingly controversial since the seminal work of Paul Gilster in 1997 (Belshaw, 2012). According to the Association of College and Research Libraries

(ACRL), digital literacy is the ability to use information and communication skills for discovery, evaluation, creation, and communication, and it requires cognitive and technical skills (2000). Moreover, according to ACRL (2000), information literacy is the ability to solve problems by using the right information sources, applying suitable technology to the information problems required for one's work, knowing when information is required, as well as being able to identify, evaluate, and use it efficiently.

This study investigates the impact of digital literacy and information literacy on intention to use digital technologies for learning. There are studies on the role or effect of digital literacy or information literacy in a specific country (Nikou et al., 2019), but there is a lack of international studies that compare the digital or information literacy of people in two or more countries. This study is an international comparison of the effects of digital literacy and information literacy on intention to use digital technologies for learning in Korea and Finland. For a rigorous comparison, our study focuses on young people in their 20s and 30s, who have been often described as "digital natives" (Prensky, 2001; Ng, 2012; Nikou et al., 2020). Among all generations, young people in their 20s and 30s tend to show little difference in their levels of ICT utilization (KISDI, 2020).

The research questions guiding us throughout this study are as follows.

- *RQ1: Are there differences in ICT usage between Korea and Finland?*
- *RQ2: Do digital literacy and information literacy affect intention to use digital technologies for learning in Korea and Finland?*
- *RQ3: Are there differences between Korea and Finland in terms of the effects of digital literacy and information literacy on intention to use digital technologies for learning?*

To answer the research questions, an integrated conceptual model using the factors from the Unified Theory of Acceptance and Use of Technology (UTAUT: Venkatesh et al., 2003; Venkatesh et al., 2012) and the concepts of information literacy and digital literacy is proposed and tested. This paper also seeks to check the mediating effect of the UTAUT constructs in the relationship between information literacy and intention to use digital technologies for learning and between digital literacy and intention to use digital technologies for learning. Differences of mediating effect between the two countries are also checked. Data was collected From Korea

and Finland and structural equation modelling (SEM) was employed to examine the proposed model. This paper theoretically contributes to the literature by showing that the effect of critical 21st century skills, that is information literacy and digital literacy skills, on individual's intention to use digital technologies for learning differs between Koran and Finnish respondents. This is an important observation as the use of advanced technology in teaching has been implemented for almost two decades in both Korean and Finnish higher educational institutions.

This paper begins a conversation to explore literacy skills, and in particular focuses on the digital literacy and information literacy. After that the research hypotheses are introduced and discussed, and the research model is proposed. Section three provides research methodology, and Section four provides the descriptive and conceptual results. Section five provides discussion and conclusion. Limitation and future research directions are introduced in this section.

2. Literature Review and Research Hypothesis

It has been argued that in the complex information landscape of an information-based society, a broad range of critical 21st century skills (literacy skills [e.g., digital and information], learning skills [e.g., critical thinking skills] and life skills [e.g., leadership skills]) and competences are required (Bawden, 2001; Jensen et al., 2016, p. 4; Mietzner and Kamprath, 2013; Nikou et al., 2018). Such skills and competencies are not "add-ons" to traditional literacy, but rather part of a wider notion of literacy (Bawden, 2001). In particular, information and digital literacy skills enable individuals to use digital technologies more competently.

2.1 Digital literacy

Digital literacy (hereinafter DL) refers to the skills and abilities needed to use the available digital technology (tools, devices, and software) to meet information needs. Gilster (1997) defines DL as: "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers" (p. 1). This term, which is used interchangeably with media literacy or computer literacy, has been widely used among scholars in relation to different contexts, such as the adoption of technologies for personal, academic, and professional use (Beetham and Sharpe, 2011, p. 1), and the cognitive skills needed to understand and use information in multiple formats (Chan et al., 2017, p. 2).

In Korea, DL in the educational context has gained scholarly attention. Because DL consists of a number of complex concepts, various studies have been conducted to measure it objectively and consistently. Many scholars are developing conceptualisation and measurement tools for DL in the educational context (Heo and Chung, 2011; Kang et al., 2014; Ok et al., 2016; Yang and Kim, 2016; Park, 2018). In addition, because it varies greatly between age groups (Nikou et al., 2020), research has assessed the DL of age groups such as children, teenagers, college students, and middle-aged people (Lee, 2007; Kwon and Hyun, 2014; Yi et al., 2020). Comparative studies have also been conducted (Ahn, 2013), and there have been studies on ways to improve DL through public libraries or makerspaces (Bae and Park, 2013; Chang, 2018). Furthermore, researchers have studied the impact of the DL of teachers and students on the use of IT in education (Kim and Lee, 2019; Lee and Lee, 2016).

In Finland, many scholars have also conducted research on DL in the educational context. For example, Niemi et al. (2014) explore DL in the context of digital storytelling for 21st century skills in virtual learning environments. The findings indicate that DL is connected with collaborative learning and sharing; the students enjoyed creating digital stories, and they gained 21st century skills in the process of doing so. DL has also been explored in the context of ICT education for seniors (Naumanen and Tukiainen, 2009). The findings indicate that elderly individuals are capable of and excited about gaining ICT skills, as they are motivated by younger acquaintances as well as by novelty and practicality. Moreover, DL in the Finnish educational setting has been researched in contexts such as Nordic school curriculums (Berge, 2017), and exploring the DL of kindergarten art teachers (Zhao and Li, 2015). In a more recent study on digital skills and ICT skills among Finnish students, Kaarakainen et al. (2018, p. 356) found that students and teachers perform generally better on basic digital skills (e.g. content creation or information searching skills) compared to advanced technological skills (e.g. software and operating system installation and initialisation and maintenance). The authors concluded that ensuring optimal digital skill learning opportunities for every student in the Finnish schools, more training and the interventions and staff development efforts are needed (Kaarakainen et al., 2018, p. 356-357).

2.2 Information literacy

Information literacy (hereinafter IL) refers to a set of skills and abilities to locate, find, evaluate, use, and share information. Machin-Mastromatteo (2012) defines IL as the individual's ability

to manage information in general. As with any instructional and learning technologies, teachers and students need to consider why they are using the tool in class and how it contributes to learning outcomes (Brooks, 2015). Brooks (2015) argues that in the higher education environment, the students with access to digital technology, and in particular, to tablets will be exposed to a variety of information sources and creation tools.

In Korea, many scholars have studied various aspects of IL. There are studies on the definition of the concept and on the education of students to improve their IL. For instance, Oh (2013) describes the major components of the IL of social media users and suggests a way to use social media for educational purposes. Choi (2016) compares instructional design models in IL instruction with those in the field of pedagogy, claiming that IL instruction borrows major models from pedagogy and has recently developed features and characteristics that suit the IT environment. Kim and Lee (2006) analyse IL classes in universities and extract seven components (i.e. information sources, need, access, analysis, management, transfer and communication, and ethics) and propose a curricular model for IL classes. Furthermore, research has been conducted on the impact of IL on educational effectiveness in various academic disciplines such as nursing (Cho and Hwang, 2019), translation (Kim, 2017), math (Kang et al., 2011), and law (Kim and Jung, 2011).

In Finland, IL in the educational context has also received scholarly attention. For example, MacDonald and Saarti (2005) develop a web-based course in IL for students. The findings indicate that the students improved their understanding of IL as they became less intimidated by online databases. Eskola (2005) studies the relationship between learning methods and students' information behaviour in the context of medical students' IL. According to the findings, student IL is developed through active information usage connected to real information needs, as well as through an educational context that provides varying perspectives on issues. Moreover, IL in the Finnish educational setting has been researched in contexts such as e-learning programs at universities (Marcinek et al., 2011), supporting IL at universities (Juntunen et al., 2006), and teacher facilitation of collaborative learning in the context of IL assignments (Sormunen et al., 2013).

2.3 Research hypothesis

To respond to research questions, we adopted the unified theory of acceptance and use of technology (UTAUT: Venkatesh et al., 2003) and its expansion UTAUT II (Venkatesh et al., 2012). In addition, we incorporated the constructs of DL and IL into our research model to examine respondents' intention to use digital technology for learning in Korea and Finland. We employed the UTAUT model not only because it is one of the most widely used conceptual framework to predict the intention to use technology, but also because this framework has been recently been used in the context of digital literacy skills (Mohammadyari and Singh, 2015). The authors showed that digital literacy not only has a positive effect on performance expectancy and effort expectancy, but also it has an impact on the intention to use IT through performance expectancy (Mohammadyari and Singh 2015).

In an information-based society where individuals are overloaded with information, DL skills can enhance the functional use of technology. To understand the diversity of engagement with ICT and potential explanations for why certain people are more digitally literate than others, a clear definition of digital literacy is needed (Helsper, 2016, p. 176). Helsper and Smahel (2020) define digital literacy as set of skills and different levels of engagement with the Internet and other ICTs. The authors argue that higher intensities of use are seen as a positive indicator because they indicate digital embeddedness and confidence in engaging with the opportunities available online (Helsper and Smahel, 2020, p. 1258; Van Deursen et al., 2016).

In this paper, we argue that university students' perceptions of their DL skills may directly or indirectly impact their intention to use digital technology for learning purposes. It may also affect their expectations concerning the effort required to learn and use a new technology and its impact on their academic performance. Therefore, if they benefit from using technology for learning, use of that technology may become habitual end even enjoyable. Thus, we posit that:

H1: There will be a positive relationship between digital literacy and intention to use digital technology for learning.

H1a: There will be a positive relationship between digital literacy and performance expectancy.

H1b: There will be a positive relationship between digital literacy and effort expectancy.

H1c: There will be a positive relationship between digital literacy and habit.

H1d: There will be a positive relationship between digital literacy and hedonic motivation.

We also expect to see an indirect effect of digital literacy on intention to use digital technology for learning mediated by four UTAUT constructs (performance expectancy, effort extinct, habit and hedonic motivation).

The Society of College, National, and University Libraries (SCONUL) has identified seven pillars of IL, one of which emphasises the ability to recognise the information and data landscape of the research context as a foundation for analysing information sources (2011). This ability is particularly important for university students, as college studies require them to evaluate sources of information. Bell and Secker (2014) argue that IL programs enhance higher education in several ways. Moreover, it has been argued that the IL of students is affected by ICT experience, possession of devices, number of ICT-supported university courses, and personal confidence in various aspects of Internet use (Šorgo et al., 2017, p. 751). However, like Šorgo et al. (2017), while many scholars have assessed the impact of digital technology on IL, there is scant research on the impact of IL on students' intentions to use digital technology for learning purposes or on their expectations regarding the performance and effort required. Nevertheless, the impact of IL skills on the habitual use of digital technology for learning has been insufficiently studied. Thus, we posit:

H2: There will be a positive relationship between information literacy and intention to use digital technology for learning.

H2a: There will be a positive relationship between information literacy and performance expectancy.

H2b: There will be a positive relationship between information literacy and effort expectancy.

H2c: There will be a positive relationship between information literacy and habit.

H2d: There will be a positive relationship between information literacy and hedonic motivation.

We also expect to see an indirect effect of information literacy on intention to use digital technology for learning mediated by four UTAUT constructs (performance expectancy, effort extinct, habit and hedonic motivation).

Several prior studies have demonstrated that the UTAUT model is one of the most appropriate conceptual models to predict individual's intention to use technology, especially in the educational settings (Marchewka and Kostiwa, 2007; Thomas et al., 2013). According to Venkatesh et al. (2003, 2012), performance expectancy is defined as "the degree to which an individual believes that the system helps to improve job performance". Moreover, an individual may be more likely to use a new technology if she or he finds that it improves performance. In the context of this research (higher education), we argue that both Korean and Finnish students will be more inclined to use technology for learning purposes. In other words, performance expectancy represents their beliefs regarding whether the use of digital technology will enhance their learning performance.

Thus, we posit that:

H3: There will be a positive relationship between performance expectancy and intention to use digital technology for learning.

Effort expectancy has been argued to be one of the most significant predictors of intention to use technology. According to Venkatesh et al. (2012), effort expectancy is "the degree of ease associated with the use of the system." Some authors (e.g. Cimperman et al., 2016; Nikou, 2019) have compared the effort expectancy to perceived ease of use in the technology acceptance model. In this paper, we argue that the easier a new technology is to use, the more people will intend to use it for learning purposes. We assume that effort expectancy will have a direct impact on Korean and Finnish students' intention to use digital technology for learning. In other words, effort expectancy represents their beliefs regarding its ease of use. Thus, we posit that:

H4: There will be a positive relationship between effort expectancy and intention to use digital technology for learning.

Venkatesh et al. (2012) conceptualises *habit* as having both direct and indirect effects on intention to use. Habit can be defined in two ways: (i) as repeating past behaviour (Kim and

Malhotra, 2005), or (ii) as an individual's belief that behaviour is automatic (Lamayem et al., 2007). In this research, we expect students' past behaviours and habits concerning digital tools and devices will increase their intention to use digital technology for learning. Thus, we posit:

H5: There will be a positive relationship between habit and intention to use digital technology for learning.

Brown and Venkatesh (2005) defined hedonic motivation as an enjoyment or happiness resulting from using a technology, which plays a significant part in determining new technology adoption. Raman and Don (2013) show that hedonic motivation has a positive influence on intention to use learning management software. In this research, we expect the enjoyment and satisfaction that students gain from digital tools and devices will increase their intention to use digital technology for learning. Thus, we posit:

H6: There will be a positive relationship between hedonic motivation and intention to use digital technology for learning.

Based on the above theoretical discussions and the hypotheses, we expect not only DL and IL but also the four UTAUT constructs will have a direct influence on students' use of digital technology for learning. The four UTAUT constructs are also expected to mediate the relationships between IL and DL and intention to use technology for learning. In the proposed conceptual research model, intention to use digital technology for learning is theorised as a dependent variable. Our research model is shown in Figure 1.

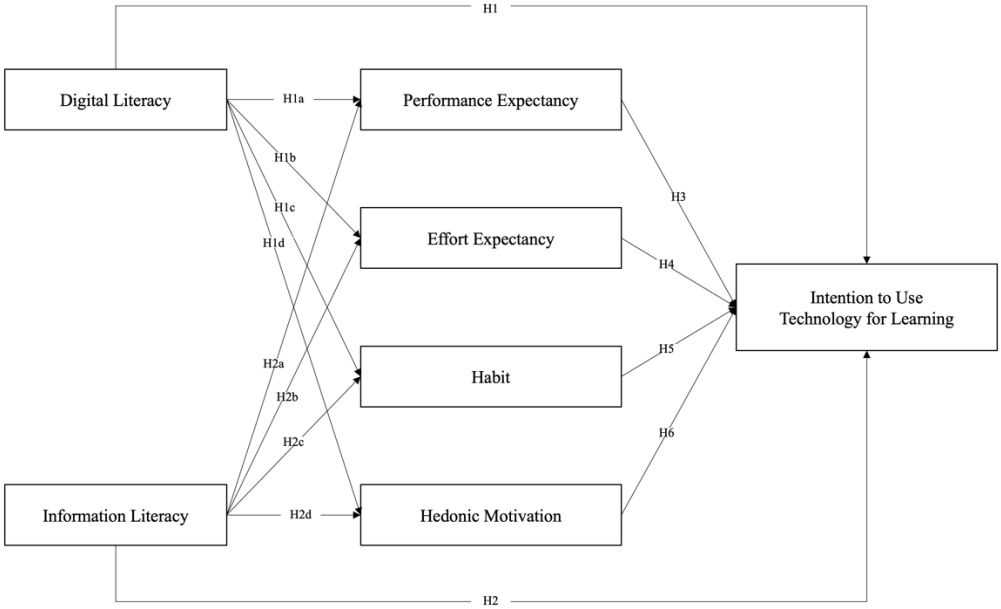


Figure 1. Conceptual research model

3. Methodology

Korea and Finland were selected for our international comparative study. These two countries are the leading ICT powerhouses in Asia and Europe, respectively, and they survive in a global ICT ecosystem mainly led by the US and China. In addition, both countries have global ICT manufacturers such as Samsung Electronics and Nokia, in addition to promising tech start-ups. For example, global mobile apps such as *Angry Birds* and *Clash of Clans* are made in Finland (Helsinki Times, 2020), and *Pinkfong* and *Lineage M* are made in Korea (ABC News, 2018; Pulse, 2020). Because Korea and Finland have the world's best ICT infrastructure, Internet usage and smartphone penetration are also rated as the best in the world (Korea Herald, 2018; OECD, 2020). However, Korea and Finland seem to differ in their educational philosophies and systems, even though both countries have very strong interest and competitiveness in education (BBC News, 2013). While Korea focuses on relative rankings, Finland is committed to equal and personalised education (TED, 2014; The Conversation, 2015). Thus, it is meaningful to compare two countries that enjoy the same level of ICT development but have different educational environments.

For a good comparison, our study focuses on young people aged in their 20s and 30s who—although this is debated (Bennett and Maton, 2010) —are described as "digital natives" (Prensky, 2001; Ng, 2012; Nikou et al., 2020). Digital natives were born in the digital era and

acquired familiarity with digital technology naturally unlike "digital immigrants" who were born before the digital era and later adopted digital technology intentionally (Prensky, 2001). Digital natives are different from other generations in learning or using digital technology especially in learning context (Kivunja, 2014) and they tend to show little difference in their levels of ICT utilization (KISDI, 2020). Thus, we conducted an online survey of these people in both countries. Two identical online survey questionnaires were used to collect data. In Finland, the data were collected between July and August 2019 and in Korea in December 2019. The respondents were recruited through multiple channels, such as university notice boards, student mailing lists, and the authors' social media networks.

The participants were asked to provide their responses to three sets of questions. First, they provided background information on gender, age, and highest level of education. In the second part of the questionnaire, respondents responded to items on their access to digital technologies, frequency of use, and self-reported level of proficiency. In the last section of the questionnaire, based on previous literature, we adopted survey items from validated sources to investigate the factors in our research model (i.e. 10 items on DL (Ng, 2012), 10 items on IL (Ahmad et al., 2020; Kurbanoglu et al., 2006), four items on performance expectancy, four items on effort expectancy, four items on habit, three items on hedonic motivation, and six items on intention to use digital technology for learning, all from Venkatesh et al. (2012). Table 1 presents our survey items. Respondents responded to statements on a seven-point Likert scale, from 1 *strongly disagree* to 7 *strongly agree*. We obtained 192 usable responses from Finland and 194 from Korea.

Table 1. Survey items

Digital Literacy (Ng, 2012)	DL1	I know how to solve my own technical (ICT related) problems.
	DL2	I can learn new digital technologies easily.
	DL3	I keep up with new important digital technologies.
	DL4	I know about a lot of different digital technologies.
	DL5	I have the technical skills I need to use digital technologies for working/learning and to create artefacts (e.g. presentations, wikis, blogs) that demonstrate my understanding of what I have learnt.
	DL6	I do not have good digital technology skills.
	DL7	I am confident with my search and evaluate skills in regard to obtaining information from the Web.
	DL8	I am familiar with issues related to web-based activities (e.g., cyber safety, search issues, plagiarism).
	DL9	Digital technology enables me to collaborate better with my peers on project work and other learning activities.
	DL10	I frequently obtain help with tasks from my friends over the Internet (e.g., through Facebook, Skype, Blogs).
Effort expectancy	EFF1	Learning how to use digital technologies is easy for me.
	EFF2	My interaction with digital technologies is clear and understandable.
	EFF3	I find digital technologies easy to use.

(Venkatesh et al., 2012)	EFF4	It is easy for me to become skillful at using digital technologies.
Habit (Venkatesh et al., 2012)	HAB1	The use of digital technologies has become a habit for me.
	HAB2	I am addicted to using digital technologies.
	HAB3	I must use digital technologies.
	HAB4	Using digital technologies has become natural to me.
Hedonic Motivation (Venkatesh et al., 2012)	HED1	Using digital technologies is fun.
	HED2	Using digital technologies is enjoyable.
	HED3	Using digital technologies is very entertaining.
Information Literacy (Ahmad et al., 2020; Kurbanoglu et al., 2006)	IL1	I know how to define the information I need.
	IL2	I feel confident to select information most suitable to my information needs.
	IL3	I am confident with my ability to interpret visual information (e.g., graphs, tables).
	IL4	I feel competent to learn from my experiences and improve my information literacy skill.
	IL5	I know how to use different kinds of print sources (e.g., books, encyclopedias).
	IL6	I know how to use digital information sources (e.g., search engines, websites, digital databases).
	IL7	I know how to locate information sources in the library.
	IL8	I can create bibliographic records for different kinds of materials (e.g., books, websites).
	IL9	I feel competent to combine newly gathered information with previous information.
	IL10	I am able to critically evaluate the quality of my information seeking process.
Intention to use (Venkatesh et al., 2012)	INT1	I will not hesitate to use digital technologies to access information when I want/need to learn something.
	INT2	I plan to use digital technologies to seek information when I want/need to learn something.
	INT3	I do not intend to use digital technologies to obtain information when I want/need to learn something.
	INT4	I am very likely to use digital technologies to gain information when I want/need to learn something.
	INT5	I will continue using digital technologies for learning purposes in the future.
	INT6	I will recommend my friends to use digital technologies for learning purposes.
Performance expectancy (Venkatesh et al., 2012)	PER1	I find digital technologies useful in my daily life.
	PER2	Using digital technologies increases my chances of achieving things that are important to me.
	PER3	Using digital technologies helps me accomplish things more quickly.
	PER4	Using digital technologies increases my productivity.

To respond to our research questions and test the hypotheses, we conducted three analyses. First, we conducted an independent two-sample t-test to analyse the differences in ICT usage (*RQ1*). Second, we used PLS-SEM to test our research model to investigate whether DL and IL affect intention to use digital technologies for learning in Korea and Finland (*RQ2 and Hypotheses*). Finally, multigroup analysis (MGA) was conducted to compare the path coefficients of the two countries (*RQ3*).

4. Results

4.1 Country differences in ICT usage

The Finnish sample consisted of 116 (61%) males, 74 (39%) females, and two who identified as "other." The Korean sample contained 53 (27.5%) males and 141 (72.5%) females. The

respondents were within the age range of 20 to 39 with an average age of 28.63. The majority of respondents stated that their highest level of education was a bachelor's degree, n = 246 (64%), of whom 88 were Finnish and 158 were Korean. The responses concerning access to digital technology (Table 2), frequency of software use (Table 3), and self-rated proficiency with digital technology can be seen in Table 4.

As shown in Table 2, below, the differences between Korean and Finnish respondents' access to digital technology can be seen in relation to various digital tools. For example, Korean respondents have more access to tablets (mean = 2.64) than Finnish respondents (mean = 1.86); nevertheless, access to these digital devices is not very high for either Korean or Finnish respondents. Moreover, while access to personal computers is much higher for the Korean group, the Finnish group had more access to laptop computers. We found no significant differences between the Koreans and the Finns in relation to other digital tools and technology.

Table 2. Access to digital technology

Digital tools	Mean of Korean respondents (S.D.)	Mean of Finnish respondents (S.D.)	Mean difference
Mobile (smart) phones	4.974 (0.214)	4.952 (0.375)	0.022
Tablets	2.634 (1.621)	1.858 (1.241)	0.776***
Desktop computers (PCs)	4.062 (1.467)	2.805 (1.607)	1.257***
Laptop computers	3.196 (1.571)	4.179 (1.054)	–0.983***
Game consoles	1.664 (1.141)	1.695 (0.955)	–0.031
Wearable devices (e.g., smartwatch, Fitbit)	1.711 (1.365)	1.674 (1.399)	0.037

Note: *$p < .05$. **$p < .01$. ***$p < .001$.

As shown in Table 3, below, there were some differences between Korean and Finnish respondents in their frequency of use of software such as spreadsheets. The use of these applications is much higher for the Korean (mean = 3.90) than the Finnish groups (mean = 2.84). Therefore, it can be concluded that the frequency of software use differs between Korean and Finnish respondents.

Table 3. Frequency of software use

Digital tools	Mean of Korean respondents (S.D.)	Mean of Finnish respondents (S.D.)	Mean difference
Word processors (e.g., Word, Pages)	3.629 (1.453)	3.532 (1.042)	0.097
Spreadsheets (e.g., Excel, Numbers)	3.892 (1.441)	2.821 (1.168)	1.071***
Presentation software (e.g., PowerPoint, Keynote)	2.918 (1.518)	2.384 (0.738)	0.534***
File sharing tools (e.g., Google Drive, Dropbox)	2.768 (1.444)	3.226 (1.087)	–0.458***
Photo/image editing tools (e.g., Photoshop, PhotoScape)	2.572 (1.413)	1.937 (0.990)	0.635***
Website management tools (e.g., WordPress, Squarespace)	1.706 (1.235)	1.484 (0.895)	0.222*
Mobile device organisers (e.g., address book, calendar)	3.716 (1.342)	3.589 (1.243)	0.127

Email services (e.g., Outlook, Gmail)	4.242 (1.246)	4.689 (0.566)	–0.447***
Social media sites (e.g., Facebook, Instagram)	4.134 (1.408)	4.737 (0.662)	–0.603***

Note: *$p < .05$. **$p < .01$. ***$p < .001$.

As shown in Table 4, below, we found some differences between Korean and Finnish respondents' self-reported proficiency with digital tools and technology. The observable difference was in their proficiency with tools such as the MS Word processor and file sharing tools, where the Finnish respondents indicated higher proficiency than the Korean respondents. Therefore, again it can be argued that their self-reported proficiency in digital tools and technology differs.

Table 4. Self-rated proficiency

Digital tools	Mean of Korean respondents (S.D.)	Mean of Finnish respondents (S.D.)	Mean difference
Word processors (e.g., Word, Pages)	4.644 (1.555)	5.842 (0.943)	–1.198***
Spreadsheets (e.g., Excel, Numbers)	4.603 (1.683)	4.384 (1.541)	0.219
Presentation software (e.g., PowerPoint, Keynote)	4.510 (1.725)	5.174 (1.185)	–0.664***
File sharing tools (e.g., Google Drive, Dropbox)	4.206 (1.760)	5.505 (1.316)	–1.299***
Photo/image editing tools (e.g., Photoshop, PhotoScape)	3.732 (1.792)	3.221 (1.707)	0.511*
Website management tools (e.g., WordPress, Squarespace)	2.531 (1.810)	2.574 (1.740)	–0.043
Mobile device organisers (e.g., address book, calendar)	5.284 (1.510)	5.537 (1.359)	–0.253
Email services (e.g., Outlook, Gmail)	5.526 (1.541)	6.147 (0.959)	–0.621***
Social media sites (e.g., Facebook, Instagram)	5.227 (1.827)	5.763 (1.265)	–0.536***

Note: *$p < .05$. **$p < .01$. ***$p < .001$.

4.2 Impact of DL and IL on intention to use digital technology for learning

4.2.1 Survey validation

We examined and assessed the proposed research model by comparing with the measurement model and the structural model. To evaluate the analysis result, we followed the general guideline for PLS-SEM (Hair et al., 2016). Through the factor loadings, composite reliability (CR), and average variance extracted (AVE), the reliability and validity of the measurement model were assessed. The values for CR and AVE were both above the recommended threshold values (0.50 and 0.70, respectively) (see Table 5). However, owing to some low factor loadings, we removed several items (DL10, DL6, IL8, and INT 3) from the analysis.

Table 5. Construct reliability results

Construct	No. of items	Item loading	Cronbach's α	CR	AVE
Digital literacy	8	0.746–0.887	0.930	0.942	0.671
Effort expectancy	4	0.916–0.942	0.950	0.964	0.870
Habit	4	0.691–0.902	0.838	0.886	0.663

Hedonic motivation	3	0.919–0.952	0.934	0.958	0.883
Information literacy	9	0.768–0.846	0.935	0.946	0.660
Intention to use	5	0.826–0.932	0.933	0.924	0.689
Performance expectancy	4	0.796–0.926	0.906	0.934	0.781

To establish discriminant validity, we used the square root of AVE for each latent variable (Fornell and Larcker, 1981). The obtained values were higher than those for other correlations among the latent variables (see Table 6). Therefore, we established discriminant validity in our dataset.

Table 6. Discriminant validity [Fornell and Larcker, 2015]

Construct	**DL**	**EFF**	**HAB**	**HED**	**IL**	**INT**	**PER**
Digital literacy	**0.819**						
Effort expectancy	0.822	**0.933**					
Habit	0.612	0.657	**0.814**				
Hedonic motivation	0.659	0.734	0.668	**0.939**			
Information literacy	0.771	0.732	0.576	0.612	**0.812**		
Intention to use	0.638	0.669	0.742	0.607	0.691	**0.888**	
Performance expectancy	0.650	0.697	0.688	0.674	0.668	0.769	**0.884**

Note: DL= Digital literacy; EFF= Effort expectancy; HAB = Habit; HED = Hedonic motivation; IL = Information literacy; INT = Intention to use; and PER = Performance expectancy

However, as we used PLS-SEM to perform the analysis, we report the results of the heterotrait–monotrait ratio (HTMT), which is an alternative approach to establishing discriminant validity. All values were below the recommended value of 0.85; see Table 7.

Table 7. Discriminant validity: Heterotrait–monotrait ratio [HTMT]

Construct	**DL**	**EFF**	**HAB**	**HED**	**IL**	**INT**	**PER**
Digital literacy							
Effort expectancy	0.834						
Habit	0.651	0.690					
Hedonic motivation	0.703	0.777	0.726				
Information literacy	0.819	0.771	0.590	0.649			
Intention to use	0.678	0.711	0.763	0.649	0.731		
Performance expectancy	0.702	0.753	0.722	0.733	0.718	0.831	

Note: DL= Digital literacy; EFF = Effort expectancy; HAB = Habit; HED = Hedonic motivation; IL = Information literacy; INT = Intention to use; and PER = Performance expectancy

4.2.2 Hypothesis testing

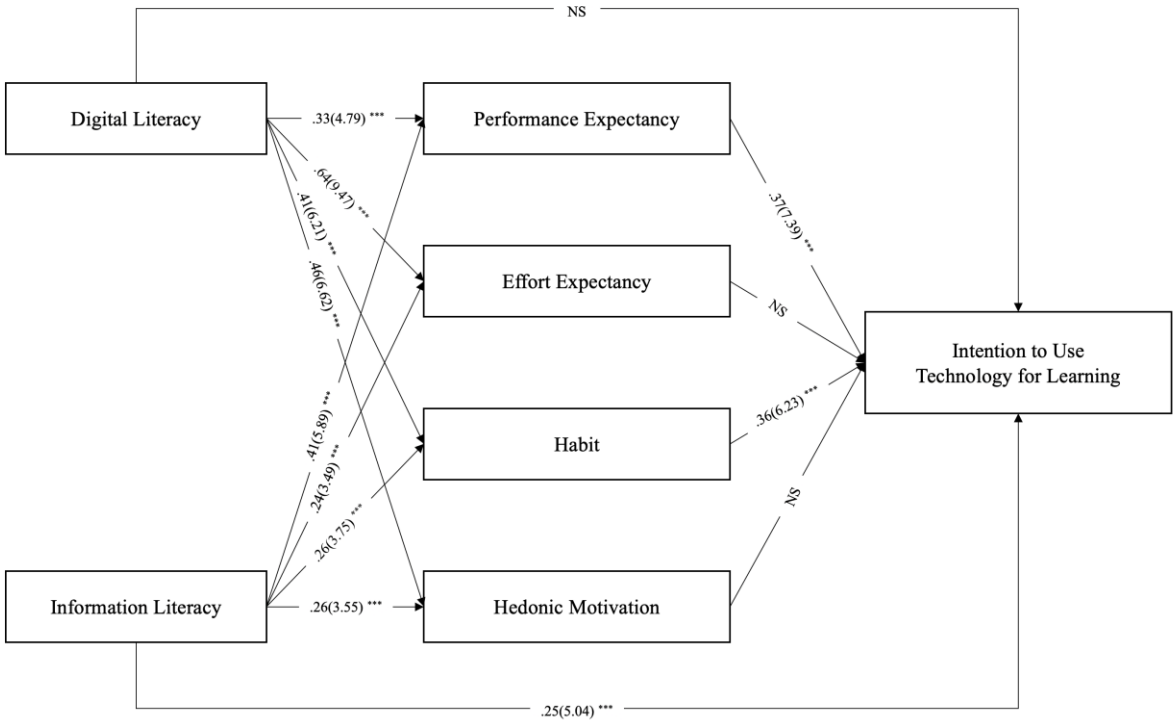
To test our research hypotheses, we used the entire dataset of 386 respondents (194 Korean; 192 Finnish). The SEM results show that 71% of the variance in intention to use digital

technology for learning was explained (see Figure 2). For the UTAUT constructs, performance expectancy, effort expectancy, habit, and hedonic motivation, 49%, 70%, 40%, and 46% of the variance was explained, respectively. Regarding the path analysis, the SEM results showed that DL has no direct impact on intention to use technology for learning, so H1 was rejected. However, the SEM results showed that DL has a direct impact on all four UTAUT constructs. H1a was supported since the higher DL was related to performance expectancy with a medium effect (β = .33, t = 4.794, p < .001) as the effect sizes of between 0.3 and 0.7 are considered medium (Teo and Noyes, 2011). The higher DL was related to effort expectancy with a medium effect (β = .64, t = 9.474, p < .001), so H1b was supported. The higher DL was related to higher habit with a medium effect (β = .41, t = 6.215, p < .001), so H1c was supported. The higher DL was related to higher hedonic motivation with a medium effect (β = .46, t = 6.625, p < .001), so H1d was supported. Therefore, the results present that digital literacy have a positive effect on performance expectancy, effort expectance, habit, and hedonic motivation.

Moreover, the SEM results showed that IL has a direct impact on intention to use digital technology for learning. The higher IL was related to higher intention to use digital technology for learning with a small effect (β = .25, t = 5.044, p < .001), so H2 was supported. The SEM results also showed that IL has a direct impact on all four UTAUT constructs. The higher IL was related to higher performance expectancy with a medium effect (β = .41, t = 5.934, p < .001), so H2a was supported. The IL was related to higher effort expectancy with a small effect (β = .24, t = 3.494, p < .001), so H2b was supported. The higher IL was related to higher habit with a small effect (β = .26, t = 3.753, p < .001), so H2c was supported. The higher IL was related to higher hedonic motivation with a small effect (β = .26, t = 3.554, p < .001), so H1d was supported. Therefore, the results reveal that information literacy have a positive effect on intention to use digital technology for learning, performance expectancy, effort expectance, habit, and hedonic motivation.

Regarding the influence of the UTAUT constructs (performance expectancy, effort expectancy, habit, and hedonic motivation) on intention to use, the SEM analysis revealed interesting results. The higher performance expectancy was related to higher intention to use digital technology for learning with a medium effect (β = .37, t = 7.392, p < .001). The higher habit was related to higher intention to use digital technology for learning with a medium effect (β = .36, t = 6.226, p < .001). Thus, H3 and H5 were supported. The coefficients for the paths

between effort expectancy and hedonic motivation were not positively associated with the intention to use technology for learning; therefore, both H4 and H6 were rejected. The results show that two of four UTAUT constructs could not have positive effects on intention to use digital technology for learning. Only performance expectancy and habit have positive effects on intention to use digital technology for learning.



*Notes: *p < .05. **p < .01. ***p < .001.*

Figure 2. Structural model results

4.2.3 Mediation effect

To examine whether the UTAUT constructs— performance expectancy, effort expectancy, habit, and hedonic motivation—mediate the path relationships from DL and IL to intention to use digital technology, we ran a mediation test. The results showed some interesting mediation effects, specifically regarding the path between DL and intention to use, which was fully mediated by habit ($\beta = .15$, $t = 4.353$, $p < .001$) and performance expectancy ($\beta = .13$, $t = 3.957$, $p < .001$). Moreover, the path from IL to intention to use was also partially mediated by habit ($\beta = .10$, $t = 3.233$, $p < .001$) and performance expectancy ($\beta = .15$, $t = 4.383$, $p < .001$). As for effort expectancy and hedonic motivation, we did not find any mediation effects.

Overall, the results present that the higher DL or IL was related performance expectancy, effort expectancy, habit and hedonic motivation. In addition, IL has a direct effect on the intention to use technologies for learning, and the effect of DL on the intention to use is only released through the mediation effects of performance expectancy and habit. The results indicate that digital literacy does not have a direct impact on the intention to use digital technology for learning, but it does use two UTAUT constructs as mediators.

4.3 Country differences around the impacts of DL and IL

We ran a multigroup analysis (MGA) to find differences in path coefficients between the Korean and Finnish respondents. The intention was to examine whether the impact of DL, IL, or the four constructs of UTAUT on intention to use digital technology for learning differed between Korean and Finnish respondents. Before conducting multigroup analysis, we followed the measurement invariance of composite models (MICOMS; Henseler et al., 2016) which are configural invariance, compositional invariance, and equality of composite mean values and variance. The test results present that our dataset of the two countries can be pooled but possibility of structural model differences still needs to be considered, so MGA is conducted (Henseler et al., 2016; Hair et al., 2018). The MGA revealed interesting differences in results for the path relationships of the two groups, as shown as Table 8.

The coefficient for the path between DL and intention to use was not significant for either group, and the path between IL and intention to use was significant only for Finnish respondents (β = .26, t = 3.252, p < .001). Moreover, the MGA results showed no significant differences between the groups regarding the path between DL and the UTAUT constructs (performance expectancy, effort expectancy, habit, and hedonic motivation). For both Korean and Finnish respondents, these path coefficients were positive and significant. However, the MGA yielded different results when the paths between IL and the UTAUT constructs were examined. For example, IL was positively associated with all four UTAUT constructs for the Korean respondents, but none were significant for the Finnish respondents. This is a very important observation, as it shows the interplay between the literacy skills and the decisions of individuals to use digital technology. It is rather surprising to see that the IL skills of the Finnish respondents had no impact on the UTAUT constructs.

When the path relationships between the UTAUT constructs and the intention to use were assessed, the MGA revealed no significant differences between the Korean and Finnish respondents. For example, the coefficients of the paths from performance expectancy to intention to use and from habit to intention to use were positive for both groups. For the other two paths: effort expectancy to intention to use, and hedonic motivation to intention to use, the MGA results did not reveal any differences between the groups.

Regarding the mediation effects of the four UTAUT constructs between DL and intention to use as well as between IL and intention to use, the MGA revealed many significant differences between the two groups. For example, while the path from IL to intention to use was mediated by habit for the Korean group (β = .13, t = 2.293, p < .001), the coefficient was not significant for the Finnish group. Moreover, while the path between IL and intention to use was mediated by performance expectancy for the Korean group (β = .22, t = 3.752, p < .001), this path coefficient was not significant for the Finnish group. Finally, the path between DL and intention to use was mediated by performance expectancy for the Finnish group (β = .14, t = 2.932, p < .001), but the coefficient was not significant for the Korean group.

Table 8. MGA results

Path	**Difference in path coefficients**	
DL → Intention to use	No	not significant for either
IL → Intention to use	Yes	positive only for Finns
DL → UTAUT constructs	No	positive for both
IL → UTAUT constructs	Yes	positive only for Koreans
Performance expectancy → Intention to use	No	positive for both
Effort expectancy → Intention to use	No	not significant for either
Habit → Intention to use	No	positive for both
Hedonic motivation → Intention to use	No	not significant for either
IL → Habit → Intention to use	Yes	positive only for Koreans
IL → Performance expectancy → Intention to use	Yes	positive only for Koreans
DL → Performance expectancy → Intention to use	Yes	positive only for Finns

5. Discussion and Conclusion

The core theoretical aim of this paper was to develop a conceptual model to investigate the DL and IL of young Koreans and Finns in their 20s and 30s. In this paper, in addition to DL and IL as separate constructs, we incorporated a theoretical model with four constructs from UTAUT (i.e., performance expectancy, effort expectancy, habit, and hedonic motivation). The theoretical contribution of this paper to the literature is to propose an integrated theoretical model that includes DL, IL, and four UTAUT constructs. To the best of our knowledge, this is one of the first studies to use such a conceptual model. Most if not all prior studies have either investigated the intention to use digital technology for learning via both UTAUT models or have studied the impact of DL and IL on intention to use digital technology for learning. However, this combination (incorporating both DL and IL into the UTAUT model) has never been investigated.

The results showed that not only was the UTAUT model strongly validated by the results in predicting young people's intention to use digital technology for learning, but it also showed that IL has only a direct positive impact on Finnish respondents' intention to use technology. The SEM results showed that the effects of DL and IL on intention to use digital technologies for learning differ between young people in Korea and Finland. Our results contribute to the literature by showing that both dimensions of literacy—information and digital—affect individual decisions to use digital technology for learning. Our findings show that the relationships of DL and IL with all four UTAUT constructs (performance expectancy, effort expectancy, habit, and hedonic motivation) were significant. These findings suggest that individual DL facilitates the use of digital technology for learning purposes. Moreover, prior studies have demonstrated a positive impact of effort expectancy (e.g., Wang and Shih, 2009) on intention to use technology for learning; however, Jairak et al. (2009) find no such effect. In this paper, it was found that effort expectancy positively impacts intention to use digital technology for both Koreans and Finns. In addition, Venkatesh et al. (2003) indicate that the UTAUT model explains approximately 70% of the variance of behavioural intention. In our paper, we confirmed this by showing that 71% of the variance of intention to use digital technology for learning was explained. However, it should be noted that the SEM results and hypothesis test outcomes provide mixed support for our proposed model. Consistent with prior results, the analysis results showed no significant impact of effort expectancy or hedonic

motivation on people's intention to use digital technology (Salloum and Shaalan, 2018). Furthermore, the analysis results also provide theoretical support for an earlier study by Mohammadyari and Singh (2015) by showing that the factors such as performance expectancy and habit have significant effects on intention to use digital technology. So, our results imply that the factors influencing the intention to use digital technology may vary depending on the purpose of using digital technology. For instance, the factors that affect the intention to use digital technology for learning may be different from those for general purpose.

Moreover, the results showed that both young Koreans and Finns are similar in many respects. The groups' proficiency in the use of digital technologies and tools for learning was not substantially different. These results confirmed our expectation that young people in both countries might show little difference in their levels of ICT utilization. The higher DL was related to the higher UTAUT constructs (performance expectancy, effort expectancy, habit, and hedonic motivation) for both countries. In addition, the higher performance expectancy and habit were related to higher intention to use for both countries. In spite of these similarities, there are substantial differences in their use of digital technology for learning. Korean respondents reported extensive use of PCs and tablets in their studies, whereas the Finns reported extensive use of laptops. Furthermore, only for Finns the higher IL was related to higher intention to use. The effect of DL on the intention to use is released through the mediation effects of performance expectancy only for Finns. Only for Koreans, the higher IL was related to higher UTAUT constructs. The effect of IL on the intention to use is released through the mediation effects of performance expectancy and habit only for Koreans. These intergroup comparisons present that IL affects intention to use digital technology for learning for Finns. For Koreans, IL does not directly affect intention to use digital technology for learning. These results may have a few important social implications. For example, in Korea, enhancing IL will not bring to higher intention to use digital technology for learning. Accordingly, governments and other stakeholders should pay attention to people's performance expectancy and habit to make them mediate IL and the intention to use digital technology for learning.

This study is not without limitations. Owing to the context of this research (Korea and Finland), further research is needed in other countries to examine our proposed conceptual model. This can be done by including other people in different age groups; we only considered young people in their 20s and 30s. Moreover, we did not examine demographic differences between the young

Korean and Finnish people. Furthermore, we recommend that future studies pay greater attention to DL and IL in other contexts beyond learning. It would be also useful to consider other types of literacy such as media literacy when socio-cultural perception is more important.

Despite of these limitations, the findings of this research suggest several implications for encouraging people to better use digital technology for learning in the COVID-19 pandemic situation. We expect that the results of this paper will increase the understanding of DL and IL in learning. The practical implications of the results indicate that DL and IL standards must be consciously and deliberately incorporated into the educational process. In the COVID-19 pandemic, not only educational institutions but also other organisations are moving online and investing heavily in digital tools, devices, and technologies for learning and performing tasks. Therefore, if they aim to increase the use of digital technologies for learning purposes, they should define specific strategies that consider the needs for programs, instructions, and training sessions to enhance learners' IL and DL skills. The governments also need more active policy initiatives to support extensive literacy education through public resources. However, considering the differences between the Korean and Finnish groups in this study, a detailed literacy program should be country specific.

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