The Relative Importance of Teenagers' Personal Characteristics on Technology Addiction

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Abstract: As the Internet becomes the major means to conduct business, new types of agenda arise in e-Business arena. One of them is Ethics. Compared to other topics, ethics education for e-services takes long time because of its characteristics. Thus, Cyberethics education is required from childhood. In this paper, we examine the status of the Korean teenagers' technology addiction, their personal characteristics, and their environmental factors composed of parents, friends, and media to diagnose their behavior and to boost their morality. In order to achieve our research goals, we survey 1,421 primary and secondary school students, and then do factor, regression, and dominance analyses. Also, we examine the relationships between the students' characteristics and their technology addiction. We focus on the Internet and mobile phone addiction as technology addiction. Based on this study, we summarize a few issues to be solved for our adolescents to do their right actions on e-environment.

1 INTRODUCTION

As people have used the technology such as the Internet or mobile devices in their daily lives recently, their dependency on the technology are on the increase. Most people are already familiar with shopping on the Internet and studying with e-Learning contents. Thus, the technology becomes indispensable to their lives. However, the side effects of the technology also occur when we use various kinds of e-services (Smglo, 2006) (Petrovic-Lazarevic et al., 2004). One of the side effects is technology addiction. Unlike the substantial addictions such as alcohol and drug, the technology addiction has two sides because many companies and schools require the fluency on the technology to fulfil their organizations' profit. Thus, it is not easy to handle the technology addiction in such an environment. Also, appropriate educational solutions and the construction of social and cultural environment are needed to prevent the technology addiction and to enhance the technology fluency.

On the ther hand, many scholars have been interested in time perspective (Zimbardo et al., 2009) for people's successful business and lives. There are several researches on time perspective that influences academic achievement, socio-economic status, and leadership (Barber et al., 2008) (Guthrie et al., 2009) (Humaira, 2006). In summary, time perspective is regarded as an important yardstick to explain a person's characteristics. Recently, the research about substance addiction combined with time perspective has started (Apostolidis et al., 2006) (Romer et al., 2010). However, there rarely exists the research about technology addiction and time perspective together. In particular, in spite of the importance of time perspective, it is hard to find education about time perspective for children.

In this paper, we analyze how our teenagers' characteristics have influences on their technology addiction, especially on the Internet and mobile phone addiction. In order to achieve the research objective, we select 5 factors: the present time perspective (PTP), the future time perspective (FTP), parents' negative attitude factor, friend factor, and media factor. The two time perspectives are self factors and the rest of the factors are environmental factors. The friend factor represents the self-efficacy about friends, called social-efficacy, whereas the media factor is the self-efficacy about media, called media-efficacy. In addition, we examine the relationships between the 5 factors and the two

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addictions. Finally, we present the relative importance of the 5 factors on the two addictions. Based on these results, we define the potential problems of the teenagers' behavior with respect to media-efficacy and propose a desirable educational way to solve the problems.

2 BACKGROUND

In this Section, we describe the types of time perspectives proposed by Zimbardo. And then, we summarize the previous research related to the time perspectives to see how they affect people's lives.

2.1 Zimbardo et al.'s Time Perspective

Zimbardo et al. (2009) proposed 6 types of time perspectives as follows: the Past-negative (PN), the Past-positive (PP), the Present-fatalistic (PF), the Present-hedonistic (PH), the Future (F), and the Transcendental-future (TF). In addition, in 1997 and in 1999, they made ZTPI (ZTIP, n.d.) and TTPI (Transcendental-future Time Perspective Inventory) (TTPI, n.d.).

The web site for Ideal Time Perspective (http:// www.thetimeparadox.com/surveys/) shows a figure that contains the survey result of the average score for the 6 time perspectives so far. According to the survey, the 6 average scores are 3.0 (PN), 3.7 (PP), 2.4 (PF), 3.4 (PH), 3.5 (F), and 3.3 (TF). The ideal scores are 1.95 (PN), 4.6 (PP), 1.5 (PF), 3.9 (PH), 4.0 (F), and 3.3 (TF). The maximum score is 5.0 and the minimum score is 1.0. It means that the ideal time perspective is the combination of the low level past negative, the high level past positive, the low level present fatalism, the high level present hedonism and future, and middle level trans-cendental future time perspectives.

However, it remains unexplored whether we can apply the same time perspective rules to teenagers for measuring their time perspectives. In other words, there is no evidence if the high level of the present hedonistic time perspective is desirable for teenagers who are morally immature.

2.2 Related Works

In Barber et al.'s research (2008), the relationship between time perspective of college students and their academic achievement levels were described. The number of the students was 255. GPA was the measure for their academic achievement. According to their experiment, when students have high levels of self-control, their time perspectives do not work well. However, when the students have low levels of self-control, the results are different. The students at a high level FTP have higher GPAs than the students at a high level PTP.

In Guthrie et al.'s research (2010), people's socio-economic status was included. The subjects were 525 adults. The more the subjects are educated, the higher the levels of their FTP are. The more professional job they have, the higher the levels of their FTP are. Besides, there are lots of researches on the relationship between the time perspective and value (Taciano et al., 2006), happiness (Zhang et al., 2011), health (Daugherty et al., 2010), suicide (Laghi et al., 2009), and so on.

3 EXPERIMENT

3.1 The Respondents

In our experiment, there were 1,421 students as shown in Table 1. As already described in Section 1, the students were in the $5^{th} \sim 6^{th}$, the $8^{th} \sim 9^{th}$, and the $11^{th} \sim 12^{th}$ grades. We surveyed at 1 primary school, 2 middle schools, and 2 high schools.

Table 1: The respondents.

Gender / School	Male	Female	Total
Primary school	87	95	182(12.8%)
Middle school	254	382	636(44.8%)
High school	297	306	603(42.4%)
Total	638 (44.9%)	783 (55.1%)	1421 (100%)

3.2 Test Measurements

Our questions for the Internet addiction test were made based on Young's measures (Young, 1998). They were composed of 25 questions. For each question, there are 5 levels such as rarely (1 point), occasionally (2 points), frequently (3 points), often (4 points), and always (5 points). Thus, a person can get 25 points as the minimum and 120 points as the maximum. Based on the range of the total score, we could divide the respondents into three groups (mild, moderate, and severe). Recently, several researches indicated the drawbacks of the Young's measure (Kang et at., 2001) (Park et al., 2010). The measure is not suitable for Korean adolescent in some aspects. Unlike Young's measure, we added students' emotion category such as intoxication in the virtual world and patience to the measures, and then modified them to be suitable to our teenagers. Our

questions fall into 4 categories: cyber world directivity, overindulgence in the Internet, ordinary life disorder, and the loss of self-control.

Similarly, the measures for testing mobile phone addiction were prepared based on the research outcome of Koh et al. (2011). Basically, since the testing measures for mobile phone addiction came from the Internet addiction test measures, the measures had similar categories to the Internet addiction test measures. There were also four categories such as the loss of self-control, depression and obsession, ordinary life disorder, and refreshing in emotion.

3.3 The Five Predictors

We proposed 5 predictors as shown in Table 2. The factors were recomposed from several research works such as (Ryu et al., 2004), (Shin, 2008), and (Han et al., 2009). And then, we performed the focus group interview with 5 teachers to examine the questions. In fact, Table 2 shows the result of the factor analysis we performed. The 2 types of time perspective represent a student's own self factors. The rest of the predictors represent his/her environmental factors.

Table 2: The 5 predictors.

Factors	Related items
PTP (Present Time Perspective) Factor	· It is important to establish my future plan. · Since whatever will be will be, it doesn't really matter what I do. · If things don't get done on time, I don't worry about it. · I take each day as it is rather than try to plan it out. · Fate determines much in my life. · There is enough time to do my postponed works. · My life path is controlled by forces I cannot influence. · Fortune brings better outcomes than effort do. · Spending what I earn on pleasures today is better than saving for tomorrow's security.
FTP (Future Time Perspective) Factor	· I meet my obligations to friends and authorities on time. · It upsets me to be late for appointments. · I complete projects on time by making steady progress. · I am able to resist temptations when I know that there is work to be done.
Parents (negative attitude toward their children) Factor	· Parents shout and scold me. · Parents neither respect my individuality nor pay attention to me. · Parents meddle in my affairs very much. · Parents are uncooperative.
Friends (social-efficacy) Factor	· When I make friends, I approach them first. · I rarely give up friendship. · It is easy for me to make friends.
Media (media-efficacy) Factor	· If I can know about the Internet very well, I can study better than now. · If I can study with the Internet, then I can achieve higher learning efficiency. · I can teach my friends about the Internet.

4 RESULTS

4.1 Time Perspective

Firstly, we describe the result of the analysis of variance which contains the differences in time perspectives among school groups (primary, middle, and high). The questions for measuring time perspectives came from (ZTPI, n.d.). The maximum score for each time perspective is 5. As shown in Table 3, the differences among school groups were significantly different (PTP: $F(2, 1418) = 7.53$, $p < .005$, FTP: $F(2, 1418) = 6.00$, $p < .005$). We confirmed that primary school students had the lowest average PTP score and the highest average FTP score. The middle and high school students had similar time perspectives. The average PTP score increased as the school grade went up whereas the average FTP score decreased as the school grade went up. These results were similar to those of Mello et al. (2006). One difference was that in case of the FTP score, high school students had a little bit higher score than middle school students.

Table 3: School group difference in the PTP scores and the FTP scores.

		N	Mean	Standard Deviation
PTP score	P	182	2.37	.66
	M	636	2.53	.55
	H	603	2.54	.52
FTP score	P	182	3.26	.47
	M	636	3.12	.45
	H	603	3.14	.47

		SS	df	*F*	Sig.
PTP	Inter	4.7	2	7.53	.001*
	Intra	437.5	1418		
	Total	442.2	1420		
FTP	Inter	2.6	2	6.00	.003*
	Intra	302.1	1418		
	total	304.7	1420		

Note. P: primary school, M: middle school, H: high school, SS: sum of square, df: degree of freedom, Sig.: significance

However, their difference was not significantly different. The result of the post-hoc analysis by using the LSD (Least Significant Difference) test was as follows: for the PTP, (i) the mean differences between primary-middle school and between primary-high school were -.16($p < .005$) and -.18($p < .0005$) and for the FTP, the mean differences between primary- middle and between primary-high were -.13 ($p < .005$) and -.11($p < .01$) respectively. Next, we describe the result of *t*-test which shows

the differences between male and female students. The differences were significantly different (*PTP: t = 3.44, df = 1419, p < .005, FTP: t = -2.32, df = 1419, p < .05*). Also, the male students had a higher average PTP score (2.59) than the female students (2.5), whereas the female students have a higher average FTP (3.03) score than the male students (2.96).

4.2 Technology Addiction

In this Subsection, we describe the result of the analysis of variance which tells the differences in the Internet and mobile phone addiction points among school groups. For the two addiction points, the middle and the high school students had higher scores than the primary school students. And, their gap was significantly different as shown in Table 4 (Internet: *F(2, 1418) = 88.81, p < .0005*, Mobile: *F(2, 1418) = 63.63, p < .0005*). As school grade went up, the Internet and mobile phone addiction points also increased (Internet: *34.3(P) < 44.6(M) < 45.4(H)*, Mobile: *29.7(P) < 44.2(M) < 46.6(H)*).

In addition, according to the result of the post-hoc analysis by using the LSD test, all groups were different for mobile phone addiction ((i) primary-middle = -14.46(*p < .0005*), (ii) middle-high = -2.39 (*p < .001*), (iii) high-primary = 16.85(*p < .0005*). In case of the Internet addiction, there was a significant difference between primary-middle and between primary-high ((i) primary-middle=-10.31(*p < .0005*), (ii) high-primary = 11.08 (*p < .0005*).

Table 4: School group differences in the two addictions.

		Average square	df	*F*	Sig.
Internet	Inter	202493	2	88.81	.000*
	Intra	2280	1418		
	Total		1420		
Mobile phone	Inter	91508	2	63.63	.000*
	Intra	1438	1418		
	total		1420		

Note. P: primary school, M: middle school, H: high school

Next, we describe the result of *t*-test which shows the difference between two genders. The differences are significantly different (Internet: *t = 10.36, df = 1419, p < .0005*, Mobile Phone: *t =-6.83, df = 1419, p < .0005*) as shown in Table 5. In case of the Internet addiction, the male students' mean score was higher than the female students' average. However, in case of mobile phone addiction, the female students' mean score was higher than the male students' mean score.

4.3 Regression Analysis

In this Subsection, based on the result of our factor analysis shown in Table 2, we present the result of regression analysis to see which factors influence the Internet addiction and mobile phone addiction.

Table 5: Gender difference in two addictions.

		N	Mean	Standard Deviation
Internet	Male	638	47.3	11.66
	Female	783	40.6	12.38
Mobile phone	Male	638	40.2	15.13
	Female	783	46.0	16.24

Firstly, Table 6 describes how the 5 factors influenced the students' Internet addiction. All predictors were statistically significant to the Internet addiction. Among the 5 factors, the FTP and the social-efficacy had negative relationships with the Internet addiction. In other words, a student's Internet addiction point decreased when his/her FTP score increased. The social-efficacy had the same result as the FTP score. However, the present time perspective, parents' negative attitude toward children, and high levels of media-efficacy affected the Internet addiction positively.

Table 6: The student's individual 5 factors and the Internet addiction.

Factors	B	Beta	*T*	Sig.
constant	43.63	-	151.63	.000
PTP (X_1)	4.67	.37	16.23	.000*
Parents (X_2)	2.50	.20	8.68	.000*
FTP (X_3)	-1.63	-.13	-6.67	.000*
Friends (X_4)	-1.07	-.09	-3.72	.000*
Media (X_5)	2.72	.22	9.45	.000*

R^2=.251, *F*=94.78, *p* <.0005

Next, Table 7 shows how the 5 predictors influence the students' mobile phone addiction. Similar to the Internet addiction, the PTP, parents, and media-efficacy factors affected on mobile phone addiction and had positive relationships with it. Also, the FTP factor had a negative relationship with mobile phone addiction. However, in case of mobile phone addiction, the social-efficacy did not influence mobile phone addiction.

Table 7: The student's individual 5 factors and mobile phone addiction.

Factors	B	Beta	*t*	Sig.
constant	43.36		106.00	.000
PTP (X_1)	2.66	.17	6.50	.000*
Parents (X_2)	2.77	.17	6.76	.000*
FTP (X_3)	-1.36	-.09	-3.33	.001*
Friends (X_4)	.71	.04	1.73	.083
Media (X_5)	1.48	.09	3.62	.000*

R^2=.075, *F*=23.04, *p* <.0005

4.4 Relative Importance

In this Subsection, we use dominance analysis (Budescu, 1993) to investigate the relative effects of the 5 predictors on the Internet and mobile phone addictions. We cannot assure the relative importance among predictors by using the coefficient value, B, in a regression analysis. In order to measure that, Budescu (1993) proposed a novel way to calculate the dominance among predictors. In Budescu's research, the dominance analysis is defined to measure the relative importance among different variables, which are obtained from a factor analysis.

The calculation method and its proof are given in (Behson, 2002). Let k be the number of variables already in the equation. For a predictor, x_i, ($1 \le i \le$ *the number of predictors*), M(Cx_i) is defined as a mean usefulness index and it means the average of the average R^2 for all k ($0 \le k < 5$). The total R^2 was .251 and each M(Cx_i)s were .1393, .0400, .0170, .0073, and .0473 respectively. The sum of all M(Cx_i)s equals to the total R^2. The result indicated that among the 5 predictors, the PTP took the biggest portion (55.6%). It was followed by media-efficacy (18.8%). The rest were 15.9% (parents), 6.8% (the FTP), and 2.9% (social-efficacy). Thus, the PTP exerted the greatest marginal influence on the Internet addiction. The next three factors were media-efficacy, parents, and the FTP.

Next, for mobile phone addiction, the M(Cx_i)s were .0276 (PTP, 36.75%), .0299 (parents, 39.81%), .0071 (FTP, 9.45%), .002 (social-efficacy, 2.66%), and .0086 (media-efficacy, 11.33%). In case of mobile addiction, the PTP factor and the parental factor had similar portion in their importance. In fact, the social-efficacy was not significant for mobile addiction. Unlike the Internet addiction, parents' negative attitude toward their children exerted the greatest influence. The next three factors were the PTP, media-efficacy, and the FTP. From our experiment, we confirmed that there were differences in factors which influence the Internet and mobile phone addictions.

4.5 Media-efficacy

According to the results of the dominance analysis, the media-efficacy is an important factor which can influence the two addictions. The media-efficacy is important when we use new technologies. The positive effect of the media-efficacy brings technology fluency. However, the negative effect of the media-efficacy brings technology addiction. We show the media-efficacy effect with the purposes of the Internet usages and academic achievement levels. Firstly, as the Internet addiction level increased, students used the Internet usage to play on-line games more (20% < 30.4% < 42.5%). However, the less the number of students who used the Internet for 'information acquisition for homework' was, the lower the addiction level was (10.7% < 5.1% < 3.1%). Next, we compared the same analysis with academic achievement levels and the purposes of the Internet usage. The higher the academic achievement level was, the higher the number of students who use the Internet for 'information acquisition for homework' was.

In summary, having media-efficacy is important to teenagers because they must have media-efficacy for a better use of technology. However, if they are educated in a wrong way and if they have a biased attitude towards technology or they have a wrong concept on media-efficacy, then they can be addicted to the technology. Thus, schools and institutes should examine their instructional methods and contents to educate teenagers to use technology positively in the future.

5 CONCLUSIONS

In this paper, we examine the relationship between the self and the environmental factors of Korean teenagers and technology addiction. As the factors, the present time perspective, the future time perspective, parents, friends, and media were studied. We focused on the Internet and mobile phone addiction as technology addiction. Also, we presented which factor was the most influential to the two addictions by dominance analysis.

In case of the Internet addiction, all the 5 factors influenced the Internet addiction. Among the 5 factors, the present time perspective was the greatest factor that influences the addiction. On the other hand, in case of mobile phone addiction, 4 factors (except social-efficacy) influenced mobile phone addiction. And, the parental factor was the greatest among the factors.

We confirmed that time perspective factor is important to control the addiction level from our research. Therefore, if teachers can make their students have a high level of the future time perspective and a low level of the present time perspective, then their education will contribute to reduce the technology addiction level in the future.

In addition, media also plays an important factor for the two addictions. This result may bring misunderstanding that if students can use the

Internet very well, then they are easy to be addicted to the Internet. However, students cannot study without technology in the future. To prohibit the use of technologies is not the right answer. The existing educational methods for media including the Internet and mobile devices should be modified. There has been no consideration of ethics in technology education. In the future, new educational methods should be developed for teenagers.

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