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Gender Differences in Problematic Online Behavior of Adolescent Users over Time

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남녀 청소년 소비자의 온라인 문제행동 차이에 대한 종단 분석

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Abstract

This study identifies and tracks changes gender differences in adolescent users' problematic online behavior. This study used Korea Youth Panel Survey (KYPS), which has tracked respondents over 7 years, with self-control theory and social learning theory applied as a theoretical framework. The model included individual-level variables such as self-control and respondent's experience of problematic behavior (offline), as well as socialization variables such as the number close friends who engaged in problematic offline behavior, parent-child relationships, and parental monitoring. Dependent variables included problematic online behavior, unauthorized ID use (ID theft) and cyberbullying (cursing/insulting someone in a chat room or on a bulletin board). Control variables consisted of academic performance, time spent on a computer, monthly household income, and father's educational attainment. Random and fixed effects models were performed by gender. Results supported self-control theory even for the within-level analysis (fixed effects models) regardless of gender, while social learning theory was partially supported. Only peer effects were found significant (except for unauthorized ID use) among girls. Year dummy variables showed significant negative associations; however, academic performance and time spent using computers were significant in some models. Father's educational attainment and monthly household income were found insignificant, even in the random effects models. We also discuss implications and suggestions for future research and policy makers.

Keywords

Introduction

Since the Internet and computers have begun to permeate our daily lives, people have started using the Internet at a much younger age. Particularly, in Korea, one of the most wired countries in the world [22, 24], almost all teenagers (99.9%) and children aged 3 to 9 years (85.5%) have reported that they are currently using the Internet [35].

The growing use of the Internet is reflected in the rise in problematic online behavior patterns. As teens and adolescents represent the rising population of heavy Internet users, it seems that their problematic and delinquent behaviors are also transferred to the online platform. Various types of problematic online behavior, for example, cyberbullying, online ID theft, and digital piracy, as well as addictive behaviors such as online game addiction, have emerged during the past decade and received much attention. The prevalence of online

delinquency has been well-documented [31, 46, 64], and negative effects such as poor academic achievement and school commitment [38, 58, 70] as well as depression and suicide [6, 7, 19, 51, 54] have been reported by media and research worldwide.

While it is well-known that overall risky behavior reaches a peak at around the age 15 [26, 28], most previous research has focused on the population of late teens, college students and/or adults [7, 19, 40, 69]. Taking into consideration that adolescence is a major transitional period, during which children start to exhibit the tendency of risky and problematic behavior [15], and peer association becomes much stronger [63], more attention needs to be paid to younger adolescents in their earlier teens. In addition to starting from the early stage of participation in online misbehavior, research needs to track behavioral changes over time to see how they change and what factors affect the changes.

Meanwhile, gender difference has well been noted in adolescent delinquent behavior [14, 17]. Furthermore, there exist gender differences in using the Internet [25], with boys being more proficient in digital competence. While studies have found that gender differences exist in delinquent behaviors online, as well [19, 38, 65], whether factors of problematic online behavior differ by gender and how the factors of such behaviors may change overtime have rarely been explored.

The purpose of the current study was to investigate gender differences in adolescent users' problematic online behavior over time. Among the various types of problematic online behavior, unauthorized ID use and cyberbullying were the variables of interest in this study, with four waves from the Korea Youth Panel Survey (KYPS) were used for analysis. Panel analysis is a powerful tool especially for examining within-individual changes over time [5], while prior research to date has mostly utilized cross-sectional data.

This study contributes in several aspects. First, the findings will shed light on gender differences in problematic online behavior; for example, whether such behavior is gender-based and whether the significant factors are different across genders. Second, this study will provide information which will contribute to the development of policy and education programs by gender regarding online ethics and behavior. Third, using a panel analysis, estimates which are more consistent than the pooled logit/regression analysis, and furthermore, within-individual changes over time can be obtained.

Literature Review

1. An Overview of Theoretical Framework

Studies have attempted to explain problematic behaviors and delinquency through theories such as self-control theory [11, 12], social learning theory [1, 4], and interaction theory [63]. In this light, a growing body of literature on problematic online behavior, which can be seen as another type of problematic behavior, has applied these theories to understand the determinants [47, 55].

Self-control is a person's ability to resist temptation when opportunity comes, the lack of which is a major factor of criminal/deviant behavior. Therefore, low self-control leads to delinquency including that committed online. Based on self-control theory, people with low self-control have a tendency to be impulsive, insensitive, self-centered, and risk-takers; they are likely to engage in risky analogous behaviors (e.g. drinking, smoking) and actions which bring them instant gratification. Hence, those who with a propensity of criminal involvement or risky behavior are thought to lack sufficient self-control. Moreover, those who have participated in one type of criminal or risky behavior are very likely to be involved in other types of crime.

On the contrary, social learning theory does not assume any natural impulse toward delinquency or crime [1, 61]. This perspective emphasizes reciprocal interaction between cognitive, behavioral and environmental determinants of human behavior [1, 4]. Akers [1] applied this to the field of criminology and argued that delinquent behavior must be learned through the same mechanism as confirming behavior. The more individuals are exposed to models of criminal behavior from salient others, the more likely they tend to participate in crime and deviance [1].

Developed from the aforementioned theories, interaction theory suggests the reciprocal nature of the development of human behaviors; differing from self—control theory, lack of control does not necessarily lead to delinquency [63]. Instead, human behavior such as delinquent behavior develops over time as people interact with each other and as a result of prior behavior [36, 63]. According to this theory, the influence of parents is stronger through childhood, but starts to decrease when children become teenagers (12–13 years old, in particular). During this stage of life, peer influence becomes much greater [63]. Hence, the influence of both parents and friends must be considered.

2. Prior Research on Problematic Online Behavior

A number of factors based on these theories have been studied in the attempt to understand online deviant/problematic behaviors (cyberbullying, digital piracy, and addiction to the Internet/online games to name a few). Self—control was a significant factor in understanding adolescents' problematic online behaviors [8, 9, 32, 66], showing negative association with problematic online behaviors; those with a higher level of self—control were less likely to be involved in problematic online behavior. Self—control has shown as consistently a significant association with problematic online behavior as it has with problematic offline behavior [13].

In this light, the relationship between deviant behavior committed offline needs to be considered in regard to problematic online behavior since the experience of problematic offline behavior could represent the tendency of becoming delinquent online, as well. With the prevalence of teens' online exposure and increasing problems online, some researchers have linked teens' offline behaviors to their online behaviors [9, 19, 37, 62, 70], and concluded that problematic online behavior was an extension of offline behavior, while others did not find significant association between online and offline bullying [69].

Meanwhile, based on social learning theory, which asserts that parents are salient others after whom adolescents model their delinquent behavior, variables for the parent—

child process such as parental attachment/relationship, parental warmth, and parental monitoring have been utilized. Teenagers with positive parent—child relationships were less likely to engage in problematic behavior on the Internet [8, 20, 33, 42, 69]. Parental monitoring/control, however, was not necessarily helpful. While previous research has reported that parental monitoring showed a negative association with problematic online behavior [53, 69], other studies from Korea found that parental control/monitoring was positively related to problematic online behaviors [30, 51]. Researchers argue that teens might be more likely to commit deviant behavior online when they felt more stressed from parental control [29]. Furthermore, parents often monitor children physically, but may not be able to monitor children's online activities effectively.

Friends, known to be another salient source in delinquent behavior and a stronger influence on teenagers, play a greater role in teens' behaviors including both problematic online and offline behaviors. Korean Educational Development Institution (KEDI) [34] reported that 95% of teens used abusive language and learned such language from their peer groups and from the Internet. Having deviant peers was positively associated with the probability of committing problematic online behavior [8, 52, 55, 62].

With regard to gender differences, boys showed a higher tendency of delinquent/problematic behavior in general [17, 26], and are known to have better digital competence/literacy than girls [10, 50]. In addition to differences in computer and Internet use, past studies have demonstrated that prevalence and frequency of engaging in problematic online behavior is significantly higher for male students [8, 18, 19, 32, 38, 39, 57, 65], while other researchers found no difference when taking into consideration other personal characteristics such as sensational seeking [49]. Men were found to have more favorable attitudes toward online piracy than female students [31, 43], while no difference in gender was found in other studies regarding other types of online delinquency [20, 56, 67, 70].

Although findings have been mixed at times, extant research has demonstrated that several individual level

factors are predictive of, or related to, varying forms of online delinquency/problematic behavior. Some found a positive relationship between poor academic achievement and frequent cyberbullying [48, 70], while others found no significant association between school performance and problematic online behavior [38, 58]. Children's mental health problems such as depression seem to affect problematic online behaviors, and positive relationships have been found [6, 21, 51, 70]. Time spent on the Internet/computers was found to be positively associated with problematic online behaviors [19, 38, 39, 41, 65, 69]. Although father's educational attainment was utilized in several studies, the results were inconsistent; sometimes it was positively associated [8], while it was not significant in others [39].

To date, only a few studies have tested factors based on both self-control and social learning theory. The current study tests both theories in that (1) self-control affects problematic online behavior as an individual-level factor, and (2) parents and peer have influence as proxies of socialization. Some studies excluded either parents or peer effects in the models; according to interaction theory, however, the strength of parent and peer influence changes over time, especially during adolescence, and hence both should be taken into consideration. In addition, to date, most findings on problematic online behavior focused on subjects in their late teens or collegiate and were based on cross-sectional data. Little is known about how younger adolescents in their early- to mid-teens develop and change in regard to their online behaviors over time. Furthermore, research on gender differences in problematic online behavior is scarce. This study will contribute to identifying the gender differences in adolescent users' problematic online behavior and examining within individual variation during their early- to mid-teens with panel data.

Methods

1. Data and Sample

The data used in this study was from the 1st to the 4th

waves taken from the KYPS, which has been accumulated over 7 years, and administered by the National Youth Policy Institute (NYPI). Second-year middle school students (the equivalent of eighth graders in the U.S.) residing in Seoul and 11 other cities and provinces in South Korea were the subjects of this survey when it was begun in 2003 (for more information on data collection and sampling, refer to the NYPI website http://www.nypi.re.kr).

Each wave has 3,449 cases and thus, there are 13,796 cases in total, while the final sample size for the present study was 11,636 (male=5,808 and female=5,828; four waves) and the dataset was strongly balanced, which means there are 2,909 cases in each wave. Observations not included in any of the four waves were excluded from the analysis. Data was screened for out-of-range values.

2. Measures

1) Dependent variables

Problematic online behavior was defined in this study as an illegal or immoral behavior which occurs when an individual is online. The dependent variables are as follows: (1) using an unauthorized Internet ID or the resident registration number of another person during the past year (unauthorized ID use), and (2) cursing or insulting someone in a chat room or on a bulletin board (cyberbullying) during the past year.

2) Independent variables

(1) Individual-level variables

To measure self-control, a 7-item composite scale was used referring to previous studies [3, 8], and it included the following statements: "I wholeheartedly take part in exciting things even if I have to take an examination tomorrow," "I abandon a task once it becomes hard and laborious," "I am apt to enjoy risky activities," "I enjoy teasing and harassing other people," "I feel like I am a ticking time bomb," "I lose my temper whenever I get angry," and "I habitually don't do my homework." Responses were measured with the Likert format and the ranged from 1 (strongly agree) to 5 (strongly

disagree), with the alpha coefficient being .675, .698, .702, and .694, respectively, in each wave. The measurement for respondents' own delinquent behavior was made up of 14 items regarding their experience of smoking, drinking alcohol, having an unexcused absence from school, running away from home, underage sex, beating other people, taking part in a group fight, petty extortion, stealing, being involved in a 'sugar-daddy' relationship, severely teasing other people, threatening someone, partaking in collective bullying, and sexual assault or sexual harassment during the past 1 year. These were coded to dichotomous variables (0=never and 1=more than once) and summed (ranged from 0 to 14). Through the summation of various types of deviant behavior, even the extent of participation, not to mention the existence, can be reflected.

(2) Socialization variables

Deviant peer association was measured with eight items in total, and regarded whether respondents have close friends who (1) have been disciplined, suspended, or expelled from school; (2) have been arrested by the police; (3) have drunk alcohol; (4) have smoked; (5) have had an unexcused absence from school; (6) have beaten another person; (7) have committed petty extortion; and (8) have committed theft during the past year. These items were coded to binary outcomes (0=never and 1=more than once), and summed respectively (ranged from 0 to 8). As for parent-related variables, the scale for parent-child relationship was based on previous studies using the KYPS [8, 37], and the following questions were used regarding the affection of the respondent's parents: "My parents and I try to spend much time together," "My parents treat me with love and affection," "My parents and I have frequent conversations," and "My parents and I understand each other well," with the responses in the Likert format ranging from 1 (very untrue) to 5 (very true). The alpha coefficients were .817 in 2003, .842 in 2004, .841 in 2005, and .848 in 2006, respectively. Parental monitoring was measured with a summation of 4 items referring to previous research [60]. "When I go out, my parents usually know where I am," "When I go out, my

parents usually know whom I am with," "When I go out, my parents usually know what I am doing," and "When I go out, my parents usually know when I return" were used to build this scale with the alpha coefficients being .850 in 2003, .869 in 2004, .885 in 2005, and .881 in 2006. Responses ranged from 1 (very untrue) to 5 (very true).

(3) Control variables

Questions regarding respondents' psychological health condition were also ascertained ("I have psychological or mental problems," with the responses in Likert format ranging from 1, 'very unlikely,' to 5, 'very likely'). Time spent on the computer (hours of computer use per day), school performance (percentile rank in class; the lower, the better), father's educational attainment (converted into years of schooling), monthly household income (log transformed) were also included, as well as year dummies (reference category=year 2003) for controlling for time period effects.

3. Analyses

The current study performed panel logistic regression analyses with STATA ver. 12.0 (Stata Co., College Station, TX, USA). Pooled estimators using cross-sectional data are generally inconsistent since they ignore heterogeneity across individuals, whereas more consistent estimates can be obtained with the panel data [45]. According to the assumption of panel regression models, the error terms are decomposed into two components: (1) a person-specific error (time-invariant) and (2) an idiosyncratic error (time-varying) [68]. Random and fixed effects models are known to be the most commonly used [2], while these two models are based on different assumptions. A random effects model's assumption is that unobserved individual effects do exist, and that these are uncorrelated with the variables in the model. It is, however, more likely that unobserved variables produce some bias in reality, which favors a fixed effects model [5] since a fixed effects model does not assume the uncorrelation. Moreover, the assumption of exogeneity for a fixed effects model, which accounts for a form of

endogeneity resulting from time–invariant unobservable variables, enhances this model's power [16]; there is no need to worry about heterogeneity bias. Meanwhile, there exist disadvantages of a fixed effects model; only the cases which experienced changes over time are included, while time–invariant variables are excluded during the estimation procedure. The focus of this study is a fixed effects logit model, while results from both fixed and random effects models were provided. Listwise deletion was used for missing data.

Results

1. Descriptive Results

The mean age of respondents was 13.8, 14.8, 15.8, and 16.8 years in each respective wave. Respondents' experience of problematic online behaviors decreased over the four time periods in general. Among the respondents who had committed problematic online behavior, many had experienced such behavior in 2003 when they were in middle school. For girls, unauthorized ID use decreased over time (from 317 individuals, which is more than 21%, in 2003, to only 45 in 2006), as did cyberbullying (from 41.8% in 2003 to 5% in 2006). Boys also showed a decrease in problematic online behavior; unauthorized ID use decreased from 26.17% in 2003 to 8.2% in 2006, and cyberbullying from 43.18% to 13.02%. The overall means over the four time periods are illustrated in Table 1. Girls showed a significantly lower tendency in either type of problematic online behavior.

With regard to the individual–level variables, the overall mean score of self–control was 23.89 for girls and 23.64 for boys on a scale of 7 to 35 over the four time periods. The level of self–control was significantly higher for girls than boys. The overall mean of respondents' experience of delinquent behavior was .79 for girls, and .89 for boys, which was a statistically significantly higher frequency for boys.

In terms of socialization variables, the overall mean score of parent–child relationship was 14.16 for girls and 13.73

Table 1. Descriptive Statistics (N=11,636; T=4)

Variable	Overall mean		Overall SD		Minimum value	Maximum value	t/z
	Girl	Boy	Girl	Boy			
Unauthorized ID use	.097	.142	.296	.349	0	1	-7.53[***]
Cyberbullying	.185	.239	.388	.427	0	1	-7.24[***]
Self-control	23.885	23.642	4.442	4.396	7	35	2.95[**]
Delinquent behavior	.792	.888	1.328	1.390	0	13	-3.79[***]
Parent-child relationship	14.155	13.730	2.989	2.915	4	20	7.76[**]
Parental monitoring	13.924	12.895	3.316	3.295	4	20	16.79[**]
Deviant peer association	1.001	1.211	1.646	1.840	0	8	-6.46[***]
Psychological health problems	1.629	1.637	.856	.858	1	5	-.53
Rank per class (%)	36.284	37.934	27.263	27.447	1	100	-3.17[**]
Computer use (hr/day)	2.071	2.410	1.369	1.657	.033	14.00	-11.94[***]
Monthly household income (log)	5.648	5.680	.758	.790	1.609	9.210	-2.18[*]
	(2,837,300 KRW; app. 2,800 US$)	(2,929,500 KRW; app. 3,000 US$)					
Father's education (schooling yr)	13.183	13.291	2.970	3.014	0	22	-1.93[+]

For the dependent variable 'software piracy,' z score was computed from a proportion test, and t-tests were done under the equal variance assumption based on results from Bartlett's statistics for an equal variance test.
KRW, Korean Won.
[+]p<.10, [*]p<.05, [**]p<.01, [***]p<.001.

for boys, while for parental monitoring, it was measured at 13.92 for girls and 12.90 for boys on a scale of 4 to 20. Both parent-related variables showed a significantly higher level for girls than boys. The overall mean of friends' experience of delinquent behavior over time (deviant peer association) was 1.00 for girls and 1.21 for boys, respectively, on a scale of 0 to 8. Compared to girls, boys had significantly more friends who had exhibited delinquent behavior offline.

The overall mean of psychological health problem was 1.63 for girls and 1.64 for boys on a scale of 1 to 5. The overall mean of percentile rank in class was 36.28 for girls and 37.94 for boys on a scale of 1 to 100. Boys showed a significantly lower level of school performance. Time

spent using computers was more than 2 hours per day on average (2.07 hours for girls and 2.41 hours for boys, a significant difference, and monthly household income was approximately 2,800 dollars for girls and 3,000 dollars for boys (2.84 and 2.93 million Korean Won, KRW), which was similar to the average amount of Korean household income during the same period (2.91 million KRW) as was reported by Statistics Korea [59]. The level of father's education converted to years of schooling was 13.18 years on average for girls and 13.29 years for boys.

2. Estimates from Panel Logistic Regressions

Results from a random effects model are demonstrated

Table 2. Results from Random Effects Models by Gender

| Random effect | Unauthorized ID use | | | | | | Cyberbullying | | | | | |
| | Girl | | | Boy | | | Girl | | | Boy | | |
	Coef.	SE	p/CI	Coef.	SE	p/CI	Coef.	SE	p/CI	Coef.	SE	p/CI
Self-control	-.062	.017***	.001	-.043	.014**	.002	-.057	.014***	.001	-.040	.012***	.001
Delinquent behavior	.306	.052***	.001	.251	.042***	.001	.416	.049***	.001	.303	.038***	.001
Parent-child relationship	.005	.026	.853	.032	.022	.138	-.006	.022	.775	.011	.018	.548
Parental monitoring	-.016	.023	.490	-.022	.019	.240	-.026	.019	.186	-.024	.016	.125
Deviant peer association	.038	.044	.394	.095	.032**	.003	.101	.037**	.006	.060	.027*	.030
Psychological health problem	.079	.076	.300	.084	.062	.181	.011	.065	.860	.010	.054	.854
Rank in class (%)	-.002	.003	.368	-.007	.002**	.003	-.006	.002**	.005	-.003	.002+	.063
Computer use (hr/day)	.086	.049+	.081	.090	.033**	.007	.096	.041*	.019	.099	.029***	.001
Household monthly income (log)	-.099	.101	.326	.012	.075	.876	.027	.078	.732	-.008	.060	.889
Father's education (yr)	.002	.027	.944	.002	.023	.935	-.025	.023	.268	.021	.019	.258
Year 2004 (ref. 2003)	-1.204	.155***	.001	-1.114	.135***	.001	-1.445	.127***	.001	-1.158	.113***	.001
Year 2005	-2.161	.202***	.001	-1.683	.148***	.001	-2.680	.166***	.001	-1.818	.122***	.001
Year 2006	-2.446	.220***	.001	-1.720	.151***	.001	-3.116	.186***	.001	-2.095	.130***	.001
Constant	-.361	.837	.666	-1.183	.691+	.087	.955	.683	.162	.004	.569	.994
Variance of residuals within groups (log)	.819	.177	.472 .116	.761	.138	.491 1.031	.691	.145	.409 .974	.564	.812	.324 .804
Rho: intra-class correlation	.408	.043	.328 .494	.394	.033	.332 .460	.378	.034	.314 .446	.348	.028	.296 .404
N	4,969 (1,419 groups)			5,125 (1,419 groups)			4,969 (1,419 groups)			5,125 (1,419 groups)		
Chi square	294.54***			295.81***			537.55***			464.87***		
Pseudo R2	.294			.210			.333			.222		
LR test (rho=0)	88.21***			161.97***			135.57***			197.77***		
Hausman (FE vs. RE)	2.76			64.48***			35.52***			37.49***		

Coef., coefficients.
+p<.10, *p<.05, **p<.01, ***p<.001.

Table 3. Results from Fixed Effects Models by Gender

Fixed effect	Unauthorized ID use						Cyberbullying					
	Girl			Boy			Girl			Boy		
	Coef.	*SE*	*p*	Coef.	*SE*	*p*	Coef.	*SE*	*p*	Coef.	*SE*	*p*
Self-control	-.076	.027**	.004	-.022	.019	.255	-.047	.023*	.039	-.004	.016	.789
Delinquent behavior	.195	.077*	.011	.181	.057**	.002	.244	.069***	<.001	.243	.047***	<.001
Parent-child relationship	.022	.041	.588	.058	.030+	.054	-.016	.035	.635	.036	.026	.161
Parental monitoring	-.02	.035	.581	<.001	.025	.998	-.027	.030	.363	-.009	.021	.682
Deviant peer association	.099	.062	.107	.108	.041**	.008	.152	.054**	.004	.083	.033*	.014
Psychological health problem	-.088	.112	.432	.018	.076	.813	-.046	.090	.612	-.005	.069	.940
Rank in class (%)	-.001	.004	.857	-.001	.003	.714	-.009	.003**	.003	<.001	.002	.952
Computer use (hr/day)	.058	.073	.424	.089	.047+	.058	.017	.060	.773	.088	.039*	.026
Household monthly income (log)	-.063	.129	.624	.096	.087	.267	.041	.112	.716	-.021	.071	.768
Father education (yr)	(omitted)			(omitted)			(omitted)			(omitted)		
Year 2004 (ref. 2003)	-1.246	.179***	<.001	-1.038	.146***	<.001	-1.541	.148***	<.001	-1.137	.123***	<.001
Year 2005	-2.220	.212***	<.001	-1.706	.155***	<.001	-2.766	.181***	<.001	-1.866	.128***	<.001
Year 2006	-2.528	.235***	<.001	-1.725	.161***	<.001	-3.257	.208***	<.001	-2.158	.138***	<.001
N	1,257 (341 groups)			1,747 (473 groups)			2,239 (615 groups)			2,664 (722 groups)		
Chi square	335.07***			269.67***			767.09***			508.36***		
Pseudo *R²*	.352			.207			.462			.255		

Coef., coefficients.
+p<.10, *p<.05, **p<.01, ***p<.001.

in Table 2. From the results of the likelihood−ratio test, a panel model was found to be preferable to a pooled model. Coefficients in a random effects model show changes on average and were estimated from all units whether or not they experience a change during the specific time period. For girls, a higher level of self−control led to a decrease in either type of problematic online behavior, while respondents' experience of deviant behavior increased the likelihood of problematic online behavior. As girls spent more time using computers, both unauthorized ID used and cyberbullying increased over time. For cyberbullying by girls, deviant peer association and academic performance was found to be significant, while not so for unauthorized ID use. As girls grow older, either type of problematic online behavior decreased. In terms of boys' behavior, self−control, the respondent's experience of deviant behavior, deviant peer association, school performance, computer use, and year effects were significant in both types of online misbehavior.

The Hausman test showed that a fixed effects model was preferable to a random effects model except for girls' unauthorized ID use. This could be due to the small number of observations (only 1,257 cases out of 4,969 remained for the fixed effects analysis). Fixed effects models include only the individuals who showed changes in their behavior over time, and thus, the respondents who consistently exhibited or didn't exhibit problematic online behavior over the four time periods were entirely excluded from the analysis. Table 3 presents the estimates from fixed effects models including girls' unauthorized ID use, while the focus is on the other three models. Overall, girls' unauthorized ID use showed somewhat different features in its significant factors; only the individual level variables, namely, self−control and respondent's experience of deviant behavior, were significant except for the year dummies. For girls, in particular, self−control showed a significant influence even in the fixed effects models, while it was not for boys; increased self−control level led to a diminished tendency of unauthorized ID

use and/or cyberbullying for girls. Respondent's experience of deviant behavior was a significant factor across gender in either type of problematic online behavior.

Among socialization variables, parent–child relationship was marginally significant for boys' unauthorized ID use, while the direction of magnitude was positive. Having more associations with deviant friends has increased the likelihood of problematic online behavior except for girls' unauthorized ID use.

School performance was significant only for girls' cyberbullying, while time spent with computers was significant for boys' unauthorized ID use and cyberbullying; as they spend more time using a computer over the four time periods, boys were more likely to be involved with problematic online behavior. Lastly, year effects were significant in all models; as the respondents got older, they were less likely to engage in problematic online behavior.

Discussion

The present study investigated gender differences in problematic online behaviors, namely unauthorized ID use and cyberbullying, based on several major theories. The factors examined in this study includes individual–level variables (self–control and respondent's experience of deviant behavior), socialization variables (parent–child relationship, parental monitoring, and deviant peer association), and other control variables.

Overall, approximately 5% to 43% of respondents in the current study turned out to have experienced either type of problematic online behavior during the period of 2003 to 2006. With regard to the main analysis, the focus was on the fixed effects model since this model, which yields within–individual estimates, are known to have more strength in estimation. Also, the Hausman test revealed that a fixed effects model was preferable to a random effects model except for girls' unauthorized ID use.

Findings support both self–control and social learning theory partially. In regard to self–control theory

(individual–level variables), the level of self–control was significant only for girls' behavior, while respondent's past experience of deviant behavior was fully supported in all models across gender. Among the socialization variables, peer effects showed significant influences regardless of gender in each type of problematic online behavior. Parent–related variables, however, showed almost no significant effects; only the parent–child relationship was marginally significant for boys' unauthorized ID use. Considering the interaction theory suggested by Thornberry [63], no strong influence from parent–related variables is not surprising since parent's influence starts to weaken while that of friends grows stronger during this period.

Out of the control variables, school performance was significant for girls' cyberbullying, while time spent with computers was significant for boys in both behaviors. Among the boys who showed changes in their problematic online behavior (either starting to exhibit or quitting problematic online behavior) over 4 years, increased amount of computer usage time led to them committing problematic online behavior. Year effects were consistently significant in every model; respondent's problematic behavior was likely to diminish over time. This may be because adolescents become more mature over time.

The results suggest the need to undertake an analysis according to each type of problematic online behavior as well as by gender. It seems that sorting all types of problematic online behaviors into one general problematic online behavior, as was the case in some previous studies, may not be an appropriate approach to discover the determinants thoroughly since each type of problematic online behavior showed different features. In addition, the majority of previous research included gender as a variable in the model, while only a few have analyzed separate models by gender. A separate analysis by gender seems inevitable for more thorough investigation.

In the meantime, percentile rank in class (school performance) has shown a negative influence on girls' cyberbullying even in the fixed effects model. That is, girls with higher academic achievement were more likely

to engage in cyberbullying. This may be due in part to the fact that higher academic performance is related to higher digital literacy/proficiency as was shown in the Organizations for Economic Cooperation and Development [50]'s report. Another possible explanation would be the positive relationship between academic stress and cyberbullying [27]; girls who experience increased academic pressure might start to participate in cyberbullying as one way to avoid academic stress. Boys, however, seemed not to be affected by their academic achievement and thus, further investigation is necessary. For boys' unauthorized ID use, parent-child relationship has shown a significant and positive association, which means as the relationship improved, the likelihood of using unauthorized ID increased. This could result from the fact that children may obtain information on their parents' personal information while observing and learning their parents' (father's, possibly) use of digital devices. Kids, then, may use their parent's personal information when they need to provide personal information such as a resident registration number, which is similar to social security number in the U.S., to create an account or log into adult-only websites.

Implications

The present study provides practical suggestions based on the results that expand our understanding of two types of problematic online behavior. Suggestions for practitioners and policy makers are as follows. First, the results call for program intervention in regard to young adolescents' self-control. For girls who showed a significant influence of self-control even in fixed effects models, in particular, self-control can work as a critical factor, while gender-specific programs need to be developed, as well. Also, school teachers and parents need to pay more attention to adolescents who exhibit deviant behavior offline or who show low levels of self-control since they are more likely to be engaged in online delinquency, which is difficult to become aware of. Furthermore, children with deviant

behavior offline may involve in online misbehaviors and vice versa. Educators and researchers need to note the possibility of escalation of problematic behaviors by reinforcement of each other.

Second, deviant peer association gets more strongly associated with youth problematic behavior as teens passing through mid-teen period [63]. The relationship with delinquent friends is an important factor in sparking youth delinquency, according to theories reviewed previously, while peers can be selected by an adolescent who has similar characteristics. Therefore, school-based digital socialization to prevent adolescents' online delinquency is inevitable.

Third, parental monitoring starting from early childhood, during which parents' influence is greater than peers', can help to prevent youth online delinquency although parents' influence appeared not to be significant in fixed effects models. Reminiscent of the results which showed a positive association with time spent on computers, especially for boys' online behavior, parents' role seems even more critical. Considering that children are starting to use computers/Internet at a younger age, and that individuals who received insufficient parenting before the age of eight to ten develop less self-control [12], a parent's role in digital socialization of children seems very important. To provide their children with the proper guidance in regard to online ethics and appropriate behavior on the Internet, and to monitor children's behavior, parents need to develop their own digital competence/literacy in the first place. Teens often have a higher level of digital proficiency than their parents, with 29% of parents feeling overwhelmed by technology and hoping for the best when it comes to their children's online activities [44]. Parents, who are not capable of providing the necessary guidance to their children or monitoring children's usage of the Internet/computers would exacerbate their children's safety online. Education and training programs for parents on the Internet/computer skills and children's digital socialization should be provided.

While the current study contributed to identifying gender differences in adolescent problematic online behavior, the limitations and suggestions for future research need

to be addressed. First, the Internet penetration rate in Korea, even in early 2005, was similar or higher than that of other countries in 2013 [23]. Thus, the results might be substantially different than those in other countries. Moreover, there exists the possibility that the data used in this study is dated, as it was taken from 2003 to 2006, a time when smart phones and apps didn't exist and Internet access was only possible via computer. After the introduction of smart phones around 2005, wired and wireless platforms and accessibility to them have changed in various ways. More research would be needed on the impact of the mobile platform on problematic online behavior. Second, regarding variables used to construct measures, there were limited variables especially in regard to psychological health condition and friends' online delinquency. Psychological health condition needs to be measured through a compound measure instead of one question. Also, it was based on the respondent's subjective evaluation and not a medical diagnosis. Peer effects ought to contain online-only friends' or school/offline friends' problematic online behaviors for future research. Parenting and media experience variables, related to children's digital socialization, were also not available in the current data. To test socialization factors, these variables are essential although time spent on computers could work as a proxy of media. Fourth, considering the four time periods, many respondents seem to get involved in problematic online behavior just out of curiosity or a desire to experiment in their early teens. It is necessary to figure out the characteristics of those who remain delinquent as well as the optimal time for intervention. In addition, the population of younger children needs to be investigated. As online delinquency level peaked in the first wave when respondents were eighth graders, more information is necessary to see whether this is a peak point or not.

The current study discovered that boys and girls showed different features in their problematic online behavior over time. Furthermore, each type of problematic online behavior showed different significant factors, although they shared some aspects. Future research needs to focus more on a

specific population (e.g. gender, race) and a specific type of behavior.

Declaration of Conflicting Interests

The author declared that she had no conflicts of interest with respect to her authorship or the publication of this article.

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