

# Development of the Scale for Diagnosing Online Game Addiction

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*Abstract:* - The purpose of this study is to develop the scale for diagnosing elementary school children's online game addiction through a scientific development process. The pilot test was conducted three times, and items analysis, reliability analysis, and factor analysis were conducted in each test, so 30 questions were decided for the main questionnaire survey. Some referential variables were included in the questions for the main survey such as items for testing the actual use condition and attitude of online game, aggressive behavior, impulsive behavior, solitude and self-control. In the main survey, a total of 2,584 fifth and sixth-grade students participated. For the results of the main survey, item analysis and reliability analysis were conducted, and validity was tested by exploratory factor analysis and correlation analysis. Finally, the final questions and the grouping criteria were developed through the standardization process.

*Key-Words:* Online Game Addiction, Diagnostic Scale, Elementary School Students, Game, Addiction

## 1. Introduction

Online game has been applied to education in Korea as it has been used extensively. Korea is a leading country in edutainment. On the other hand, elementary school students are showing addiction symptoms as they are immersed deeply in online game, and they frequently experience daily life disorders and health disorders. Most of children addicted to online game reject conversation with their parents, which gives rise to troubles in both sides and even the children's learning ability goes down because they lose interest in school. In addition, they tell a lie many times for game, want to have a time to be alone, and show the tendency of being immersed in or attached to game. With this, it is also impossible for them to control themselves without playing games. Recently, children's online game addiction has been developing into misdeeds or crimes and, in order to cope with this problem, relevant studies are being conducted actively.

Several domestic studies about game addiction[4] [6] [7] are showing inconsistent results in classifying addiction groups. It is because they use the Young's Internet Addiction Scale[8] not verified in the actual circumstances of Korea in most studies relevant to game addiction and each

of them establish different criteria for classifying addiction groups. These suggest the necessity for developing a reliable scale providing valid criteria for diagnosing students' online game addiction in Korea.

The purpose of this study is to identify accurate factors of online game addiction in elementary students and to develop standardized scale that can diagnose the tendency of online game addiction.

## 2. Development of the Scale

### 2.1 Pilot Test

We conducted a pilot test three times to develop the scale. We analyzed consultation data about online game uploaded to the bulletin board 'Cyber Consulting Room' at IAPC[1] and reflected the results of analysis in the 1<sup>st</sup> pilot test tool. In addition, we referred to several studies[2][3][7] including the Young's Scale[8], and advice of 10 elementary school teachers were reflected in the 1<sup>st</sup> pilot test tool. Through this process, we decided 81 items for the 1<sup>st</sup> pilot test. Also, we selected 13 items to determine the genuineness of replies referring to the MMPI test[4].

The result of the three phased pilot tests was analyzed through item analysis, reliability analysis, and exploratory factor analysis (PCA; Principle Component Analysis), and we selected items satisfying statistical criteria (Mean: 1.5~4.5, Std. deviation > 0.75, Skewness: -2~+2, Kurtosis: -2~+2, Inter-item correlations > 0.3, Eigen value > 1, Factor loading > 0.5, Rotation method: Varimax ) and confirmed factors. Table 1 shows the contents of pilot tests.

**Table 1.** Contents of pilot tests

Test	Tool	Sample	Results
1 <sup>st</sup> pilot test	81 items (5-point likert scale)	370 elementary school students	Selection of 40 items and 8 factors for the 2 <sup>nd</sup> pilot test
2 <sup>nd</sup> pilot test	40 items (5-point likert scale)	459 elementary school students	Selection of 33 items and 8 factors for the 3 <sup>rd</sup> pilot test
3 <sup>rd</sup> pilot test	33 items (5-point likert scale)	310 elementary school students	Selection of 30 items and 6 factors for the main test

## 2. 2 Main Test

We selected and clarified 30 items through the three phased pilot tests and made up the online game addiction diagnostic scale composed of 30 items. Some referential variables were included in the questions for the main survey including 20 questions for testing the actual use conditions and attitude of online game, 20 questions on aggressive behavior, 23 questions on impulsive behavior, 20 questions on solitude, and 20 questions on self-control scale.

The participants in the main survey were sampled from 4 areas divided into groups by the ratio of population (Seoul-Gyeonggi-do, Chungcheong-do-Gangwon-do, Honam-Jeju, Youngnam) in Korea, each of which was again divided into 3 subgroups (metropolitan areas, cities, towns). A total of 2,584 students at 36 elementary schools in 12 provinces throughout the country were surveyed in 2006. Excluding 267 responses (inexperienced responses of online game, wrong responses, unfaithful responses, etc), we used a total of 2,317 responses for analysis. Table 2 shows the sampling specification of the main test.

**Table 2.** Sampling specification of the main test

Area	Metropolis		City		Town		Total	
	Send-ing	Return	Send-ing	Return	Send-ing	Return	Send-ing	Return
Seoul-Gyeonggi	440	416	380	346	465	442	1,285	1,204 (93.7%)
Chuncheong-Gangwon	164	137	150	137	145	142	459	416 (90.6%)
Honam-Jeju	145	139	145	127	150	133	440	399 (90.7%)
Youngnam	230	218	195	198	160	149	585	565 (96.6%)
Total	979	910 (93.0%)	870	808 (92.9%)	920	866 (94.1%)	2,769	2,584 (93.3%)

## 2. 3 Validity Analysis

We confirmed that all items satisfied the selection criteria through item analysis and reliability analysis. The validity of these items were analyzed as follows.

### 2.3.1 Construct Validity Analysis

We executed factor analysis on 30 items selected through item analysis and reliability analysis. PCA (Principle Component Analysis) was used as a factor selection model, and the Varimax method was used to secure a single dimension property of each factor. In order to decide the factor number, the method selecting factors, eigen value of which is over 1, and the method designating the number of factors were used together. In addition, the standard of factor loading was established over  $\pm 0.4$ .

Through the 1<sup>st</sup> factor analysis of the main test, we could confirm that there are factors inconsistent with factors selected by the 3<sup>rd</sup> pilot test in terms of individual attribution of items. The 2<sup>nd</sup> exploratory factor analysis was conducted after the number of factors was set at 7 considering the decrease of eigen value and item attribution per factor. The result is shown in Table 3.

Among the 7 factors, factor 1, 2, 3, 5 and 7 have a single attribution each and factor 4 and 6 have two attributions, but those factors were judged to be included in itself through re-analysis of each item. Based on these results, we formulated the construction model of online game addiction diagnostic scale as Table 4.

**Table 3.** Exploratory factor analysis of the main test

Item code	Communality	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
B2	0.632	<b>0.782</b>	0.138	0.209	0.218	0.145	0.055	0.085
B1	0.692	<b>0.776</b>	0.158	0.225	0.185	0.150	0.104	0.038
B3	0.701	<b>0.776</b>	0.149	0.176	0.173	0.116	0.081	0.092
B5	0.642	<b>0.680</b>	0.172	0.279	0.099	0.151	0.127	0.057
B4	0.478	<b>0.498</b>	0.304	0.165	0.187	0.180	0.213	0.052
A2	0.632	0.162	<b>0.763</b>	0.166	0.169	0.138	0.057	0.066
A3	0.746	0.192	<b>0.754</b>	0.140	0.188	0.164	0.081	0.083
A4	0.753	0.106	<b>0.688</b>	0.140	0.218	0.180	0.191	0.144
A1	0.713	0.119	<b>0.676</b>	0.138	0.185	0.221	0.164	0.181
A5	0.483	0.282	<b>0.558</b>	0.119	0.121	0.091	0.211	0.076
D2	0.621	0.206	0.128	<b>0.807</b>	0.153	0.106	0.109	0.080
D3	0.515	0.264	0.199	<b>0.760</b>	0.160	0.183	0.088	0.066
D1	0.701	0.261	0.145	<b>0.757</b>	0.168	0.122	0.074	0.107
D4	0.729	0.273	0.212	<b>0.562</b>	0.084	0.228	0.173	0.055
F2	0.626	0.290	0.204	0.167	<b>0.740</b>	0.220	0.153	0.134
F3	0.677	0.275	0.293	0.170	<b>0.697</b>	0.202	0.189	0.104
F1	0.742	0.210	0.276	0.214	<b>0.680</b>	0.235	0.081	0.157
F4	0.722	0.160	0.378	0.140	<b>0.557</b>	0.216	0.219	0.154
B6	0.764	0.384	0.256	0.181	<b>0.437</b>	0.168	0.210	0.078
E2	0.759	0.130	0.280	0.171	0.091	<b>0.704</b>	0.058	0.072
E3	0.527	0.105	0.174	0.202	0.145	<b>0.653</b>	0.188	0.075
E4	0.552	0.203	0.079	0.120	0.289	<b>0.640</b>	0.190	0.175
E1	0.637	0.218	0.259	0.084	0.136	<b>0.610</b>	0.184	0.079
E5	0.571	0.121	0.020	0.094	0.282	<b>0.484</b>	0.352	0.191
C5	0.621	0.103	0.160	0.103	0.136	0.253	<b>0.772</b>	0.131
C4	0.498	0.125	0.187	0.135	0.158	0.135	<b>0.706</b>	0.256
A6	0.714	0.210	0.249	0.131	0.159	0.263	<b>0.637</b>	0.086
C2	0.791	0.045	0.056	0.012	0.141	0.182	0.046	<b>0.818</b>
C1	0.764	0.092	0.128	0.100	0.062	0.082	0.154	<b>0.795</b>
C3	0.617	0.094	0.282	0.161	0.151	0.073	0.296	<b>0.630</b>
Eigen value		3.545	3.520	2.787	2.726	2.714	2.259	2.073
Explanatory variate (%)		11.817	11.734	9.290	9.085	9.046	7.530	6.909
Cumulative explanatory variate (%)		11.817	23.552	32.841	41.927	50.973	58.503	<b>65.412</b>

**Table 4.** Construction model of online game addiction

Factors	Definition
Psychological dependence	An affirmative mentality degree that one has while he (she) is playing online game or negative mentality degree that one has when he (she) cannot play online game
Daily life disorder	The degree of abnormal behavior or attitude caused by online game
Interpersonal relationship toward online	The degree of dependency of interpersonal relationships on online game
Tolerance	The degree of increase of time for playing online game
Negative behavior and emotions	The degree of negative emotion or wrong behavior caused by online game
Mental disorder	The degree of abnormal control of own mentality caused by online game
Physical disorder	The degree of abnormal health condition caused by online game

Through these processes, we confirmed the final scale to diagnose students' online game addiction tendency composed of 30 items as in Table 5.

**Table 5.** Online game addiction diagnostic scale

Factors	No	Items
Factor 1: Psychological dependence	1	I feel so good and interesting while I play online game.
	2	I have a free feeling while I play online game.
	3	I'm happy and my anxiety disappears while I play online game.
	4	I have more confidence while I play online game.
	5	It seems that I have lost interest in my life if it's impossible to play online game.
Factor 2: Daily life disorder	6	I play online game first as soon as I come home.
	7	I play online game first even if I have a lot of things to do.
	8	I have an occasion of not doing my work because of online game.
	9	I don't have enough time to study or do my homework on account of online game.
Factor 3: Interpersonal relationship toward online	10	I've heard from others that I play online game too much.
	11	I feel comfortable and good to make friends in online game.
	12	I'm well understood by friends who are fond of online game.
	13	I'm happy to talk with others about online game.
Factor 4: Tolerance	14	I talk to my friends proudly that I play online game.
	15	It's hard to stop once I start to play online game
	16	It's hard to reduce time playing online game.
	17	I come to do for a longer time than I intend once I start to play online game
Factor 5: Negative behavior and emotions	18	I don't like to study or do my homework on account of online game.
	19	I'm reminded of online game even when I don't play it.
	20	I sometimes speak ill of the opposite party while I'm playing online game.
	21	I sometimes do wrong actions in online game (telling a lie, etc.).
Factor 6: Mental disorder	22	I'm angered if I am disturbed by someone while I'm playing online game.
	23	I get angry with a person who makes me not play online game.
	24	I can't control my anger and resentment when I lose an online game.
	25	My temper is changed into bad sides on account of online game.
Factor 7: Physical disorder	26	I lose patience and perseverance on account of online game.
	27	I become nervous on account of online game.
	28	I have sore eyes after playing online game.
	29	I have a pain in my shoulder and wrist after playing online game.
	30	I'm tired ordinarily from playing online game.

We analyzed the correlation between the online game addiction diagnostic scale and each factor to verify whether each factor was constructed meaningfully and organically or not. Table 6 shows the results.

**Table 6.** Correlation between the scale and each factor

\*\*p<0.01

Factor	Online Game Addiction Scale	Factor						
		Psychological dependence	Daily life disorder	Interpersonal relationship toward online	Tolerance	Negative behavior and emotions	Mental disorder	Physical disorder
Online game Addiction Scale	1.000							
Factor	Psychological dependence	<b>0.808</b> **	1.000					
	Daily life disorder	<b>0.802</b> **	<b>0.550</b> **	1.000				
	Interpersonal relationship toward online	<b>0.765</b> **	<b>0.632</b> **	<b>0.515</b> **	1.000			
	Tolerance	<b>0.878</b> **	<b>0.659</b> **	<b>0.679</b> **	<b>0.576</b> **	1.000		
	Negative behavior and emotions	<b>0.802</b> **	<b>0.534</b> **	<b>0.567</b> **	<b>0.519</b> **	<b>0.666</b> **	1.000	
	Mental disorder	<b>0.725</b> **	<b>0.468</b> **	<b>0.544</b> **	<b>0.442</b> **	<b>0.583</b> **	<b>0.623</b> **	1.000
	Physical disorder	<b>0.568</b> **	<b>0.305</b> **	<b>0.413</b> **	<b>0.322</b> **	<b>0.449</b> **	<b>0.431</b> **	<b>0.472</b> **

The result of analysis shows that the scale and each factor are in a significant correlation with each other at p<0.01. So, the 7 factors have a meaningful structure representing the tendency of online game addiction and are valid as the factors of the online game addiction diagnostic scale.

**2.3.2 Reference Validity Analysis**

We analyzed the correlation between the online game addiction diagnostic scale and 4 psychological variables reported in previous studies[2][3][4][5][6][7] highly relevant to game addiction in order to verify the reference validity of the scale. Table 7 shows the result of correlation.

**Table 7.** Correlation between the online game addiction diagnostic scale and 4 psychological variables

\*\*p<0.01

Item	Online Game Addiction Scale	Factor						
		Psychological dependence	Daily life disorder	Interpersonal relationship toward online	Tolerance	Negative behavior and emotions	Mental disorder	Physical disorder
Aggression	0.62**	0.46**	0.43**	0.43**	0.54**	0.64**	0.48**	0.36**
Impulse	0.40**	0.23**	0.34**	0.22**	0.41**	0.38**	0.33**	0.26**
Solitude	0.19**	0.10**	0.19**	0.07**	0.19**	0.16**	0.19**	0.14**
Self-control	0.35**	-0.21**	0.34**	-0.19**	0.33**	0.31**	0.30**	0.23**

The result of this analysis represented that all the psychological variables are relevant to the addiction diagnostic scale and the correlation was significant for all the factors at p<0.01. These results verify that the scale developed in this study is highly valid.

Next, we analyzed the correlation between the online game addiction diagnostic scale and variables relevant to time, period and frequency of online game plays. Table 8 shows the result of this analysis.

**Table 8.** Correlation between the scale and variables relevant to time playing online game.

\*\*p<0.01

Item	Online Game Addiction Scale	Factor						
		Psychological dependence	Daily life disorder	Interpersonal relationship toward online	Tolerance	Negative behavior and emotions	Mental disorder	Physical disorder
Period of game playing	0.453**	0.384**	0.400**	0.374**	0.417**	0.343**	0.256**	0.166**
Number of game plays per week	0.558**	0.420**	0.585**	0.437**	0.493**	0.408**	0.359**	0.223**
Length of game playing per day	0.584**	0.437**	0.577**	0.438**	0.537**	0.454**	0.367**	0.258**
Length of game playing per time	0.553**	0.423**	0.516**	0.417**	0.536**	0.424**	0.338**	0.235**
Number of visits to PC-Bang per week	0.395**	0.300**	0.348**	0.330**	0.343**	0.345**	0.279**	0.130**
Length of staying in PC-Bang per visit	0.401**	0.322**	0.343**	0.321**	0.357**	0.332**	0.234**	0.172**

The result of this analysis showed that all time-related variables are relevant to the addiction diagnostic scale and the correlation was significant for all the factors at p<0.01. These results prove that the scale developed in this study is valid for diagnosing students' tendency of online game addiction.

**3. Grouping Criteria for Online Game Addiction Tendency**

**3.1 Distribution of Online Game Addiction Score**

Fig.1 shows the distribution of frequency about the online game addiction tendency as the original score and the standard score.

The grouping criteria were established on the basis of the point inclining steeply in Fig. 1. It is because that the point changing sharply in distribution indicates the boundary between two different groups. In this study, we established grouping criteria that classify three groups, namely, high risk-user group, potential risk-user group and normal user group according to the general method of classifying an addiction group

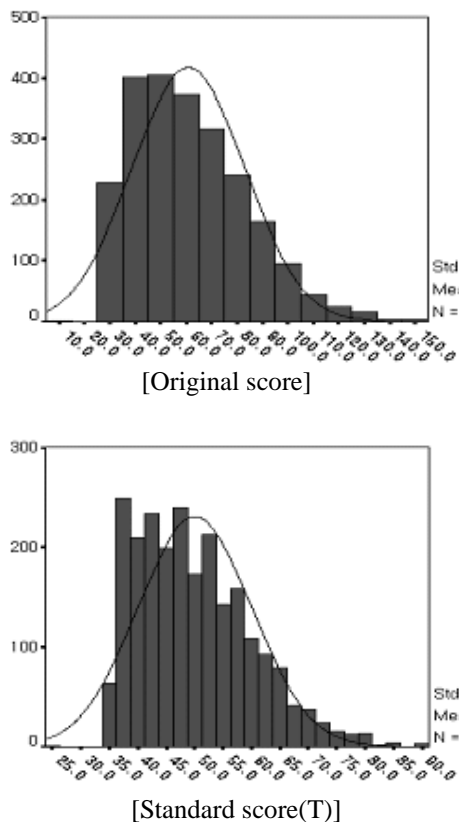


Fig. 1. Distribution of the online game addiction score: original and standard score

### 3.2 High Risk-User Grouping Criteria

#### 3.2.1 High Risk-User Grouping Criteria

The high risk-user group was established by the point where the frequency changed most sharply in distribution as we examined the distribution of addiction scores from the highest score to lower scores. The examination result showed that the frequency rises sharply at 68T as the standard point. This score approximates to 70T(2.5%), which is the statistical criterion for

the high group used frequently in the test of problem behavior. So, we can set the standard score 68T(the original score is 100, the highest 5.7%) as the high risk-user grouping criterion in this study.

In addition, among the 7 factors, 4 showed the highest correlation with addiction score. So, psychological dependence, daily life disorder, tolerance, and negative behavior and emotions can be regarded as the significant factors of online game addiction. With this, we can also classify a user into the high risk-user group when the score of each factor is over 68T. Table 9 shows the high risk-user grouping criteria

Table 9. High risk-user grouping criteria

Addiction scale score	Factor 1	Factor 2	Factor 4	Factor 5
Standard score(T)	Psychological dependence	Daily life disorder	Tolerance	Negative behavior and emotions
Over 68T	Over 100	Over 21	Over 18	Over 21
Over 100				Over 17

#### 3.2.2 Potential Risk-User Grouping Criteria

The potential risk-user group was established by the point where the frequency changed most sharply in distribution as we examined the distribution of addiction score from the high risk-user grouping score(68T) towards lower scores. The examination result showed that the frequency rises sharply at 60T as the standard point. So, we can set the standard score 60T~67T(the original score is 83~99, about 11%) as the potential risk-user grouping criterion in this study.

In addition, among 7 factors, 4 factors showed the highest correlation with addiction score. So, psychological dependence, daily life disorder, tolerance, and negative behavior and emotions can be regarded as the significant factors of online game addiction. With this, we can also classify a user as the potential risk-user group when the score of each factor is 60T~67T. Table 10 shows the potential risk-user grouping criteria.

Table 10. Potential risk-user grouping criteria

Addiction scale score	Factor 1	Factor 2	Factor 4	Factor 5	
Standard score (T)	Original score	Psychological dependence	Daily life disorder	Tolerance	Negative behavior and emotions
60T~68T	83~99	17~20	14~17	17~20	14~16

### 3.2.3 Normal-User Grouping Criteria

The normal user group is included in neither the high risk-user group nor the potential risk-user group. So, normal user grouping criteria can be established as in Table 11.

**Table 11.** Normal user grouping criteria

Addiction scale score	Factor 1	Factor 2	Factor 4	Factor 5	
Standard score (T)	Original score	Psychological dependence	Daily life disorder	Tolerance	Negative behavior and emotions
Under 59T	Under 82	Under 16	Under 13	Under 16	Under 13

## 4. Conclusions

In this study, we developed a standardized Korean scale that can diagnose the online game addiction tendency of elementary school students. The final scale is composed of 30 items and 7 factors. These factors have a significant structure showing online game addiction tendency, and are valid as the construct factors.

The results of verifying reference validity showed that the scale is valid. In addition, we developed standardized criteria that can classify online game users into three groups, namely, high risk-user group, potential risk-user group and normal user group according to the general method of classifying an addiction group.

The scale developed in this study can be useful as a basic tool in studies on online game addiction. Also, we expect that online game as edutainment can evolve into affirmative direction through the use of the scale in various studies.

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