

# Adolescents' internet addiction and its association with physical activity intention and self-efficacy

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*The current study investigated the relationship between Internet addiction and PA intention and self-efficacy, as well as the mediating effect of self-efficacy on the relationship between PA intention and Internet addiction, among a random sample of Korean adolescents. A total of 482 students (male: 247, female: 235, Mage = 13.35years, SD = 1.41) were recruited from two junior high schools in Seoul, Korea. The Internet addiction scale, the self-efficacy scale, the PA intention scale, and the leisure time exercise scale were used. The results indicated that there are significant differences in Internet addiction, self-efficacy, and PA intention between male and female adolescents, with males showing higher scores for all variables than females. Additionally, the current findings revealed that Internet addiction was significantly correlated with PA intention and all sub-variables of self-efficacy, and self-efficacy significantly mediated the relationship between PA intention and Internet addiction. This study offers theoretical and practical guidance for the treatment of Internet addiction in adolescents, especially for the suppression of addictive behavioral impulses based on the pathway of PA influencing Internet addiction.*

KEY WORDS: Internet addiction, Physical activity, PA intention, Self-efficacy, Adolescents.

## Introduction

It is widely recognized that the Internet, an indispensable cultural medium in modern society, has a significant impact on our lives and provides numerous benefits. However, it is also well known that frequent contact with and addiction to the Internet can negatively affect our adaptation to the real

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world (Scheerder et al., 2019; Roblek et al., 2020). Internet addiction disorders (such as alcoholism or drug addiction) cause perceptual, attentional, thinking, and judgment disorders, as well as psychomotor, behavioral, and interpersonal disorders (Weinstein et al., 2014). While no official scientific name for Internet addiction exists, it is being seriously considered, as evidenced by the inclusion of Internet Gaming Disorder in Section III of the DSM-V (American Psychiatric Association, 2013). Similar to other addictions, Internet addiction is defined as a state in which excessive use of the Internet results in physical, mental, and social abnormalities and pathological symptoms, such as dependence, tolerance, and withdrawal symptoms, to the extent that daily life is negatively affected (Shaw & Black, 2008).

The Korea Internet and Security Agency (2018) indicated that adolescents in Korea, aged 13–19 years, spend the majority of their time on weekdays and weekends playing computer games (78.3%) and surfing the Internet (89.7%). With the availability of smartphones, personal computers, and other mobile devices, Internet addiction has become a serious social concern. According to Statistics Korea (2019), 3.7% of Korean adolescents (5.2% male and 2.2% female) are addicted to Internet games, 6.9% develop Internet addiction (8.2% male and 5.6% female), 86.8% are average Internet game users (88.2% male and 85.4% female), and 23.0% have a positive perception of Internet games. Although the rate of internet addiction is low, the rate of adolescents becoming addicted to Internet games has gradually increased, suggesting the need for additional research.

Adolescence is an important time to form a sense of self-identity. Because the frontal cortex and subcortical monoamine system are immature (Pallanti et al., 2006), it is easy for adolescents to develop Internet addiction because they are somewhat impulsive and have weak control (Park et al., 2011). Owing to excessive Internet use in adolescence, adolescents with Internet addiction symptoms have difficulty separating the real world from the virtual world, which interferes with their real-life activities (Karacic & Oreskovic, 2017) and are reported to have low self-esteem, high self-anxiety, high boredom, and impulsivity (Rathi et al., 2022). Therefore, there is an urgent need to identify the phenomenon of Internet addiction in adolescents, find ways to prevent it, and alleviate its symptoms to improve undesirable behavior in adolescence.

Physical activity (PA) during adolescence is crucial in enhancing emotional stability, strengthening social bonds, and forming desirable attitudes by helping adolescents acquire self-confidence and harmonious relationships with others (Kemel et al., 2021; Lubans et al., 2016). The importance of PA has been emphasized in studies linking it to Internet addiction among adolescents,

which is a growing social problem (Khan et al., 2017; Li et al., 2020; Park, 2014). Adolescents with average Internet use are more likely to engage in moderate PA than those at risk (Dang et al., 2018). Qiu et al. (2023) reported that adolescents who participate in regular PA have lower rates of Internet addiction and show higher levels of enjoyment in making friends and trust in friends. Furthermore, adolescents' levels of PA participation have been reported to be inversely related to problematic Internet use, with mediating effects on sleep satisfaction and stress (Park, 2014). Although numerous studies have indicated that PA participation is significant in reducing Internet addiction (Park et al., 2016; Qiu et al., 2023; Zalewska et al., 2021), limited research has explored the psychological changes in adolescents who participate in PA and their psychological attributes related to Internet addiction.

Self-efficacy refers to an individual's confidence or expectation in his or her ability to successfully perform a behavior or activity and is a cognitive perspective for explaining and predicting behavior change (Bandura, 1977). Self-efficacy has been considered an important variable to address the psychological characteristics of adolescents in research related to Internet addiction (Berte et al., 2021; Zeidi et al., 2020). Craparo et al. (2014) indicated that adolescents addicted to the internet had lower self-regulated learning, relationship, and difficult-overcoming efficacies than those in the non-addicted group. Additionally, this study revealed that among the various subscales of self-efficacy, self-regulatory efficacy was the strongest predictor of adolescent Internet addiction (Craparo et al., 2014). Recently, Du and Zhang (2022) found that male adolescents had higher self-efficacy scores than their female counterparts, and Internet addiction behaviors were associated with self-regulatory failure and lower levels of self-efficacy.

According to Ajzen's (1991) theory, human behavior is driven by rational and planned cognitive processes, and intention plays the most critical role in determining the actual implementation and continuation of behavior. Fishbein and Ajzen (1977) define intention as the degree of willingness to perform a given behavior and indicate that an individual's intention to perform a given behavior is the strongest predictor of actual behavior. In physical activity research, numerous studies have extensively indicated that a significant relationship exists between intention and PA (Gomes et al., 2017; Kosma et al., 2009; Ruiz et al., 2021). Rhodes and de Bruijn (2013) argued that an intention-behavior gap exists in which high intentions to engage in an activity do not always translate into actual behavior. Additionally, few studies have investigated the relationship between PA intention and Internet addiction as actual behavior and self-efficacy as a significant psychological determinant of Internet addiction (Bélanger-Grave et al., 2013; Du & Zhang, 2022).

Hagger et al. (2002) addressed self-efficacy as a key variable that influences both PA intention and Internet addiction and can be considered an important mediating variable in the relationship between PA intention and Internet addiction. Several studies have identified a significant mediating role of self-efficacy in the relationship between PA intention and Internet addiction (Berte et al., 2021; Yang, 2020). According to these studies, PA intention directly influences Internet addiction, and self-efficacy is a significant mediator of the association between PA intention and Internet addiction.

Although previous studies have investigated the direct relationship between PA intention and Internet addiction with the mediating role of self-efficacy, these studies have been primarily undertaken in Western societies. Additionally, limited research has been conducted to investigate the relationship between Internet addiction, self-efficacy, and PA intentions in Korea. Therefore, this study investigated the relationship between Internet addiction and PA intention and self-efficacy, as well as the mediating effect of self-efficacy on the relationship between PA intention and Internet addiction, among a random sample of Korean adolescents.

## Method

### PARTICIPANTS

A total of 482 students (Mage = 13.35years, SD = 1.41) were recruited from two junior high schools in Seoul, Korea. In the initial stage of data collection, among the 500 students

TABLE I  
*General characteristics of participants*

Characteristics	n	%	Mean
Gender			
Male	247	51.2	
Female	235	48.8	
Internet addiction group			
no risk	258	53.6	
potential-risk	191	39.6	
high-risk	33	6.8	
Internet use (minutes per day)			
weekday			420.30
weekend			540.10

who expressed an interest in participating in the study, 482 (male: 247, female: 235, 92.4% retention rate) provided their consent forms with parental permission and completed the survey; however, only 38 (7.6%) declined to participate. Non-participants were not significantly different in age or sex from the participating students. The study was conducted following the guidelines of the Declaration of Helsinki and was approved by the Institutional Review Board of Seoul National University of Science and Technology.

## Measures

### INTERNET ADDICTION

The Internet Addiction Test was developed by Young (1998) and revised for Korean adolescents by Kim and Oh (2015). This scale was designed to measure compulsive behaviors and changes in interpersonal disposition related to internet use, impairment in school or work, locus of control, and behavioral and emotional problems. The scale comprises four sub-factors with 20 items (dependence with five items, physical withdrawal with four items, psychological withdrawal with four items, and tolerance with seven items). The participants were asked to indicate on a 5-point Likert-type scale ranging from “never (1)” to “always (5).” Higher scores indicate more severe addiction, with total scores ranging from 20 to 100, with 20–39 categorized as “average users,” 40–69 categorized as “at risk for addiction” with multiple problems due to the Internet, and 70+ categorized as “addicted”. In a study of adolescents. Cronbach’s alpha coefficient for the internal reliability of the Korean Internet Addiction Scale was 0.92. Additionally, the internal consistency scores were 0.76~ 0.88, 0.74, and 0.69, respectively (Kim et al., 2003).

### SELF-EFFICACY

The Self-Efficacy Scale was developed by Kim and Cha (1996) to measure general self-efficacy. The scale consists of 24 items, including eight on self-confidence, which refers to the state of psychological response when faced with a difficult situation, and eight on sequential processing ability and information literacy ability. Eleven items assessed self-regulatory efficacy regarding sequential processing and information literacy, and five items assessed task difficulty preferences regarding attitudes when faced with a choice between easy and difficult tasks. Responses ranged from “not at all” (1) to “very much” (5) on a 5-point Likert scale, with higher scores indicating higher self-efficacy and negative items being reverse-scored. To examine the validity and reliability of the data, an exploratory factor analysis (principal component analysis, orthogonal method) was used. Consequently, three factors were extracted as in previous studies; however, item 3 in factor 2 (self-confidence) was deleted because it showed double loadings with other factors. The total cumulative variance of the three factors for a total of 23 items was 55.31%, indicating the adequacy of the factor analysis with KMO = .90, Bartlett’s test of sphericity  $\chi^2 = 4276.20$ ,  $df = 253$ ,  $p > .001$ . The reliability of the three factors was relatively good, with self-regulation = .92, confidence = .86, and preference for task difficulty = .70.

## PHYSICAL ACTIVITY

To measure PA among adolescents, a leisure-time physical activity scale developed by Godin and Shephard (1985) was revised for Korean and used in this study (Kim & Cardinal, 2009). Participants reported how many times during a typical week they participated in strenuous (e.g., running, vigorous cycling), moderate (e.g., fast walking, easy swimming), and mild (e.g., yoga, golf) physical activities for more than 15 minutes. Scores were calculated by multiplying each reported activity session by its metabolic equivalent (MET) value and adding the results [MET score = (strenuous  $\times$  9) + (moderate  $\times$  5) + (mild  $\times$  3)]. The two-week test-retest Cronbach's  $\alpha$  reliability coefficient was used for the Korean version of the LTEQ was .86 (Kim & Cardinal, 2009). The construct validity of the Korean LTEQ was supported by a correlation with an accelerometer in a previous study (Spearman's rho = .77) (Kim, 2011).

## PA INTENTION

Courneya et al. (1998) developed the intention to engage in PA, which was revised for Korean (Kim, 2005). The Korean intention scale consisted of four items, such as "I intend to actively participate in exercise in the future for my health," with responses ranging from "never (1)" to "always (5)" on a 5-point Likert scale. Cronbach's coefficient  $\alpha$  was calculated as a measure of internal consistency for the scale, and a standardized  $\alpha$  of .88 was obtained. Additionally, a 2-week test-retest reliability test was performed as a measure of instrument stability, resulting in a reliability coefficient of .90. (Kim, 2005).

## PROCEDURES

Before fieldwork began, the principal of each selected school was required to agree with the research being conducted at his or her school. Hence, the investigator approached the principal and explained the aims of the research and the data collection procedures. Through this process, permission was obtained from the principal. Additionally, the researcher obtained permission from the students and their parents. A letter with a permission slip was provided for this purpose. The letter was sent to each parent before the test session. Only students who returned the permission slips signed by themselves and their parents participated in this study. To correct the data, the participants were asked to complete a battery of measures. The aims and processes of the testing were explained to the students, and each measure was introduced by the investigator. Students were advised that confidentiality would be maintained and voluntary participation would be emphasized. After the measures were distributed, the students were allowed to ask questions to clarify any part of the process. After the students completed the collected measures, a control sheet was attached to the front of the top paper to enable coding to be completed.

## DATA ANALYSIS

Descriptive statistics were calculated for the general characteristics of the study participants, and independent t-tests were conducted to examine differences in internet addiction, self-efficacy, intention, and PA by gender. Correlation analysis was conducted to identify the relationships between the study variables. Regression analysis was conducted to identify the

direct relationship between self-efficacy, PA intention, and Internet addiction and to explore the mediating effect of self-efficacy in explaining the relationship between PA intention and Internet addiction. All statistical analyses were performed using SPSS Win 27.0 ( $p < .05$ ).

## Results

### COMPARISON OF THE STUDY VARIABLES BY GENDER

Table II presents gender differences in Internet addiction, self-efficacy, PA intention, and PA (METs). Significant differences existed in Internet addiction ( $t=6.11$ ,  $p < .001$ ), self-efficacy ( $t=2.44$ ,  $p < .05$ ), and PA intention ( $t=6.92$ ,  $p < .001$ ) between male and female adolescents, with males showing higher scores for all variables than females.

## Correlation

Table III illustrates the results of the correlation analysis to identify the relationships among all the study variables. Generally, Internet addiction was

TABLE II  
*Differences in Internet Addiction by Gender*

Variables	Male (n=247)		Female (n=235)		<i>t</i>
	M	SD	M	SD	
Internet addiction	45.11	12.81	37.34	21.26	6.11**
DW	15.10	3.62	13.12	3.56	5.24**
T	13.83	3.43	12.11	3.35	2.72*
Phy-W	23.72	5.10	20.22	5.11	3.91*
Psy-W	21.50	4.20	17.32	4.61	5.86**
Self-efficacy	3.73	.55	3.61	.64	2.44*
SConfi	3.73	.56	3.44	.86	4.13**
SContr	3.94	.62	3.85	.70	1.66
TDP	3.24	.64	3.30	1.02	.75
METs	61.24	24.78	40.56	21.52	7.25**
PA Intention	21.63	3.44	14.52	3.51	6.92**

DW=Dependence; T=Tolerance; Phy-W=Physical Withdrawal; Psy-W=Psychological Withdrawal; SConfi=Self-confidence; SContr=Self-control efficacy; TDP=Task Difficulty Preference; PA= Physical activity; \* $p < .01$ ; \*\* $p < .001$

TABLE III  
Correlations Among the Study Variables

Variables	1	2	3	4	5	6	7	8	9	10	11
1	1.0										
2	.45**	1.0									
3	-.02	-.16*	1.0								
4	-.03	-.15*	.88**	1.0							
5	-.03	-.13	.89**	.70**	1.0						
6	.02	-.16*	.87**	.75**	.75**	1.0					
7	.02	-.08	.83	.65	.69	.72	1.0				
8	.21*	.38**	-.46**	-.34**	-.35**	-.40**	-.33**	1.0			
9	.20*	.29*	-.46**	-.37**	-.36**	-.40**	-.33**	-.35**	1.0		
10	.15*	.28*	-.19**	-.15*	-.15*	-.17*	-.19*	.83**	.26*	1.0	
11	.20*	.22*	-.26*	-.24*	-.29**	-.20*	-.22*	.63**	.33**	.40**	1.0

1=METs; 2=Physical activity Intention; 3=Internet Addiction; 4=Dependence; 5=Tolerance; 6=Physical Withdrawal; 7=Psychological Withdrawal; 8=Self-efficacy; 9=SConfi (Self-confidence); 10=SContr (Self-control efficacy); 11=TDP (Task Difficulty Preference); \* $p < .01$ ; \*\* $p < .001$

significantly negatively correlated with PA intention ( $r = -.16$ ) and self-efficacy ( $r = -.46$ ) (all subfactors:  $r = -.46$  for self-confidence,  $r = -.19$  for self-control efficacy, and  $r = -.26$  for task difficulty preference).

#### RELATIONSHIP OF INTERNET ADDICTION WITH SELF-EFFICACY AND PA INTENTION

Table IV presents the results of the multiple regression analysis that investigated the relationship between Internet addiction, PA intention, and self-efficacy. Considering Internet addiction, PA intention was entered in the first step and accounted for 4% ( $\text{adj } R^2 = .04$ ,  $\beta = -0.20$ ,  $p < .05$ ). The PA intention and self-efficacy sub-factors were entered as predictors in step two, and these variables together explained 27% of the variance in internet addiction. The incremental increase in  $R^2$  for this model was significant ( $\Delta R^2 = .31$ ,  $p < .001$ ), indicating that all of the self-efficacy variables were significantly associated with Internet addiction despite considering PA intention ( $\beta = .35$  for self-control efficacy,  $p < .01$ ;  $\beta = .22$  for self-confidence,  $p < .05$ ; and  $\beta = .12$  for task difficulty preference,  $p < .05$ ).

TABLE IV  
Regression Analysis Predicting Internet Addiction From Pa Intention and self-efficacy

Dependent Variable	Step	Predictors	B	SE	$\beta$	$\Delta R^2$	Adj R <sup>2</sup>
Internet addiction	1	PA intention	-.07	.01	-.20	.07	.04
	2	PA intention	.00	.03	.00	.31	.27
		SContr	.13	.02	.35		
		SConfi	.18	.03	.22		
		TDP	.06	.07	.12		

SContr=Self-control Efficacy; SConfi=Self-confidence; TDP=Task Difficulty Preference; PA= Physical

## Discussion

It is widely accepted that identifying the status of Internet addiction among adolescents who are easily exposed to indiscriminate Internet use as well as finding ways to alleviate and prevent Internet addiction symptoms is important for understanding adolescents who lack self-regulation of addictive behaviors and helping them modify their behavior. This study investigated the relationship between self-efficacy and PA intention with Internet addiction and the mediating effect of self-efficacy on the relationship between PA intention and Internet addiction among a random sample of Korean adolescents.

The findings indicate that male adolescents demonstrate significantly higher scores on Internet addiction, self-efficacy, and PA intention than female adolescents. Gender differences in Internet addiction are supported by previous studies, demonstrating that males generally have higher scores on Internet gaming disorder, social media addiction, and phone obsession than females (Mari et al., 2023; Rigelsky et al., 2021). It is plausible that male adolescents are more likely to use the Internet for games, erotic experiences, and gambling to pursue stimulus feelings (Fattore et al., 2014; Joiner et al., 2012). Whereas females tend to use the internet for social networking services, including Facebook and Twitter, writing blogs, chatting, sending messages, and searching for information (Heo et al., 2014; Tateno et al., 2016). Moreover, male adolescents had significantly higher self-efficacy and PA intention than females, which resulted in significantly higher actual PA (METs) in this study. These findings are consistent with those of many previous studies (Saller & Khaled, 2019; Sawari & Mensor, 2013; Spence et al., 2010). It is plausible to explain that males have higher self-confidence and intention relating to phys-

ical activity and are more regularly engaged in physical activity than their female counterparts. This interpretation is supported by Bandura's theory, which hypothesizes that an individual's level of confidence to engage in a specific behavior is significantly related to actual behavior (Bandura, 1977).

This study indicated that Internet addiction negatively correlated with PA intention but did not correlate with actual PA (METs) in adolescents. Although no previous studies have supported the relationship between Internet addiction and PA intention, it can be indirectly predicted by several studies that demonstrate that Internet addiction is negatively correlated with PA (Dang et al., 2018; Qiu et al., 2023). Additionally, some studies have indicated that PA does not have a direct relationship with internet addiction but is associated with lower levels of internet addiction through the mediation of psychological factors such as stress and self-esteem (Kim & Lim, 2013; Lee, 2009).

The mixed results of previous studies on the relationship between Internet addiction and PA may be due to the variety of scales used to measure Internet addiction and PA and the unclear definition of Internet addiction. Regarding Internet addiction scales, the conceptual distinction between Internet addiction and smartphone addiction, which is a growing problem among adolescents today, is unclear and may confuse respondents (Guazzini et al., 2019). Currently, the scales measuring Internet addiction and smartphone addiction are separate; however, given the concept of smartphones as portable PCs (Mari et al., 2023), modifications to the scale measuring Internet addiction have been considered. Additionally, previous studies measuring physical activity varied in their measurement instruments, such as using a 5-point Likert scale to measure frequency and intensity (Kim & Lim, 2013; Jee, 2013; Lee, 2009), and showed different results for the Internet addiction group depending on the intensity of exercise (Jee, 2013). Furthermore, no study has examined the relationship between Internet addiction and the METs used in this study. Therefore, further studies should focus on identifying the association between Internet addiction, PA intention, and actual PA.

The findings indicated that self-efficacy was significantly correlated with Internet addiction and supported by previous studies, demonstrating that emotional regulation self-efficacy and Internet control self-efficacy were significantly correlated with Internet addiction (Du & Zhang, 2022; Luo et al., 2010). It is possible to explain that individuals with higher levels of self-control efficacy can overcome their internal desires and rationally regulate their emotions and behaviors to achieve their goals. Therefore, they might be likely to rationally control their Internet use behavior and avoid developing Internet addiction symptoms. Moreover, in this study, self-efficacy significantly mediated the relationship between PA intention and Internet

addiction among adolescents, which is supported by previous studies (Berte et al., 2021; Yang, 2020). It is plausible to cite previous studies to explain this phenomenon. PA intention promotes PA by enhancing self-efficacy, which in turn reduces adolescents' addictive behaviors. Additionally, the efficacy between PA intention and Internet addiction was mediated by self-efficacy, which suggests that an increase in self-efficacy can promote a reduction in the level of Internet addiction (Ha & Lee, 2005; Lee et al., 2001).

Despite the significant findings of this study, it had several limitations. Data were collected from students at two middle schools in Nowon-gu, northern Seoul. Therefore, the results of this study have limited generalizability and should be interpreted with caution. The study applied a cross-sectional design and could not allow inference of a cause-and-effect relationship between the study variables.

This study examined the relationship between Internet addiction, PA intention, and self-efficacy and the mediating effect of self-efficacy on the relationship between PA intention and Internet addiction among Korean adolescents. These findings provide significant evidence on adolescent Internet addiction and its related psychological attributes. The ideas and issues identified in this study are consistent with those of previous Western studies in the same field. As PA intention and self-efficacy are significant predictors of Internet addiction, this study offers theoretical and practical guidance for the treatment of Internet addiction in adolescents, especially for the suppression of addictive behavioral impulses based on the pathway of PA influencing Internet addiction. Further research is necessary to investigate the relationship between physical activity and internet addiction.

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