

A Study on development of Common Criteria for Internet Ethics-Index Measurement

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Abstract

Background/Objectives: Internet is growing the most part in our daily life, Utilizing the Internet of our lives to the rapid development of IT technology, are living in the off-line and on-line a mix of life. However, do not systematically implement the education of Internet ethics awareness deficiencies of objective indicators to assess the current knowledge level of the Internet ethics is the actual situation.

Methods/Statistical Analysis: In this paper, we propose a common criteria of measurement for Internet ethics-index.

Findings: For the experiments, proposed common criteria for internet ethics-index was also a questionnaire that target 46 people to calculate the weight of the common reference. In this paper, we found the common criteria such as 4 objects and 26 sub-object items for internet ethics-index measurement.

Improvements/Applications: The Internet ethics-index evaluation model through the establishment of the common standards developed in this paper, municipal road Office of Education, related organizations, high school, such as small, medium, can be utilized as an indicator to measure the Internet ethics education level. Therefore, this study improve of internet ethics-index.

Key Words : Internet Ethics, Common Criteria, Internet Ethics-Index, Internet Ethics Education, Internet-Ethics Measurement, Internet Dysfunction.

1 Introduction

The growth of information technology has led to the rapid penetration of the internet and also, the use of the Internet is quickly becoming a part of our lives ¹. Furthermore, changes in the distribution and sharing information using the internet is changing the most part in our daily life, utilizing the internet of our lives to the rapid development of information technology, are living in the off-line and on-line a mix of life, it is predicted that online life specific gravity is further increased ².

Currently, Korea has the highest number of broadband subscribers and Internet users in the world, and the Internet-related industry including Internet portal service and game business is about 90 trillion won¹. The size of the Internet industry is 7.3% of GDP, making it the second-largest Internet economy in the world, following 8.3% of the UK's 20 leading nations³.

Despite the many advantages of using information on the internet online, there is a problem of the internet dysfunction. The internet malfunction can be classified such as cyber-violence and

cyber-crime. A cyber-violence is a disruption or discomfort to an anonymous user through language, video, etc. in cyberspace (such as malicious comments, cyber insults, verbal violence, personal information hacking, cyber sexual abuse, etc.). Also cybercrime is when cybercrime violates the provisions of the law (such as distribution of pornography, copyright infringement, cyber violence, hacking, cyber defamation, Internet fraud, etc.)⁴.

According to the Survey on cyber violence by the Korea Internet & Security Agency (KISA) in 2013⁵, teenage internet ethical awareness levels were significantly lower than those in their 20s and 30s. According to the survey results, 45.7% of the elementary school children had the most fun, while 68.2% of the middle school students said that they were angry at the other person (64.1%). Although the importance of internet ethics training for resolving the problem of internet dysfunction caused by the development and diffusion of the internet is higher than ever, the objective of the Internet ethics-index education systematically^{6,7}. However, not easy to measure support to systematically implement the internet ethics education awareness deficiencies of objective indicators to assess the current knowledge level of the internet ethics is the actual situation^{8,9}.

Therefore, in this paper, we propose the common criteria of measurement for Internet ethics-index, it is as a solution to the problem of internet dysfunction. The development of common criteria for internet ethics-index procedure consists of *Elicitation of Evaluation Items*, *Survey and its Analysis*, *Weight Calculation of Evaluation Items*, and *Determination of Comment Criterial*. The *Elicitation of Evaluation Items* has a series of processes that provide the evaluation items such as objects (head of school, teacher, student, and school parent) and sub-objects for internet ethics-index. To establish common criteria for internet ethics education, the internet ethics experts conducted the survey to determine the initial evaluation items. And then, the final evaluation items were derived from the research support experts composed of elementary and middle school education practitioners. The *Survey and its Analysis* contains the *Pairwise Comparison Scale* for analysis the elicitation of evaluation items. The *Survey and its Analysis* consider of feasibility and reliability for internet ethics education.

The remainder of this paper is organized as follows: Section 2 describes the internet ethics-index measurement. Section 3 sum-

marizes our conclusions and plans for future study.

2 Internet Ethics-Index Measurement

This section describes the procedure overview for the proposed common criteria for internet ethics-index measurement, which supports ethics-index measurement to provide the internet ethics measurement. Figure 1 shows the overview of the procedure of common criteria for internet ethics-index measurement.

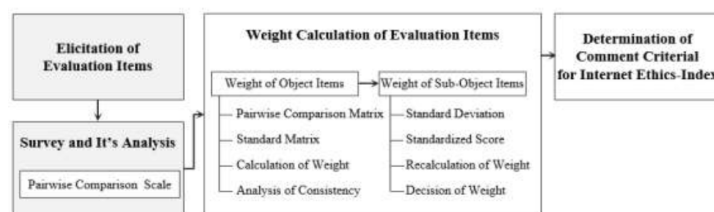


Figure 1. Procedure of common criteria for internet ethics-index

2.1 Elicitation of evaluation items

To establish a common criteria for the evaluation items for internet ethics-index, the first evaluation items were derived by a survey by experts of the Korea Society of Internet Ethics¹⁰, and then the final evaluation items were derived from the experts who were composed of Elementary, Middle and High Schools education practitioners.

Table 1 shows the evaluation items for the evaluation of internet ethics-index. The evaluation item defined by the Korea Society of Internet Ethics and the education practitioners consists of an objects category and a sub-object category. And the objects were classified as 'Head of School', 'Teacher', 'Student', and 'School Parents', and Sub-object items for each evaluation area were derived.

Table 1. Evaluation items for internet ethics-index

Objects	Sub-Object Items
Head of School	Establish medium and long-term educational goals for internet ethics education
	Establish internet ethics education plan for the year
	internet ethics education achievement (education achievement in recent 3 years)
	Self-evaluation of internet ethics education conducted last year
	Feedback from parents & students for internet ethics

	Organization and operation of internet ethics education Budget related to internet ethics education Participation in external training on internet ethics
Teacher	Participation in external training on internet ethics Organization and management of teachers' research meeting related to internet ethics education Internet addiction measurement and counseling Support about Special lectures on internet ethics education Holding IE-related events internet ethics education and promotion through website
Student	Curriculum education for internet ethics Non-curriculum education for internet ethics Online education for internet ethics Special/Guest lecture for internet ethics internet ethics qualification examination passing rate Participation rate of external events related to internet ethics internet ethics related external awards
School Parent	internet ethics education for parents in school internet ethics related publicity and events Parent participation rate in school class Utilization of student activity checkbook internet ethics related parenting activities

2.2 Survey and Analysis

The second step of the common criteria for internet ethics-index was to create a questionnaire for the weight calculation of the evaluation items. The questionnaire was prepared based on the validity and reliability for weighting the sub-object items by each evaluation area. In order to establish opinions of internet ethics officers and related organizations in elementary and middle school education, the questionnaire uses the objects shown in Table 1. Table 2 presents a comparative measure for pairwise comparisons among Internet ethics education personnel (head of school, teacher, student, school parent) on the objects in Table 1 and Table 3 shows the evaluation scale for the sub-objects of Table 1.

Table 2. Dual comparisons scale of evaluation measure

Scale	Object A	$A \geq 3B$	$A \geq 2B$	$A = B$	$2A \leq B$	$3A \leq B$	Object B
1	Head of School	()	()	()	()	()	Teacher
2	Head of School	()	()	()	()	()	Student
3	Head of School	()	()	()	()	()	School Parent
4	Teacher	()	()	()	()	()	Student
5	Teacher	()	()	()	()	()	School Parent
6	Student	()	()	()	()	()	School Parent

Table 3. Evaluation scale of sub-objects

Scale	9	7	5	3	1	0
description	Very important items	Important items	Items that are not of high importance, but should be considered	Low priority items	Items that you do not need to consider	Items you should not consider

2.3 Weight calculation of evaluation items (Objects)

In order to verify the validity of the questionnaire and to calculate the weight of each items for the evaluation items, a questionnaire survey was conducted among the persons in charge of the elementary and middle school internet ethics education and related organizations. The questionnaire method used e-mail and facsimile, and weights were calculated based on the results of 46 questionnaires who responded to the questionnaire for nine days.

In this step, it is a step to set the weight of the evaluation item for evaluating internet ethics-index. It consists of the step of calculating the weight of the evaluation area defined in Table 1 and the weight calculation step of the sub-object items of each evaluation area.

For weight calculation, this paper use the Analytic Hierarchy Process (AHP) model¹⁷ for the four evaluation areas of the objects (head of school, teacher, student, and school parent). The AHP is a method developed by Professor Sasty Thomas L. in 1970. It is designed for multi-faceted evaluation criteria and decision making by multiple subjects on multiple alternatives. It is based on the intuitive, rational and irrational judgment of decision makers, and a qualitative model that allows decision making simultaneously. For weight calculation, this paper used to four steps such as *Pairwise Comparison Matrix*, *Standard Matrix*, *Calculation of Weight*, and *Analysis of Consistency*.

2.3.1 Pairwise comparison matrix

To calculate the weights for each evaluation, first define a pairwise comparison matrix (head of school : teacher, head of school : student, head of school : school parent, teacher: student, teacher: school parent, student: school parents). In order to compare the relative importance of the internet ethics-index, this paper defined

a pairwise comparison scale for the respondents in the evaluation objects as shown in Table 4.

Table 4. Example of pairwise comparison matrix

	Head of School	Teacher	Student	School Parent
Head of School	1	2	3	3
Teacher	0.5	1	3	2
Student	0.33	0.33	1	0.5
School Parent	0.33	0.5	2	1

2.3.2 Standard matrix

A pairwise comparison matrices can be calculated based on a pair of comparison scales in the evaluation area (objects), and thereby a standard matrix can be calculated. Equation 1 represents a standard matrix calculation expression and indicates correlation values of evaluation regions.

Standard Matrix: y_n

$$= \frac{1}{x_{n1}} + \frac{1}{x_{n2}} + \frac{1}{x_{n3}} + \frac{1}{x_{n4}} \left(\text{but, } \frac{1}{x_{n1}}, \frac{1}{x_{n2}}, \frac{1}{x_{n3}}, \frac{1}{x_{n4}} > 0, \text{ the reciprocal} \right) (1)$$

The standard matrix is calculated by summing up the effects of head of school, teacher, student, and school parent, and are calculated as $1 + 1/2 + 1/3 + 1/3 = 2.167$. An example of the overall standard matrix calculation is shown in Table 5.

Table 5. Example of standard matrix

	Head of School (x_1)	Teacher (x_2)	Student (x_3)	School Parent (x_4)	Standard Matrix
Head of School (x_1)	1 (x_{11})	2 (x_{12})	3 (x_{13})	3 (x_{14})	2.167 (y_1)
Teacher (x_2)	0.5 (x_{21})	1 (x_{22})	3 (x_{23})	2 (x_{24})	3.833 (y_2)
Student (x_3)	0.33 (x_{31})	0.33 (x_{32})	1 (x_{33})	0.5 (x_{34})	97 (y_3)
School Parent (x_4)	0.33 (x_{41})	0.5 (x_{42})	2 (x_{43})	1 (x_{44})	6.5 (y_4)

2.3.3 Calculation of weight

Each objects weights can be calculated using the standard matrix defined in equation (1). The equation (2) is used to calculate the weight for each objects. In equation (2), the importance of each

objects are divided by the standard matrix value and then divided by total amount n .

Calculation of Weight: z_n

$$= \frac{1}{n} \left(\frac{x_{n1}}{y_1} + \frac{x_{n2}}{y_2} + \frac{x_{n3}}{y_3} + \frac{x_{n4}}{y_4} \right) \quad (2)$$

An example of respondent weight calculation is shown in Table 6.

Table 6. Example of weight for each objects

	Head of School (x_1)	Teacher (x_2)	Student (x_3)	School Parent (x_4)	Standard Matrix (y)	Weight (z)
Head of School (x_1)	1 (x_{11})	2 (x_{12})	3 (x_{13})	3 (x_{14})	2.167 (y_1)	0.455 (z_1)
Teacher (x_2)	0.5 (x_{21})	1 (x_{22})	3 (x_{23})	2 (x_{24})	3.833 (y_2)	0.288 (z_2)
Student (x_3)	0.33 (x_{31})	0.33 (x_{32})	1 (x_{33})	0.5 (x_{34})	97 (y_3)	0.107 (z_3)
School Parent (x_4)	0.33 (x_{41})	0.5 (x_{42})	2 (x_{43})	1 (x_{44})	6.5 (y_4)	0.165 (z_4)

2.3.4 Analysis of consistency

The consistency index is a measure of whether the response of the questionnaire respondent group to each objects are reliable. The ratio calculation formula for the consistency analysis of objects is shown in equation (3).

Consistency Index: CI

$$= \frac{\lambda \max - n}{n-1} \quad (3)$$

($\lambda \max$: Max value of pairwise comparison matrix, n : total amount of value)

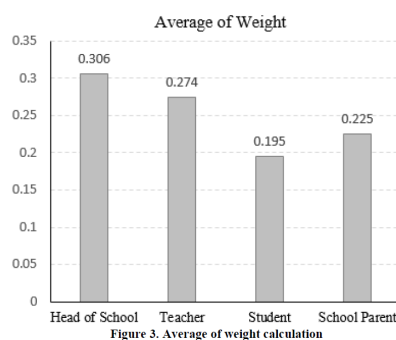
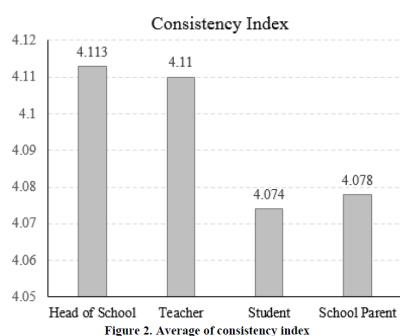
Table 7. Example of consistency index for each objects

	Head of School (x_1)	Teacher (x_2)	Student (x_3)	School Parent (x_4)	Multiplication of Weight (a)	Consistency Ratio (β)
Head of School (x_1)	1 (x_{11})	2 (x_{12})	3 (x_{13})	3 (x_{14})	1.828 (a_1)	4.112 (β_1)
Teacher (x_2)	0.5 (x_{21})	1 (x_{22})	3 (x_{23})	2 (x_{24})	1.157 (a_2)	4.087 (β_2)
Student (x_3)	0.33 (x_{31})	0.33 (x_{32})	1 (x_{33})	0.5 (x_{34})	0.432 (a_3)	4.032 (β_3)
School Parent (x_4)	0.33 (x_{41})	0.5 (x_{42})	2 (x_{43})	1 (x_{44})	0.669 (a_4)	4.054 (β_4)
CI						0.024
CI / RI						0.026

For the consistency analysis, the CI is divided by the random index (RI), which means that if the result is less than 0.1, the response of the questionnaire respondent group is reliable. In order to calculate the consistency ratio, the value of the multiplication of weight for each objects are obtained through the weight value derived first. The equation (4) can be expressed as the multiplication of the weights by the objects.

$$a_n = x_{n1z1} + x_{n2z2} + x_{n3z3} + x_{n4z4} \quad (4)$$

The value of the consistency ratio can be calculated using Equation (4). The consistency ratio (β_n) is a value (a_n) obtained by dividing the multiplication of weight ($n = \frac{a_n}{z_n}$) of each objects by the weight (z_n) of the objects. The CI value can be obtained from the λ max value, which is the average value of the consistency ratios for each objects. In general, the RI value is the value that appears when you repeat an infinite number of random numbers. In the weight calculation of this experiment, $n=4$, the value at RI is $CI/RI=0.024/0.90 = 0.026$. Therefore, the value of 0.026 is less than 0.1, so the questionnaire respondent can be said to be reliable. Table 7 shows a calculation example of the consistency analysis. The consistency ratios for the 42 respondents in the survey and the average of the weight calculation are shown in figure 2 and figure 3, respectively.



2.4 Result of comment criterial

In order to provide systematic evaluation and guidelines of internet ethics education at elementary, middle and high schools, this paper developed a common standard for the evaluation of internet ethics-index. Table 8 shows the results of the evaluation scale for the common criteria establishment defined based on the evaluation items and weights defined above.

Table 8. Results of common criteria for internet ethics

Objects	Sub-Object Items	points
Head of School	Establish medium and long-term educational goals for internet ethics education	4
	Establish internet ethics education plan for the year	4
	internet ethics education achievement (education achievement in recent 3 years)	3
	Self-evaluation of internet ethics education conducted last year	3
	Feedback from parents & students for internet ethics	4
	Organization and operation of internet ethics education	4
	Budget related to internet ethics education	4
	Participation in external training on internet ethics	3
Teacher	Participation in external training on internet ethics	5
	Organization and management of teachers' research meeting related to internet ethics education	4
	Internet addiction measurement and counseling	5
	Support about Special lectures on internet ethics education	5
	Holding IE-related events	4
	internet ethics education and promotion through website	5
Student	Curriculum education for internet ethics	3
	Non-curriculum education for internet ethics	3
	Online education for internet ethics	3
	Special/Guest lecture for internet ethics	3
	internet ethics qualification examination passing rate	2
	Participation rate of external events related to internet ethics	3
	internet ethics related external awards	3
School Parent	internet ethics education for parents in school	5
	internet ethics related publicity and events	5
	Parent participation rate in school class	5
	Utilization of student activity checkbook	4
	internet ethics related parenting activities	4
Total		100

3 Conclusions

Although the importance of internet ethics education is growing, but the internet ethical awareness education in elementary, middle and high schools are not systematically implemented due to the lack of objective indicators to assess the current level of awareness

of internet ethics. Also measurement of common criteria for internet ethics is not easy to measure of objective criteria. Therefore, we cannot systematically conduct internet ethics education in elementary school middle school high school etc. This paper proposed common criteria of measurement for internet ethics-index. For the common criteria for internet ethics-index measurement, this paper development procedures for establishing a common criteria have stages 'Elicitation of Evaluation Items', 'Survey and It's Analysis', 'Weight Calculation of Evaluation Items', and 'Determination of Comment Criteria for Internet Ethics-Index'. The proposed common criteria, can be used as a guideline of internet ethics education and to measure the level of internet ethics education in various schools and stakeholders.

In future research, it is required to apply the evaluation criteria of the common standard proposed in this study to several elementary and junior high schools and related organizations, and to improve the improvement based on the evaluation results and to formulate the evaluation scales specific to the Internet dysfunctions.

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