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A Study on the Current Status and Improvement of Digital Divide for the Disabled in Korea

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Abstract

Due to the fast development of information and communication technology, many people are enjoying benefits. However, there are those who do not enjoy the benefits of such information technology due to physical disabilities or economic reasons. This class is classified as an information-vulnerable class with so-called digital divide, and the disabled can be said to be a representative information-vulnerable class. The purpose of the paper is to identify the various causes of digital divide and propose improvement measures for the disabled in Korea. For this purpose, the digital divide data by the national institution over the past four years were analyzed. Through various statistical analysis, it was found that the main cause of the digital divide was insufficient information competency among the three factors diagnosing the digital divide namely, information access, information competency, and information utilization. It was also found that the information utilization activities of the disabled were not productive and consumption-oriented

Keywords: *Digital Divide, Information Literacy, Information-vulnerable Class, Information and Communication Technology, Smart Technology*

1. Introduction

The recent development of various technologies is benefiting many people in the cur-rent society. These various technologies now bring various benefits for individuals as well as various fields in our society such as science and culture. Therefore, basic theory and the ability to use various technology are gradually becoming critical competencies in modern society. Lack of understanding of information and the inability to utilize information can cause a decline in national competitiveness as well as individual competitiveness. There-fore, everyone must have the appropriate information capabilities that modern society needs. This information ability is called information literacy [1-3].

Thus, information literacy is a crucial ability for everyone in the modern information society. However, there are classes in our society that do not properly have information literacy for various reasons such as economic reasons and physical disabilities. These classes cannot properly enjoy the advantages and richness of the information society and cause the so-called digital divide problem. These social classes are called

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information-vulnerable classes, and they do not enjoy the various benefits of the information society [4]. Thus, solving the digital divide for the information-vulnerable class is essential for equal social realization as well as enhancing national competitiveness. Since 2017, Korea has classified four classes, including the disabled, the elderly, farmers and fisher-men, and the low-income class as information vulnerable classes, and has been investigating the digital divide for these classes [5]. Meanwhile, according to annual digital divide status reports of National Information Society Agency (http://www.nia.or.kr), the digital divide among the four information-vulnerable classes has been large in the order of the elderly, the farmers and fishermen, the disabled, and the low-income class over the past four years [6-9]. In other words, compared to the general public, the digital divide of the elderly is the largest, followed by the farmers and fishermen, the disabled, and the low-income class. In other words, it was investigated that the digital gap of the disabled was the third largest among the four information vulnerable groups. The digital divide among the information-vulnerable classes is narrowing every year, but the gap is still large compared to the general public, and national efforts are needed to reduce the digital divide by cultivating information literacy among these information-vulnerable classes. Recently, the digital divide has become a human rights issue beyond a social problem in an information society.

There are not many studies on the digital divide for the disabled. The main reason is probably that it is not easy to objectively measure the digital divide of the disabled. Also, they did not reflect the three elements of the digital divide used at the national level in Korea. Therefore, in this study, we identify and improve the biggest cause of the digital divide in terms of the three major elements of the digital divide based on the vast national survey of the digital divide for the disabled.

The purpose of our study is to identify and analyze the possible causes of the digital divide of the disabled in Korea, and propose various improvement measures to bridge the digital divide for the disabled. In order to achieve this purpose, national statistical data on the digital divide from 2018 to 2021 were analyzed [6-9]. Specifically, considering the three elements of information literacy (information access, information competency, and information utilization), we investigated the major elements affecting the digital divide, and analyzed the difference from the general public for each factor.

The later parts of this paper are composed as follows. In section 2, we present a theoretical back-ground. That is, the formal definition of the digital divide is introduced, the measurement method of the digital divide is introduced, and related works are also presented. In section 3, the current status of the digital divide for the disabled is presented and the statistical results are analyzed. Finally, we present our conclusions and further research issues in section 4.

2. Related Works

2.1. Definition of the Digital Divide

The definitions of the digital divide vary, and the representative definitions are as follows.

First, the definition of the digital divide by OECD is "the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard to both their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities" [10].

The definition of digital divide by the Digital Divide Council, the digit is “the gap that exists between individuals who have access to modern ICTs and those who lack access” [11]. In addition, the causes of the digital divide include education, income level, geographic limitations, motivation and general interest, and

digital literacy. In addition, the causes of the digital divide are diverse, and mainly include education, geographic limitations, digital literacy, and so on.

2.2. The Measurement of the Digital Divide

The Korean government has conducted an annual statistical survey on the digital di-vide since 2002. National Information Society Agency has been in charge of the statistical survey, and the Agency is currently overseeing the survey on the digital divide for the general public and various social classes.

In the digital divide statistical survey, the 'digital informatization level' is used as the unit of measurement. That is, the digital divide is measured by the difference in the digital informatization level between the general public and the information-vulnerable classes. It is assumed that the digital informatization level of the general public is 100.

The digital informatization level has three elements as follows.

①Information access level

An Indicator to measure the availability of computers and mobile devices and the availability of the Internet

②Information competency level

An indicator that measures the basic ability to use computers and mobile devices

③Information utilization level

An indicator of the quantitative and qualitative utilization of the Internet

The three elements of the digital informatization level are measured in detail as follows.

Digital informatization level = information access level (20%) + information competency level (40%) + information utilization level (40%).

①Information access level

Whether to have an information device (50%) + whether to be able to access the Internet at all times (50%)

②Information competency level

PC use ability (50%) + mobile device use ability (50%).

③Information utilization level

Whether to use wired or wireless Internet (40%) + variety of Internet services (40%) + advanced Internet use (40%)

2.3. Previous Works

Jun analyzed the digital divide of the disabled from three perspectives: information access, information competency, and information utilization, and argued that the disabled lacked information utilization ability compared to the general public. This study proposed increasing information education opportunities, expanding and distributing various application services, improving laws and systems, and improving smart accessibility as measures to resolve the digital divide for the disabled [12].

3. The Status and Analysis of Digital Divide for the Disabled

3.1. Data and Methodology of the Digital Divide Status Survey

Since 2002, the Korea Information Society Agency(http://www.nia.or.kr) has investigated and announced the status of the digital divide for the entire nation every year. The data sample for the data divide survey is as follows.

As for the survey population, the general public is eligible for the population aged 7 or older across the country, and the disabled are eligible for registered disabled people aged 7 to 69 (based on the type of delay, brain lesion, hearing/language, and visual impairment). In addition, as for the size of the sample, first, there are 7,000 people in the general public and 2,200 people with disabilities. In the sampling method, the general public first uses proportional sampling of stratification probability by metropolitan local government, and disabled people use gender, age, type of disability, and proportional allocation sampling by metropolitan local government. As the survey method, an interpersonal interview by a structured questionnaire was used.

In this study, data from the Korea Information Society Agency's 2018 to 2021 in order to analyze the current status of the digital divide of the disabled in Korea were used. That is, in this study, the Korea Information Society Agency's digital divide report was used as secondary data instead of direct interviews due to difficulties in face-to-face contact during the COVID-19 pandemic.

Also, in this study, ANOVA (Variable Analysis) was conducted as an analysis technique to analyze the digital divide of the disabled in depth based on secondary data.

3.2. The Current Status of the Digital Divide for the Disabled

In this section, we present the current status of digital divide for the disabled in Korea. In order to introduce the objective and comprehensive current status of digital divide of the disabled, the status report of the digital divide at the national level over the past four years released by National Information Society Agency was used[6-9].

At first, Table 1 presents the digital informatization level of the disabled class over the four years from 2018 to 2021. It is assumed that the digital informatization level of ordinary citizens is 100. Also, a unit represents a percentage.

Table 1. Digital informatization level of the disabled (unit: %)

2018	2019	2020	2021
74.6	75.2	81.3	81.7

Table 2 shows levels of three factors of the digital informatization level for the disabled over the past 4 years.

Table 2. Three factors of digital informatization level of the disabled (unit: %)

	2018	2019	2020	2021
Information Access	92.0	92.6	95.4	95.6
Information Competency	66.9	67.8	74.2	75.9
Information Utilization	73.6	74.0	81.4	81.5

On the other hand, ‘information competency’ is composed of two factors: 'PC use ability' and 'mobile device use ability'. Each consists of seven items as follows

- PC use ability

①Software installation and deletion, ②Internet connection and use, ③Web browser environment setting

④Connection and use of various external devices, ⑤File transfer over the Internet

⑥Malicious code inspection and treatment, ⑦Creation of documents and materials

- Mobile device use ability

①Basic environment settings, ②Wireless Network Settings, ③Moving files to computer

④Sending files to others, ⑤Installation and use of the necessary apps

⑥Malicious code inspection and treatment, ⑦Creating documents and materials

In this study, for convenience, the seven items of PC use ability and mobile device use ability are grouped into four categories, 'installation', 'transmission', 'management', and ‘creation’, respectively, and categorized as follows.

-PC use capability

·Installation: ①,②,③; ·Transmission: ④,⑤; ·Management: ⑥; ·Creation: ⑦

-Mobile device use ability

·Installation: ①,②,⑤; ·Transmission: ③,④; ·Management: ⑥; ·Creation: ⑦

The following Table 3 shows overall status of 4 elements of information competency for the disabled. The numbers in Table 3 indicate the degree to which disabled people can perform for each item of information competency. For example, 39.0 of the ‘management’ item for PC use ability in 2021 means that 39% of disabled people can inspect and treat for malicious code.

Table 3. Status of 4 elements of information competency of the disabled (100% scale)

Use Ability	Elements	2018	2019	2020	2021
PC use ability	Installation	41.0	37.0	43.4	42.0
	Transmission	36.2	37.9	42.0	41.6
	Management	28.5	32.2	39.1	39.0
	Creation	30.5	36.6	45.0	39.4
Mobile device use ability	Installation	55.7	56.0	61.4	61.4
	Transmission	50.7	52.3	58.2	57.7
	Management	35.2	43.9	50.3	48.2
	Creation	36.2	47.4	55.7	51.9

On the other hand, the following Table 4 shows the status of various elements of information utilization for the disabled.

Table 4. Status of elements of information utilization of the disabled (100% scale)

Elements	2018	2019	2020	2021
Internet Usage Rate	77.4	78.3	80.3	82.0
The Main Service Usage Rate	90.1	91.4	92.2	86.3
Social Relationship Service Usage Rate	92.5	92.0	91.2	85.3
Living Service Usage Rate	68,1	84.3	87.5	81.8
Information Production & Sharing Activity Rate	47.4	41.7	53.9	46.6
Online Network Activity Rate	76.5	67.5	67.9	61.1
Online Social Participation Activity Rate	33.3	38.9	50.4	43.2
Online Economic Activity Rate	40.0	39.0	46.5	48.6

3.3. Analysis of Digital Divide for the Disabled

In this section, we conducted statistical analysis based on the data introduced in the previous section. The purpose of the analysis is to accurately and in detail identify the causes of the digital divide for the disabled, and propose improvement plans to resolve the digital divide for the disabled based on the analysis results.

The following Table 5 presents the results of analyzing the digital informatization level of the disabled. As shown in Table 5, among 3 elements of the levels of digital informatization of the disabled, the average of information access is the highest at 93.90, followed by information utilization 77.63 and information competency 70.95, and there was a statistically significant difference ($F=41.28$, $p<0.001$). Thus, it is concluded that the disabled have the highest information access and the lowest information competency among the 3 elements of digital information level.

Table 5. Digital informatization level of the disabled

	Mean	Standard Deviation	F	p
Information Access	93.90	1.87	41.28^{***}	0.000
Information Competency	70.95	4.18		
Information Utilization	77.63	4.42		

*** $p<0.001$.

Table 6 presents the results of examining the overall difference between PC and mobile device use ability of the disabled. Considering the difference in PC and mobile device use ability of the disabled, the average of mobile device use ability was 51.39, higher than PC use ability 38.21, and there was a statistically significant difference ($t=-5.79$, $p<0.001$). Thus, it is concluded that mobile device use ability is higher than that of PC for the disabled.

Table 6. Overall analysis result of PC and mobile device use ability of the disabled

	Mean	Standard Deviation	t	p
PC Use Ability	38.21	4.63	-5.79***	0.000
Mobile Device Use Ability	51.39	7.84		

*** $p<0.001$.

Table 7 presents the results of examining the PC use ability of the disabled. Note that SD means the standard deviation. Considering the PC use ability of the disabled, the average installation ability was the highest at 40.85, followed by transmission ability 39.43, creation ability 37.88, and management ability 34.70, but there was no statistically significant difference. Therefore, it can be seen that there is no difference in PC use ability for the disabled.

Table 7. Results of analysis of PC use ability for the disabled

	Element	Mean	SD	F	p
PC Use Ability	Installation	40.85	2.75	1.40	0.290
	Transmission	39.43	2.83		
	Management	34.70	5.25		
	Creation	37.88	6.03		

Meanwhile, the results of examining the mobile device use ability of the disabled are shown in Table 8. Considering the mobile device use ability of the disabled, the average of installation ability is the highest at 58.63, followed by transmission ability 54.73, creation capacity 47.80, and management ability 44.40, and statistically significant differences were shown ($F=4.75$, $p<0.05$). Thus, it is concluded that the disabled have the highest installation ability and while they have the lowest management ability.

Table 8. Analysis results of mobile device use ability for the disabled

	Element	Mean	SD	F	p
Mobile Device Use Ability	Installation	58.63	3.21	4.75*	0.021
	Transmission	54.73	3.79		
	Management	44.40	6.69		
	Creation	47.80	8.44		

* $p<0.05$.

4. Conclusions and Further Research Issues

Currently, various studies are underway to improve the quality of life of the disabled using ICT [13.14]. However, it is more important to narrow the digital divide among disabled people, along with technical support for the disabled. This paper deals with the digital divide of the disabled in Korea. First, the current status of the digital divide of the disabled is introduced, and the causes of the digital divide of the disabled were statistically analyzed. From the analysis results, various measures were proposed to bridge the digital divide of the disabled. For this purpose, we analyzed based on the national-level digital divide status reports over the

past four years.

It is found that the digital divide for the disabled was due to the lack of information competency and information utilization among 3 factors of the digital informatization level. First of all, for the information competency, it was found that PC use ability was insufficient rather than mobile device use ability. Also, among 4 elements of information competency, installation, transmission, management, and creation, creation and management ability were found to be insufficient for the disabled. Based on this statistical analysis, we propose some plans to bridge the digital divide for the disabled from an educational and technical aspects.

The academic and theoretical contributions of this paper are as follows. That is, unlike the existing research works on the digital divide for the disabled, the most influential factors in the digital divide were determined in order based on the three major factors, and the 3 major factors of digital divide were classified into four detailed subfactors to reveal the order of influential subfactors.

The future research works of this study are following. First, it is important to identify the causes of the digital divide of the disabled from various points of view. In this study, only quantitative factors were considered to measure the digital divide. However, not only social factors but also psychological factors should be considered. In order to more accurately analyze the causes of the digital divide, qualitative factors as well as quantitative factors should be considered. In addition, various informatization textbooks and online contents for the disabled should be developed. This is because the shortcut to the bridging of digital divide for the disabled depends on the development and dissemination of various informatization textbooks.

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