Developing Curriculum for Solving the Digital Divide in Elementary and Secondary Schools

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ITの急速な発展により生じた情報格差は，社会的・経済的な不平等そして教育機会の不平等のような，多くの悪影響を引き起こしている。韓国情報文化振興院によると，2006年の韓国全国民のインターネット利用率は約75%程度であるが，情報疎外層では35%にとどまっており，深刻な問題になっている。このような情報格差を解消するために，韓国政府は多様な政策的対応を試みているが，教育面からの予防的アプローチに関しては十分とは言えない。本研究では予防的アプローチとして，初等中等教育段階の児童生徒が持っている情報格差に対する認識を育てるための「情報格差解消教育カリキュラム」の開発を目的とする。そのために，情報格差の概念を定義し，国内外の教育カリキュラム分析から示唆を得，韓国の児童生徒の情報格差に対する認識水準，教師の情報格差教育の必要性に対する認識水準の調査を行い，分析した。また開発に当たっては，情報教育及び情報格差関連機関の専門家から，情報格差解消のための教育内容の要望調査を行い，教師による教育現場における適合性の検討を通じて，より信頼できる教育カリキュラムとなるようにした。

Developing Curriculum for Solving the Digital Divide in Elementary and Secondary Schools

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The digital divide from rapid development of IT brings lots of reverse functions such as socioeconomic inequality and educational inequality. According to Korea Agency for Digital Opportunity and Promotion, people's internet utilization rate appears to be about 75% in 2006, but in the case of Information-Alienated Class(IAC) showed only 35%. The Korean government tries various political countenmeasures to solve the digital divide, but the preventive approaches about this are not enough. This research aims to develop a curriculum for solving the digital divide as a preventive approach in order to promote recognition about the digital divide in elementary and secondary school. To achieve this, Firstly, defined the concept of the digital divide, drew the suggestions by analyzing the curriculum of other countries and analyzed general recognition of Korean students' regarding digital divide. Secondly, Drew the suggestions of contests for digital divide based on information subject experts and the digital divide experts. Finally developed a reliable digital divide solution curriculum through teachers' scrutiny of the real spot appropriateness.

1. Introduction

According to Korea Agency for Digital Opportunity and Promotion which is the Korean institution specialized in solution to the digital divide, the people's internet utilization rate appears to be about 75%, but in the case of Information-Alienated Class(IAC; the disabled group, the low-income group, the old people group, the people who live rural area group) showed only 35%[1].

This can be viewed as a serious reverse function in information society which would bring educational inequality as well as socio-economic inequality to elementary and secondary school students who is learning from internet such as the Cyber Home Learning[1].

This research will search administrative and economical efforts proceeding in our government and the recognition level of Korean students and teachers about the digital divide. And this paper does not present a countermeasure but future preventive approaches about the digital divide by developing the curriculum.

2. Background

2.1 Concept Definition

The digital divide can be defined as a gap which appears when people access and use various information of the digital network from IT access and application gaps, or as a social gap between rich-information people and poor-information people in accessing and using information [2]. Sometimes it can be phenomenon which can be occur because of elements such as personal education level, economic differences, motivation and information literacy of IT use, a degree of access to IT, and commercialization and centralization of information [3]. Moreover, it can be named the phenomenon that access and use of information are not equal to every social community and classes[4].

As remarked earlier, the digital divide has various meaning and extends its meaning and category. This research is going to organize these contents and define the concept of the digital divide as the phenomenon where Information-Alienated Class(IAC) become more distant

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[1]Cyber Home Learning is a kind of e-learning brand in Korea. Most of the provinces have their own Cyber Home Learning system in Korea.

from the information society benefits due to rapid development of information.

2.2 Major Types of the Digital Divide

The digital divide is becoming social problems and issues in various fields. Table 1 shows that major types of the digital divide.

Table 1 Major Types of the Digital Divide

Major Type of the Digital Divide
Digital divide by disabled
Digital divide by area
Digital divide by income
Digital divide by sex
Digital divide by age

Through these various types, we could infer the economical aspect that the people who can not approach the information freely are often disadvantageous in income.

And the social aspect that the people fell behind in information can be isolated and abandoned because information exchange and communication are in the application of digital technology[4].

2.3 Basic Theories

The viewpoints of the digital divide can be divided into 3 major theories: diffusion theory, information gap theory and reality theory.

2.3.1 Diffusion Theory

The diffusion theory insists that the digital divide will be reduced naturally. Naisbitt emphasizes that we live in the economic era based on the information production and popularization of IT[5]. Not only Naisbitt but also many of other scholars(Negroponte, 1995; Alvin Toffler, 1990; Wuman, 1989) agree with this theory.

2.3.2 Information Gap Theory

Information gap theory insists that the digital divide will extend as information develops. Haywood criticizes the trickle down effect[2].

He is pointing out even the deepening of gap between rich and poor because of the digital divide as well as continual inequality of opportunity for information approach[6]. And lots of different scholars(Schiller, 1966; Loader, 1998; Wresch, 1996; Perelman, 1998), point out that the digital divide will be deepening in rich information through digital communication media.

2.3.3 Reality Theory

Reality theory emphasize on searching realistic alternative plans which explain how can solve the digital divide rather than theoretical disputes that the digital divide in information society will be deepening or shrinking. This is the position held by most administrations including advanced countries, and it admits the seriousness but does not see this as an impossible thing. It believes that much of the problem can be solved by the policy intervention of administration. Especially, U.S., using the term 'Digital Inclusion' rather than 'Digital Divide' in 2000, is full of confidence that the digital divide can be solved soon[7].

This paper, based on this reality theory, is going to access the digital divide more progressive way.

[2] Trickle Down Effect is theory that saw the IT is only for minority in early stage but as time goes by, it spreads all over the society[6].

3. Methodology

In this paper, in order to develop the digital divide solving curriculum, assessed Korean students' and teacher's general recognition level, surveyed for contents of digital divide from experts, and developed a reliable curriculum through teachers' scrutiny of the real spot appropriateness.

Firstly, analyzed the present condition of the digital divide and made research on the curriculum analysis in the Korea and other countries elementary and secondary school.

Secondly, we drew the suggestion through investigating recognition of digital divide from teachers and students in elementary and secondary school.

Thirdly, we secured the validity of related contents through the secondary(two times) Delphi survey aimed at experts and through scrutinizing the actual spot appropriateness aimed at teachers.

3.1 Related Contents to Solving Digital Divide

When we look into specific contents of related to the digital divide, we could know that there are various and related to the digital divide realms are exist, likes information society and life, ethical problems, information tools development and life changing, but the contents which is teach to the digital divide are not included in the official curriculum. Table 2 shows that detail contents of other countries'.

Table 2 Related Contents to Solving Digital Divide

Countries	Contents
Korea (Information)	**The life of Information society (ICT)** - Information society and life changing - Netiquette and personal morals
	Information society and information technology (elementary school) - Information society and life changing - Computer user's manners
	Information society and information technology(secondary school) - Information technology and ethics - Information technology and industry
	Information society and information technology(high school) - The change of Information society
U. S. A. (CS)	**Ethical problems** - Socio-cultural effects of IT

Japan (information) -A -B -C	**Development of information tools and life changing(Information A)** - Effects of information progress in our lives - Participation in information society and IT application - Effects of IT progress in our society
	IT supporting information society(Information B) - Considerations for human being in IT
	Information progress and its effects in our society(Information C) - Effects of information progress in our society
India (Computer)	**Social ethics issues(elementary school)** - Collaboration learning in class **Social ethics issues(high school)** - The strong point and weak point of technology resources

3.2 Investigation of cognition level of teachers and students

This study is based on the survey which investigated the cognition level of digital divide of teachers in primary and secondary schools and students from 4th grade to 12th grade.

Table 3 Draft for investigating cognition level of digital divide

Section	Contents	
Population	Teachers and students in Korea	
The object of investigation	Teachers	- Teachers of primary and secondary schools in the country (except for Jejudo)
	Students	- From forth grade of elementary schools students to 3third grade of high schools students
Valid data	Teachers	- 25 elementary school teachers, 15 secondary school teachers
	Students	- 121 elementary school students - 211 middle school students - 116 high school students. Total : 448 students
Sampling Method	- Stratified sampling and systematic random sampling which is considering the number of schools, teachers and students in each area and each grade.	
Research Method	- Survey through the online which is based on 5 point measure - E-mail and survey through the phone	
Period	- From April 24 to May 08 in 2007	

Table 3 shows that the plans of this investigation in detail. And conducted this survey that protects personal information and minimize the invasion of privacy.

3.3 Subjects Investigation from Experts

To develop more structured curriculum, we chose 31 meaningful survey sheets (27 professors who taught computer science or ethics and 4 related researchers of digital divide) among 50 experts and organized their answers below.

Table 4 Analysis table of subjects of digital divide

Scope	Sub section	Detail Contents
Concept of digital divide and understanding	Concept of digital divide	Things about concept of digital divide.
	Necessity of solving digital divide	Necessity of solving digital divide. (equality, growth of individual and development of nation)
Causes of digital divide	Educational problem	Gap between the well-educated and the poor-educated.
	Economic problem	Gap between the high-income group and the low-income group.
	Socio-cultural problem	Changing of social structure and aging society.
View points of digital divide (theory)	Information gap theory	Theory about the situation that digital divide is getting deep.
	Diffusion Theory	Theory about natural decreasing of digital divide.
	Realistic theory	Theory that is focusing on the reality rather than future.
The present situation of digital gap	Internal	Ability to get information of Korea and use it.
	External	Ability to get information of the other countries and use it.
The way to solve the digital divide	Improving its cognition and educating	Educating for information-oriented society. Training related experts.
	Political approach	Setting an effective policy. Founding the promotion system of policy for solving digital divide.
	Improving life environment	Improving the condition of using information for information-alienation class. Guaranteeing information-alienation class to get information. Spreading communication apparatus for information-alienation class.

Table 4 shows that subjects of digital divide from experts. It consists of concept of digital divide and understanding, causes of digital divide, view points of digital divide, the present situation of digital gap, and the way to solve the digital divide. Details are shown in table 4.

4. Result

4.1 Findings on Investigation of Students' Cognition Standard

When we conducted survey about 'cognition standard of information society', we excluded primary school students to raise the validity. So we conducted survey of students in middle and high school (n= 327). Fig 1 shows When asked whether they agreed this, 'I don't think that the digital divide will decrease in the information society in the future.", for middle school students **32.2%** replied above "agree" and for high school students **48.3%** replied above "agree". So, the number of students who replied that digital divide would not be filled was more than the number of students who replied that it would be filled.

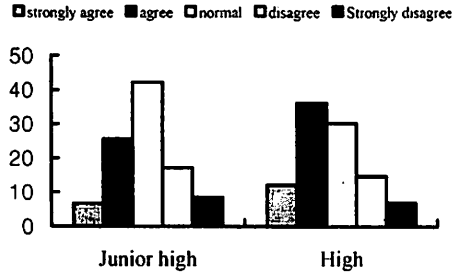

Fig. 1 View point of digital divide through 'I don't think that the digital divide will decrease'

When we asked them whether they agreed 'IAC should have opportunity to get close to it(information)', we could see many of them agreed that - Among total students(n= 448). Fig 2 shows that **68.7%** of elementary school students (above 'agree'), **69.7%** of middle school students (above 'agree') and **77.6%** of high school students(above 'agree') agree. So, the students who replied that those people should have to have that kind of opportunity were more than the students who replied that those people should have not it.

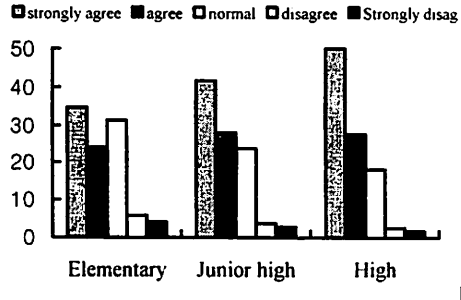

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Fig. 2 View point about IAC though 'IAC should have opportunity to get it(information)'

When asked whether they had experience to learn that 'It is necessary for IAC to learn how to use computer and internet'. Fig.3 shows that **32.3%** of the elementary school students, **30.7%** of middle school students and **31.6%** of high school students replied that they had learned this in schools. From this, we can see that not many of them have learned this in schools and especially about the old they have not learned a lot.

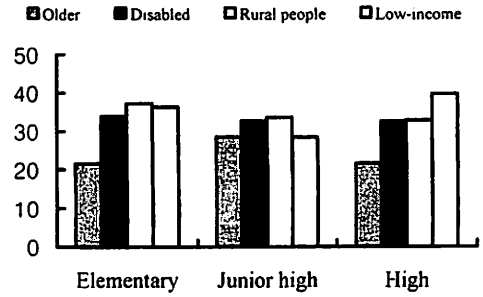

Fig. 3 Rate of learning experience for digital divide in school.

Fig. 4 shows that Comparing the answers of the question whether they want to help IAC to use computer and internet well, we can see that many students have positive attitude : **59.9%** of the elementary school students, **51.4%** of the middle school students and **51.8%** of the high school students replied that they wanted to help them. But we can see that students in secondary schools are more negative than elementary school students.

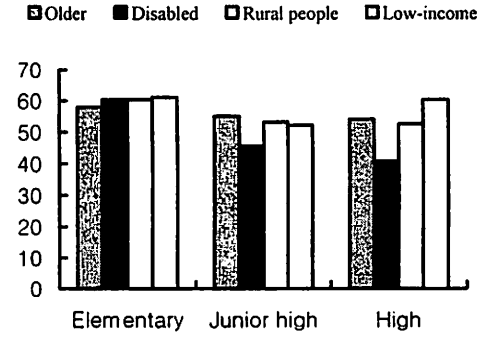

Fig. 4 Students' attitude on digital divide

The results of investigation into students' cognition suggest below.

Firstly, as not many students think that they can fill the digital divide in the future, cognition education is needed to let them recognize that they can change this positively for themselves.

Secondly, the better they recognize the needs of opportunity to get information for IAC, their attitude on this issue are not formed well. Therefore, the education which can reflect not only the concept of digital divide but also its attitude is needed.

Thirdly, though the classes for digital divide are getting on now, the classes for attitude about the old are less than the others. So the education of reflected this point is needs.

4.2 Findings on investigation of teachers' cognition standard

Survey of teachers conducted for investigating their cognition level consists of three main contents. One is how much they think it is important to teach to students about digital divide. Another is which contents they think are more important about digital divide. The other is from which grade they think students can be taught about concept of digital divide.

Firstly, when asked how much they think it is important to teach to students about digital divide. Fig. 5 shows that **92.5%** of all respondents(n=40) replied "It is important". So, they think it is needed to teach to students about digital divide in schools.

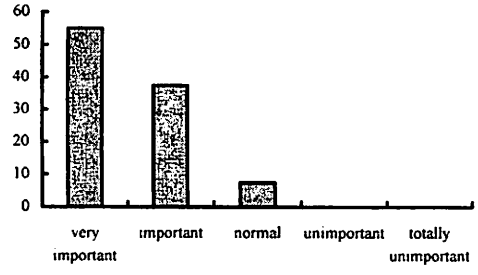

Fig. 5 Necessity of education about digital divide

Secondly, Fig. 6 shows that the survey conducted for recognizing the order of priority of the related subjects on digital divide found that teachers put "the cause of digital divide " on the top priority and " the solution and practical plan", "theory of digital divide", "the present condition and seriousness" followed it.

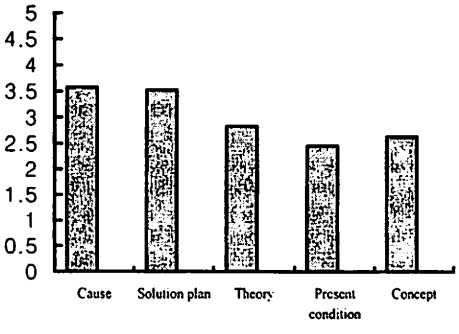

Fig. 6 Priority of the related subjects

Thirdly, Fig. 7 shows that when we asked them from what grade they thought was proper to teach the concept of digital divide, **92.5%** replied "from elementary school students".

Especially the percentage of "from the lower grades of elementary school" was the highest(42.5%). And 0% replied "from high school or from university".

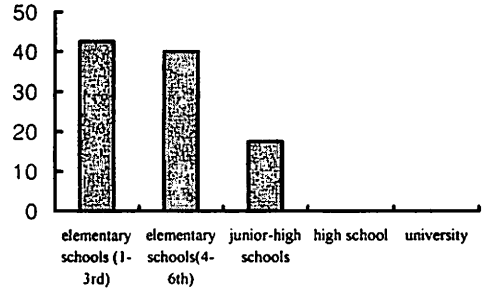

Fig. 7 Proper grade for teaching about solving digital divide

We can get those things from this survey:

Firstly, most teachers think that the education to spread awareness of the digital divide is necessary. Especially, as they think this education should be applied from the lower grades of elementary.

Secondly, as they think the cause of digital divide and solution are important, we should develop more practical teaching and learning methods.

4.3 Curriculum for Solving Digital Divide

We develop the tentative curriculum plan through suggestion of the recognition survey and survey from experts. Based on this, we develop following digital divide solving curriculum through teachers' the real spot scrutiny.

4.3.1 The Characteristic of the Digital Divide Solving Curriculum

Here are the characteristics of 'the digital divide solving curriculum'. First, the contents contain raising independent ability to solve the digital divide by getting to know basic concept and causing reason of the digital divide and learning attitude to solve this. Second, the contents contain the attitude which can understand and practice the information ethics and community's life ethics as a member of information society.

4.3.2 The Goal of the Digital Divide Solving Curriculum

First, students have ability and attitude to live in harmony based on proper understanding the relationship with information-alienation class which we often meet in home, school, and society.

Second, students have active attitude to solve the digital divide by getting to know basic concept and causing reason of the digital divide and learning how to solve this.

4.3.3 The Contents in the Digital Divide Solving Curriculum

Table 5 shows that proposal of curriculum for digital divide. The contents in the digital divide solving curriculum is made of 5 stages, like the IT operational teaching guide(ICT Curriculum) in Korea, in order to be teachable in the national basic curriculum in common. The realm constitutes 5 contents such as 'concept and understanding', 'reason', 'the present situation', 'related theories', and 'the way to solve'.

Table 5 Curriculum for solving digital divide

Stage	The 1 stage (1~2nd grade)	The 2 stage (3~4th grade)	The 3stage (5~6th grade)	The 4 stage (Junior-high school)	The 5 stage (high school)
Concept and understanding of the digital divide	Upright understanding of information-alienation class	Concept and necessity of the digital divide	Social problems caused by the digital divide	-	-
The reason of the digital divide	-	The various reasons of the digital divide	-	-	-
The viewpoint (theory) of the digital divide	-	-	-	-	The digital divide theory
The present situation of the digital divide	-	-	Investigation the digital divide in our community	The digital divide in Korea	Internal and external digital divide
The way to solve the digital divide	Information-alienation class in a home and the way to solve the digital divide	Information-alienation class in friends, neighbors and the way to solve the digital divide	Information-alienation class in our community and the way to solve the digital divide	The digital divide in Korea and the way to solve the digital divide	The various ways to solve the digital divide

4.3.4 Teaching and Learning Methods for Solving Digital Divide

Firstly, the digital divide solving curriculum deals with affective and active domain integrative which contain specific practice and experience for solving the problem as well as cognitive domain which correctly understands information related to the digital divide problems by internalizing the will and belief for solving the digital divide problems.

Secondly, the digital divide solving curriculum continuously directs students to make an action through affective empathy, not to stay in their intelligent recognition with various practical methods.

Thirdly, in the digital divide class, various teaching and learning materials are used based on the curriculum. Also the contents which contain regional characteristics and current events should be reorganized according to the region and time.

Fourthly, Direct students to analyze and solve the digital divide situation and problems in our lives.

4.3.5 The Evaluation in the Digital Divide Solving Curriculum

Firstly, the digital divide assessment pursues integrative assessment about the cognitive, affective, and active aspects of the digital divide. Cognitive aspect assesses how correctly understanding information related to the digital divide problems. Affective aspect assesses that students internalize the will and belief to solve the digital divide problems. Active aspect assesses that students understand the specific practice way to solve the digital divide problems.

Secondly, it is desirable that the digital divide assessment pursues integrative assessment and teachers assess the learning process and result integrative. So use various methods in assessing if possible.

5. Conclusion

This research developed the digital divide solving curriculum which guides students' viewpoints and attitude towards the information age. Through this, we could know that learning related the digital divide is needed urgently in education.

An education which offers specific situation through various teaching and learning methods is necessary. Additionally, it needs to give students time to think how to solve problems for themselves rather than offering contents related to the digital divide simply.

Through systematic subject reflection and practice of the digital divide solving curriculum we presented, it will be possible to approach the digital divide more progressively and preventively.

Especially for progressive and active ways of practice in solving the digital divide, 'information subject' available in technical approach needs systematic reflection and specific contents system and development of appropriate teaching materials are needed.

With this, training course for information teachers and recognition instruction for pre-information teachers should be practiced.

* This paper was supported by Korea Agency for Digital Opportunity & Promotion(KADO)

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