

**SKILLS
FOR LIFE**

Digital Literacy

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Korea Education and Research Information Service (KERIS) is a public institution under the Korean Ministry of Education. KERIS promotes national and global initiatives and supports policymaking related to Information and Communication Technology (ICT) education ranging from kindergarten to higher education.

The authors used the KERIS digital literacy assessment studies to write this brief (see Table 6).

Abstract

As the global economy and workforce are constantly being diversified with a greater emphasis on technology, 21st Century citizens are required to acquire basic digital literacy competencies. In this brief, we examine the concept of literacy and digital literacy. Then, we review the latest digital literacy studies in the United Nations Educational, Scientific and Cultural Organization (UNESCO), the European Commission, the United Kingdom, and the United States. Lastly, we provide suggestions by comparing digital literacy studies, including ICT studies, in South Korea with international literacy assessment metrics. This brief aims to contribute to developing digital literacy measurements applicable to ICT in education internationally and mitigate the digital divide.

1. Introduction

As the global economy and workforce are constantly being diversified with a greater emphasis on technology, 21st Century citizens are required to acquire basic digital literacy competencies, such as self-learning and skills necessary for using self-learning tools (Partnership for 21st Century Skills, 2002, p. 5). Such self-learning skills include Information and Communication Technology (ICT) usage, critical thinking and problem-solving, social relationships, and self-management; in particular, ICT is one self-learning tool (Han et al., 2006, p. 2., para.2)










To this end, the South Korean government has been aware of the importance of ICT literacy since the early 2000s. Recently, ICT literacy level assessments have been expanded to digital literacy, which includes digital media and related technologies. For the past three years, national-level digital literacy research was conducted in elementary and secondary schools. As a result, the ICT and digital literacy assessments have provided primary reference and evidence for the nation's ICT education policies, contributing to resolving the digital divide between students, while improving overall performance.

This brief consists of three sections themed with varying aspects of digital literacy. The first section will examine the concept of literacy and digital literacy. The second section will review the latest digital literacy studies in the United Nations Educational, Scientific and Cultural Organization (UNESCO), the European Commission, the United Kingdom, and the United States. The third and final section will provide suggestions by comparing digital literacy studies, including ICT studies, in South Korea with international literacy assessment metrics. Therefore, this brief aims to contribute to developing digital literacy measurements applicable to ICT in education internationally and mitigate the digital divide.

2. Transformation of literacy and the concept of digital literacy

The concept of literacy started with basic skills, such as reading, writing, and arithmetic. However, definitions of literacy have expanded depending on the required knowledge and skills to meet specific purposes. Literacy, in the same domain, could be expanded or advanced in response to the creation or shift of a purpose. In the chart below, Han et al. (2006) categorize the evolution of literacy based on the type of literacy, period, and category (p. 28).

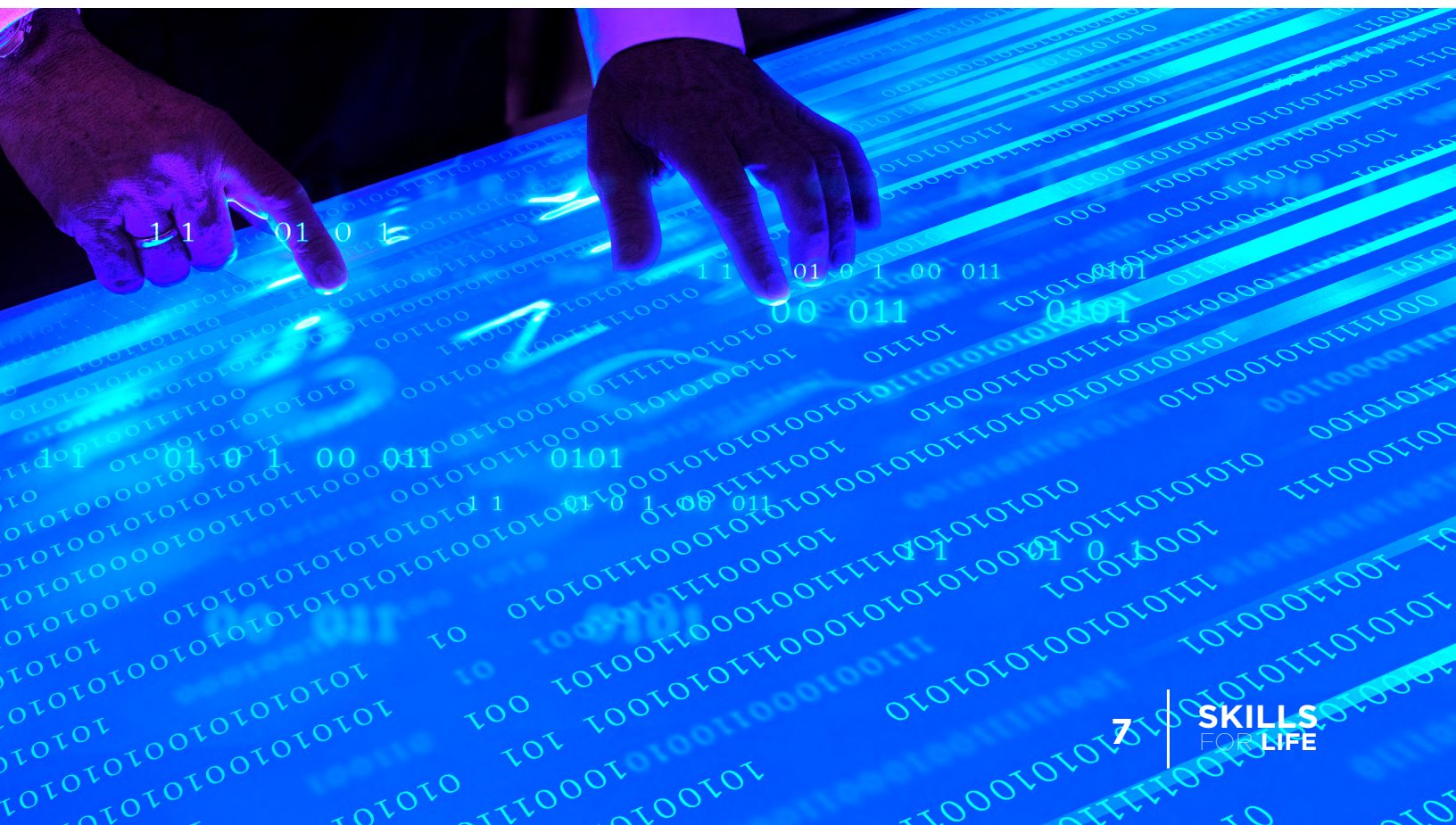
Table 1. Evolution of Literacy

| Types of Literacy | Period | Competencies |
|---|-----------------|--|
|  3Rs (Reading, Writing, Arithmetic) | 5,000 years ago | Reading, Writing, Arithmetic |
|  Visual Literacy | 1960s | Visual thinking, learning, communication, creation |
|  Television Literacy | 1950s | Visual literacy, critical thinking |
|  Computer Literacy | 1980s | Computer knowledge, computer proficiency, attitude towards computers |
|  Multimedia Literacy | 1990s | Information, communication, multi-media |
|  Information Literacy | 1990s | Recognizing the need for information, searching for sources of information, critical thinking |
|  ICT Literacy | Late 1990s | Media utilization, information searching, and screening, information assessment, problem-solving |
|  Media Literacy | Late 1990s | Information literacy, computer literacy, movie, and video literacy, cultural literacy |
|  Digital Literacy | 2000s | Computer literacy, network literacy, information literacy |

Source: Han et al., 2006, pp. 28-29

Digital literacy was first conceived in a Paul Gilster in 1997. Here, Gilster (1997) defined digital literacy as “the ability to understand and use information in multiple formats from a wide range of sources when it is presented via a computer” (p. 9). This newly defined concept of literacy in the digital domain established digital literacy apart from the conventional literacies of reading, writing, and arithmetic.

Furthermore, the research of Gilster (1997) inspired numerous digital literacy studies around the world. Gilster (1997) defined it 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). Similarly, Yu (2001) said that digital literacy is the ability to create new knowledge via a process of assessing, filtering, and processing digitalized information (p. 100). Conversely, others viewed digital literacy from a technological aspect or pedagogical aspect that includes the use of technology. Scholars who see digital literacy apart from a technological aspect defined digital literacy as focusing on the ability to use digital media, namely see it as acquiring and understanding the skills for manipulating and transmitting new forms of information (Eshet-Alkalai, 2004, p. 93)



Since the early 2000s, South Korea has been a leader in ICT accessibility, in addition to the number of Internet users and broadband internet subscribers. However, these indicators may not be directly translated into high ICT literacy among users. Thus, it was necessary to examine and track the ICT literacy of users. In response, the Korea Education and Research Information Service (KERIS) developed a digital literacy competency index to improve ICT abilities (Han et al., 2006). This study emphasized the importance of ICT literacy levels and the development of the digital literacy competency index as a prerequisite for South Korea to maintain its leading status in IT. Furthermore, it argued that the measurement of literacy needed to account for the unpredictable nature of advances and implications of digital media and technology. This digital literacy was defined as an ability to use digital media and technology efficiently with skills, knowledge, and critical thinking skills to solve problems, communicate, and create new knowledge.

Also, under the premise that literacy consists of technological and cognitive aspects, this study further argued that the social aspects that account for the interaction between technological and cognitive aspects must also be considered (Educational Testing Service [ETS], 2006, p. 15). The results of the digital literacy measurement tool could also be reflected in the curricula of training and official and unofficial education.

In South Korea, recent national digital literacy level studies on elementary and secondary school students focused on developing appropriate frameworks and categories, from the technological and pedagogical perspective in the era of the digital transition. After the 2015 Revised National Curriculum made computational thinking education compulsory, questions on computational thinking were added. KERIS defines digital literacy as, “a basic skill necessary to live an independent life as a member of a digital society and that includes practical abilities to solve everyday problems by searching, managing, and creating information with the understanding and utilization of digital technology and ethical attitudes” (Lee et al., 2019 p. 15)

3. Latest research trends in digital literacy: Competence areas and levels

Organizations and researchers have studied and assessed digital literacy in European Commission, the United Kingdom, and the United States, which will be reviewed in this section. First, UNESCO's 2018 definition of digital literacy combines the abilities required to incorporate individuals in a digital society, which is emphasized in recent studies. Here, digital literacy is defined as, "the ability to access, manage, understand, integrate, communicate, evaluate, and create information safely and appropriately through digital technologies for employment, decent jobs, and entrepreneurship. It includes competencies that are variously referred to as computer literacy, ICT literacy, information literacy, and media literacy" (Law et al., 2018, p. 6).

European Commission introduced DigComp (Digital Competence) 2.0 frameworks in 2016 (Vuorikari et al., 2016). DigComp yields tools for increasing European citizen's digital competency and centers on education, vocational training, and the workplace. DigComp2.0 framework includes five digital competence areas and competencies, the areas being 1) Information and data literacy, 2) Communication and collaboration, 3) Digital content creation, 4) Safety, and 5) Problem-solving (Carretero et al., 2017)



Table 2. DigComp (Digital Competence) 2.0.

| Competence areas | Competences |
|--|---|
| Information and data literacy | 1.1 Browsing, searching, and filtering data, information, and digital content 1.2 Evaluating data, information, and digital content 1.3 Managing data, information, and digital content |
| Communication and collaboration | 2.1 Interacting through digital technologies 2.2 Sharing through digital technologies 2.3 Engaging in citizenship through digital technologies 2.4 Collaborating through digital technologies 2.5 Netiquette 2.6 Managing digital identity |
| Digital content creation | 3.1 Developing digital content 3.2 Integrating and re-elaborating digital content 3.3 Copyright and licenses 3.4 Programming |
| Safety | 4.1 Protecting devices 4.2 Protecting personal data and privacy 4.3 Protecting health and well-being 4.4 Protecting the environment |
| Problem-solving | 5.1 Solving technical problems 5.2 Identifying needs and technological responses 5.3 Creatively using digital technologies 5.4 Identifying digital competence gaps |

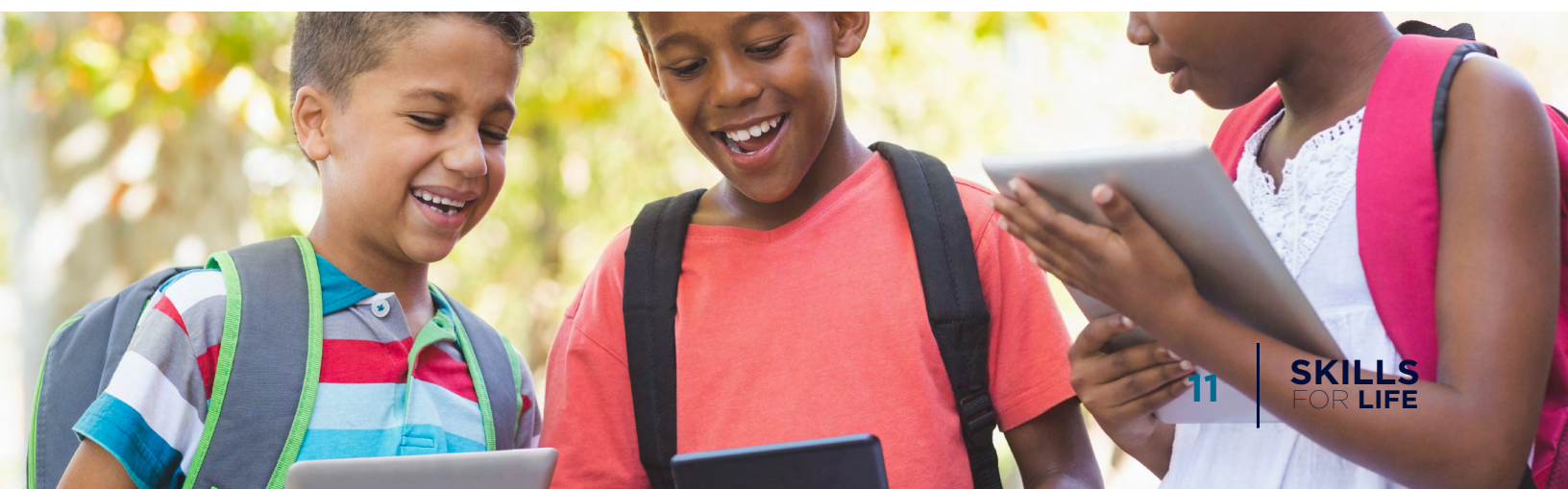
Source: Vuorikari et al., 2016, pp. 8-9

Then, in 2017 European Commission updated DigComp2.0 to DigComp2.1 (Carretero Gomez et al., 2017). This update pointed out that digital competence should be a part of basic education for citizens. The recent version diversified levels of DigComp from 3 to 8 and gave detailed examples for each level of competence.

Table 3. DigComp 2.1 Proficiency Levels.

| Levels in DigComp2.1 | Complexity of tasks | Autonomy | Cognitive domain |
|-----------------------------|---|--|-------------------------|
| 1 | Simple task | With guidance | Remembering |
| 2 | Simple task | Autonomy and guidance where needed | Remembering |
| 3 | Well-defined and routine tasks, and straightforward problems | On my own | Understanding |
| 4 | Tasks, and well-defined and non-routine problems | Independent and according to my needs | Understanding |
| 5 | Different tasks and problems | Guiding others | Applying |
| 6 | Most appropriate tasks | Able to adapt to others in a complex context | Evaluating |
| 7 | Resolve complex problems with limited solutions | Integrate to contribute to the professional practice and to guide others | Creating |
| 8 | Resolve complex problems with many interacting factors | Propose new ideas and processes to the field | Creating |

Source: Carretero Gomez et al., 2019. p.13



In the United Kingdom, a JISC (2014) national study defined digital literacies as the capabilities which fit an individual for living, learning, and working in a digital society. The study also suggests seven elements of digital literacy that are essential in higher education and the professional workforce which are in response to changes in the latest technology. This means that digital literacies encompass a range of capacities in multiple dimensions, rather than a single capacity. Therefore, digital literacy is a combination of media literacy, information literacy, digital scholarship, learning skills, career and identity management, and communication and collaboration (JISC, 2014). Also, digital literacy includes the capacity to manage oneself in a new technological environment and the capacity to communicate and collaborate with others in an online environment. It is natural that on/offline communication and collaboration is gaining more significance, in the context of openness and connection of Web 2.0 and the Fourth Industrial Revolution.

Table 4. JISC’s seven elements of digital literacies

| Competence areas | Competences |
|-------------------------------|---|
| Media literacy | Critically read and creatively produce academic and professional communications in a range of media |
| Information literacy | Find, interpret, evaluate, manage, and share information |
| Digital scholarship | Participate in emerging academic, professional, and research practices that depend on digital systems |
| Learning skills | Study and learn effectively in technology-rich environments, formal and informal |
| ICT literacy | Adopt, adapt, and use digital devices, applications, and services |
| Career & identity management | Manage digital reputation and online identity |
| Communication & collaboration | Participate in digital networks for learning and research |

Source: JISC, 2014. para. 1

On the other hand, the popular online learning platform TeachHUB (2019), which is provided by the K-12 Teachers Alliance in the United States, explained digital literacy as the eight transformative technology in-the-classroom skills required of the digitally literate student. This definition highlighted the necessity to initiate digital literacy education in kindergartens where students are first exposed to the internet.

Table 5. Eight transformative technology-in-the-classroom skills

| Competence areas | Competences |
|--|--|
| Basic Technology-in-the-Classroom Tools | Skills to utilize digital devices for learning (Digital devices, digital class calendar, annotation tool, Student digital portfolios, class website or blog, Vocabulary tool) |
| Social Media | Using social media to share information and ideas (rather than using it for a space for gossip) |
| Cloud Computing | “Today’s classwork means starting a report at school and finishing it at home” with the internet, overcoming limitations of differing file formats |
| Digital Database | Access to digital databases in and out of school |
| Virtual Collaboration | Virtual collaboration through sites like Google Hangouts and Skype |
| Sharing to Build Knowledge | Presenting shared knowledge and insights (through webpages, wikis, YouTube streams) |
| Evaluate Information Found Online | Evaluating the reliability and veracity of online information (e.g., Is the site legitimate? Is the author an expert? Is the information current or dated? Is the data neutral or biased?) |
| Digital Citizenship | Cyberbullying, the legality of online material, buying items online, digital footprints, privacy and safety |

Source: TeachHUB, 2019. para. 2

These digital literacy studies and assessments share common elements in the composition of recent digital literacies. First, communication skills in the online environment were emphasized. It is required that learners transmit, process, and share data and information irrespective of physical location and device used. Second, the ability to reorganize given information or create new information is important. This especially includes the capacity to creatively reorganize information for efficient problem-solving. Third, ethical aspects such as privacy protection, copyright, and netiquette receive constant attention. Lastly, practical aspects of problem-solving are emphasized as a required skill in the future.

4. Digital literacy measurement and assessments of South Korea and leading countries

Since 2007, South Korea has conducted digital literacy assessments annually. In 2009, a performance assessment tool was developed where participants were asked to complete tasks according to given directions. In 2016, computational thinking was incorporated into the assessment questionnaire. In 2018, the main domains of assessment become ICT elements and computational thinking. Findings from these studies have directly and indirectly influenced the South Korean ICT-based education policies in the digital era. National ICT literacy level measurement since 2007 is as follows.

Table 6. South Korea’s ICT and Digital Literacy Assessments

| Year | Title | Main objective |
|------|---|---|
| 2007 | Developing ICT literacy assessment tools for elementary students (Lee et al, 2007) | Developing ICT literacy assessment tool-for elementary students |
| 2008 | Development of Self - Diagnostic Indicators for ICT in Primary and Secondary Schools (Baek et al, 2008) | Developing ICT literacy assessment tool-for secondary students |
| 2009 | National ICT literacy assessment for elementary and secondary students (Kim G. et al, 2009) | Developing online assessment systems |
| | Developing performance ICT literacy assessment tool (Baek S. et al, 2009) | Developing a performance assessment tool |
| 2010 | 2010 National ICT literacy assessment for elementary and secondary students (Kim G. et al, 2010) | Conduct online assessment, switch focus to capability elements |
| 2011 | 2011 National ICT literacy assessment for elementary and secondary students (Kim H. et al, 2011) | Developing questions and meta-data for questionnaire DB construction (300 questions), conduct online assessment |
| 2012 | 2012 National ICT literacy assessment for elementary and secondary students (Kim Y. et al, 2012) | System improvement, conduct online assessment |
| 2013 | Correlation analysis of ICT literacy and education variables (Kim H. C., Kim H. R., et al, 2013) | Time series analysis of ICT literacy (2010-2012) and analysis between education variables |

| | | |
|-------------|--|--|
| 2014 | 2014 National ICT literacy assessment for elementary and secondary students (An S. et al, 2014) | Questionnaire revision, conduct online assessment, suggest improvements for ICT literacy measurement |
| 2015 | 2015 National ICT literacy assessment for elementary and secondary students (An S. et al, 2015) | Questionnaire revision, conduct online assessment, suggest improvements for ICT literacy measurement |
| 2016 | 2016 National ICT literacy assessment for elementary and secondary students (Chae G. et al, 2016) | Questionnaire revision, conduct online assessment, introduce computational thinking |
| 2018 | 2018 National digital literacy assessment for elementary and secondary students (Lee H. et al, 2018) | Transition to digital literacy framework, conduct online assessment |
| 2019 | 2019 National digital literacy assessment for elementary and secondary students (Lee H. et al, 2019) | Revise 2018 digital literacy questionnaire, conduct online assessment, time series analysis (18-19) |

South Korea's digital literacy assessments include ICT elements and computational thinking elements. First, ICT elements of the South Korean assessment studies are composed of search, analysis, and evaluation, organization and creation, utilization and management, and communication.

Second, computational thinking consists of abstraction and automation skills. Specifically, abstraction is the ability to decompose the problem into sub-problems, extracting, and organizing key elements for automation. Conversely, automation is the ability to program/debug based on abstract procedures and rules for problem-solving. Automation skills in middle school students were tested with an online coding platform (i.e., Scratch). South Korea introduced mandatory computational thinking education in the 2015 Revised National Curriculum. The concept of computational thinking is in line with the National Curriculum. The recent digital literacy assessment framework and questionnaire are shown below.

Table 7. Digital literacy assessment framework

| Competence areas | | Competences |
|------------------------|--------------------------------|---|
| ICT | Search | Ability to collect necessary information effectively, accurately, and safely |
| | Analysis and evaluation | Ability to analyze whether acquired information is useful for problem-solving, and to select only appropriate information by evaluating accuracy and credibility |
| | Organization and creation | Ability to reorganize chosen information for problem-solving, and to creatively compose and create new forms of information |
| | Utilization and management | Ability to categorize and save information safely and efficiently, and protect information without infringing upon others' rights |
| | Communication | Ability to collaborate efficiently by selecting methods of information sharing and communication according to the nature and purpose of the given information |
| Computational Thinking | Abstraction | Ability to understand the problem and decompose the problem into sub-problems, extracting, and organizing key elements for problem-solving. |
| | Automation | Ability to automate effective problem-solving method and procedure using ICT devices and computers |
| Content | Data and information | <ul style="list-style-type: none"> • Document creation: Creating and editing documents, integrating documents, and creating Web documents • Data analysis: Electronic table creation, worksheet editing, chart, and data creation and management • Multimedia creation: audio, pictures, videos, animations, and multimedia creation |
| | Computer and Network | <ul style="list-style-type: none"> • Computer structure: Computer system structure • Operating System: Operating systems' concepts, types, function, and organization • Internet and Network: Server, network, and internet utilization |
| | Information Society and Ethics | <ul style="list-style-type: none"> • Information Society: Characteristics and future of information society, application of information technology, types, and roles of cyber institutions and organizations, new jobs and prospects in the information society • Information ethics: Protection of personal information and intellectual property rights, computer encryption and security programs, digital citizenship and critical thinking, and prevention of Internet and game addiction. |
| | Algorithm and programming | <ul style="list-style-type: none"> • Algorithm: Understanding the control structure, algorithms design, and analysis • Programming: Programming, automating, simulating, debugging algorithms using a programming language |

Adapted from Lee et al. (2019), p. 48.

Outside of South Korea, International ICT or digital literacy assessments include the International Computer and Information Literacy Study (ICILS) (IEA, 2013, 2018), ETS (2006), and the Program for International Student Assessment (PISA) (OECD, 2018). Specifically, 47,000 8th Grade students from 12 countries participated in ICILS 2018, where the framework was extended to include computer information capacity and computational thinking, adding to conventional ICT elements (IEA, 2018). This falls in the same trend where computational thinking is included in digital literacy areas. These international ICT literacy assessments can be summarized according to advances in technology and changes to educational content as follows.

Table 8. International ICT and Digital Literacy Assessments

| Study | Purpose | Target | Assessed Areas | Questionnaire |
|--|---------------------------------------|---|---|---|
| Framework for ICT literacy (ETS, 2006) | Industrial and higher education needs | High school students, university students, adults | Definition, access, management, evaluation, integration, creation, communication | Multiple-choice, operational |
| International Computer and Information Literacy Study (ICILS) (IEA, 2013) | International comparison | 8th Grade students | Information collection and management Information creation and exchange | Multiple-choice, constructed response, authoring task |
| International Computer and Information Literacy Study (ICILS) (IEA, 2018) | International comparison | 8th Grade students | Computer Information capacity Computational thinking | Multiple-choice, constructed response, authoring task |
| Program for International Student Assessment (PISA) (OECD, 2018) | International comparison | Middle school students | Frequency of digital device usage in class, frequency of internet usage out of school, digital device usage (at home), school-equipped digital device usage | Multiple-choice |

Digital literacy assessments, including KERIS, ICILS, and PISA, have different purposes, targets, and assessment areas. They all serve as references for conducting related research and available resources exist that can be used for developing tests for different countries, including past assessments.

5. Implications and Conclusion

In this brief, key concepts and research trends in digital literacy were summarized and lessons learned from South Korean national digital literacy assessments were discussed. First, a background survey allows policymakers to gain insight into students' digital environment and their perspectives towards the digital environment. This serves as a basis for building ICT-based education policies. A survey in ICT infrastructure, education system, and available teaching material grants the basis for installing policies needed in schools.

Secondly, student achievement can be measured according to national standards. The advantage is that questionnaires for elementary and middle school students can be developed, and tasks for improvement can be identified. However, it requires effort in controlling the variables by having the students participate in the assessment for a certain period. In South Korea, it is recommended that students participate in the assessment under a school teacher's guidance and supervision to produce a uniform testing environment.

Lastly, much experience is gained in developing digital literacy measurement tools, its analysis, and establishing education policies. This will aid policymakers in creating a system that can respond to quickly evolving ICTs. As aforementioned, literacy can be combined with keywords from diverse fields. By building measurement frameworks for digital literacies, literacy assessment, and analysis in diverse domains, this will add valuable feedback for future policies.

Achievement standards and literacy frameworks can vary in different countries. Therefore, when conducting digital literacy research, it is necessary to systemize and localize indices with domestic and foreign expertise. It is also necessary to identify frameworks and elements that would help strengthen national education policymaking.

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SKILLS FOR LIFE

21st Century Skills is an initiative led by the InterAmerican Development Bank (IDB) that brings together public and private sector stakeholders. The initiative strengthens learning ecosystems to equip Latin American and Caribbean citizens with transversal skills.

<https://clic-skills.iadb.org/en/skills21@iadb.org>