

Internet Addiction Among Elementary and Middle School Students in China: A Nationally Representative Sample Study

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Abstract

The purpose of this study was to examine the prevalence of Internet addiction in a nationally representative sample of Chinese elementary and middle school students and to investigate Internet addiction among Internet users with different usages. The data were from the National Children's Study of China (NCSC) in which 24,013 fourth- to ninth-grade students were recruited from 100 counties in 31 provinces in China. Only 54.2% of the students had accessed the Internet. According to the criteria of Young's Diagnostic Questionnaire (YDQ), an eight-item instrument, the prevalence of Internet addiction in the total sample was 6.3%, and among Internet users was 11.7%. Among the Internet users, males (14.8%) and rural students (12.1%) reported Internet addiction more than females (7.0%) and urban students (10.6%). The percentage of Internet addicts in elementary school students (11.5%) was not significantly lower than the percentage of middle school students (11.9%). There was no statistically significant difference between the four geographical regions (9.6%, 11.5%, 12.3%, 11.1%) characterized by different levels of economy, health, education, and social environment. As the frequency of Internet use and time spent online per week increased, the percentage of Internet addicts increased. When considering the location and purpose of Internet use, the percentage of Internet addicts was highest in adolescents typically surfing in Internet cafes (18.1%) and playing Internet games (22.5%).

Introduction

OVER THE PAST FEW YEARS, the number of child and adolescent Internet users has been increasing dramatically in China. As of December 31, 2012, there were 145 million Internet users aged 6 to 19 years.¹ Additionally, there has been a trend toward lower ages of initial Internet use. An investigation of 1,200 city pupils aged 6 to 12 years from Beijing, Shanghai, and Wuhan in 2009 revealed that the number using the Internet reached 1,079. Of those Internet users, 63.9% started surfing between the ages of 6 and 9 years, and especially notable are the 18.0% who had experienced the Internet before the age of 6.²

Children and adolescents can obtain information and knowledge,^{1,3} and interact conveniently with each other through the Internet.⁴ Additionally, children and adolescents can gain social support online, and improve their level of psychological well-being.⁵⁻⁷ However, excessive or inappropriate Internet use can lead to Internet addiction, which has been defined as an impulse-control disorder that does not involve an intoxicant.⁸ Internet addiction can cause children

and adolescent physical and psychological health problems, such as depression and suicidal ideation,^{9,10} loneliness,¹¹ interpersonal problems,¹² time management problems,¹³ sleeplessness,¹⁴ destructive lifestyles and poor dietary behaviors,¹⁵ and the increase of blood lead concentration.¹⁶ There is a greater likelihood that the adolescent will behave aggressively and even commit a crime if he or she is addicted to the Internet.^{17,18}

Many countries have investigated Internet addiction in children and adolescents, and the results show that the prevalence of Internet addiction is between 1.6% and 17.1%.^{10,19-23} In China, many studies have been conducted on this topic. For example, Wang's study of 14,296 high school students in Guangdong Province showed that 12.2% of the 12,446 Internet users were addicts.²⁴ Cao and Su surveyed 2,620 high school adolescents in Changsha city and identified 2.4% of 2,315 Internet users as Internet addicts.¹³ Xiao performed a study of 1,466 elementary and middle school students in Nanjing city and discovered that 2.7% of the sample were addicted to the Internet.²⁵ Wang et al. conducted a large-scale study that included 31,915 elementary and middle

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school students in 10 provinces. They found that 3.6% of the sample was Internet addicted.²⁶ The participants in past studies have primarily been urban school students, and the results are not consistent. To date, there is no nationally representative study on prevalence and correlation of adolescent Internet addiction in China. According to China's Development Index, there were great differences in the level of development among different regions.²⁷ Additionally, there was an imbalance of basic Internet resources in different regions, such as the number of IPv4 addresses.²⁸ Consequently, the result of one region may not be generalized to the whole nation.

The purpose of this study was to examine the prevalence of Internet addiction based on a national representative sample of Chinese elementary and middle school students and to investigate Internet addiction among Internet users with different usages. These findings can provide data to support policy intended to prevent Internet addiction.

Methods

Participants

The data analyzed in this study were collected from the National Children's Study of China (NCSC).²⁹ The NCSC used paper and pencil tests to examine the psychological development of children and adolescents and the relationship between this development with family, school, and individual factors. The NCSC was conducted by the National Key Laboratory of Cognitive Neuroscience and Learning at Beijing Normal University. The NCSC used multistage, stratified, and unequal probability methods to draw the sample in each of the 31 provinces in the Chinese mainland. First, 100 counties were selected using a stratified sampling method from the 2,859 counties in 31 provinces. Second, a certain number of schools were randomly selected from each county. Third, a certain number of students were randomly selected from each school. Each case was assigned a weight that stood for the number of individuals in the population that this person represented. More details about sampling can be found in the technical report of the NCSC.³⁰ The research program was approved by the Institutional Review Board of the National Key Laboratory of Cognitive Neuroscience and

Learning of Beijing Normal University. Data were collected during the spring semester of 2009.

The data in the present study included 24,013 participants in fourth to ninth grade (age range: 7.58–15.92 years), who were recruited from 100 counties in 31 provinces in China. A summary of the participant characteristics was shown in Table 1.

Measurements

Demographics. Demographic measures included age, gender, grade (elementary school students in grades 4 to 6 and middle school students in grades 7 to 9), location of school (urban or rural), and region (1st region, 2nd region, 3rd region, 4th region). Region was a very important demographic variable in the NCSC. With a large population and the vast geographical areas in China, the level of development in one region differs greatly from other regions. For that reason, Chinese researchers worked out "China's Development Index,"²⁷ which consists of a Health Index, Education Index, Living Standard Index, and Social Environment Index. Each index was composed of specific variables. For example, the Health Index included life expectancy at birth, infant mortality rate, and number of sick beds per 10,000 persons. According to the Development Index, 31 provinces in the Chinese mainland were divided into four regions. The first region comprised Beijing, Shanghai, and Tianjin, which has the highest levels of development. The second region comprised Zhejiang, Jiangsu, Shandong, Liaoning, Guangdong, and Jilin. The third region comprised Fujian, Inner Mongolia, Heilongjiang, Shanxi, Hunan, Hubei, Henan, Hainan, Guangxi, Chongqing, and Sinkiang. Lastly, the fourth region comprised Ningxia, Jiangxi, Shaanxi, Anhui, Szechwan, Qinghai, Yunnan, Gansu, Guizhou, and Tibet, which had the lowest levels of development.

Internet usage. Five questions about the respondents' Internet usage were asked: "Do you have access to the Internet? (yes/no)," "How many times do you surf online per week in general?," "How many hours do you surf online per week on average?," "Where do you surf online mostly? (home/school's computer room/Internet cafe/other place)," and "What do you mainly do on the Internet? (search for

TABLE 1. AGE AND GENDER DISTRIBUTION OF PARTICIPANTS

	N (%)	Age (years) mean \pm SD	Male N (%)	Female N (%)
Grade				
Elementary school	12,023 (50.1)	11.59 \pm 1.25	6,395 (53.7)	5,523 (46.3)
Middle school	11,990 (49.9)	14.35 \pm 0.96	6,277 (53.0)	5,565 (47.0)
Location of schools				
Urban	4,149 (17.3)	12.77 \pm 1.81	2,147 (52.4)	1,947 (47.6)
Rural	19,864 (82.7)	12.86 \pm 1.77	10,525 (53.5)	9,141 (46.5)
Region				
1st region	315 (1.3)	12.41 \pm 1.80	162 (51.5)	152 (48.5)
2nd region	6,531 (27.2)	12.84 \pm 1.74	3,408 (52.7)	3,064 (47.3)
3rd region	9,825 (40.9)	12.81 \pm 1.83	5,194 (53.3)	4,544 (46.7)
4th region	7,342 (30.6)	12.92 \pm 1.74	3,908 (54.0)	3,327 (46.0)
Total ^a	24,013 (100.0)	12.84 \pm 1.78	12,672 (53.3)	11,088 (46.7)

Note. ^aA total of 253 participants did not fill in any information about their gender. According to the education statistics report of China in 2008,³¹ males accounted for 53.27% (84,730,000) and females accounted for 46.73% (74,326,700) in all elementary and middle school populations. The proportions were very close to this study.

information/online communication/play online games/general entertainment, e.g., watching movies, listening to music, reading web novels/other)."

Internet addiction. Internet addiction was assessed using Young's Diagnostic Questionnaire (YDQ), which consisted of eight yes/no questions. Respondents who answered yes to five or more of the eight questions were classified as addicted Internet users.⁸ The original questionnaire was translated from English into Chinese and then back into English and reviewed by a bilingual psychologist. Based on the pilot studies, some words of the original items were modified, taking into account the real life of elementary and middle school students.³² For example, "Have you jeopardized or risked the loss of a significant relationship, job, educational, or career opportunity because of the Internet?" was modified to "Have you jeopardized or risked the decrease of academic performance or the loss of a significant friendship because of the Internet?". In this study, the split-half reliability and Cronbach's alpha of eight items were 0.72 and 0.74 respectively. The exploratory factor analysis with categorical items by MPLUS6.0 showed that only the first factor had an eigenvalue above 1.0, explaining 55.5% of the variance, and the loadings of the eight items ranged from 0.58 to 0.81. Thus, the YDQ had a good reliability and single dimensionality.

Statistical analysis

In the NCSC, each case was assigned a weight. These weights were implemented to produce an unbiased estimate of the prevalence of Internet addiction in Chinese elementary and middle school students. Because of multistage, stratified, and unequal probability samples, the balanced repeated replication method (BRR) was used to estimate the sampling error, and to calculate the standard error (SE).³⁰ A number of statistical tests were applied to the data, including descriptive statistics and Z-test. All analyses were performed with SPSS v20.0 for Windows.

Results

Internet use

In this study, only 54.2% (12,993/24,013) of elementary and middle school students had accessed the Internet. More males (61.7%) than females (45.7%) reported Internet use ($z=10.16, p<0.01$). Forty-two percent of elementary school students and 65% of middle school students had surfed the Internet before. The difference between the two groups was statistically significant ($z=13.24, p<0.01$). A total of 48.5% of students in rural schools and 81.8% of students in urban schools had previously used the Internet. This difference was also statistically significant ($z=15.73, p<0.01$). Moreover, the percentages in regions one, two, three, and four were 86.6%, 62.3%, 59.0%, and 39.2% respectively. The difference between the second and third region was not statistically significant ($z=1.27, p>0.05$). The other differences among the four regions (first-second, first-third, first-fourth, second-fourth, and third-fourth) were all statistically significant ($z=7.38-19.85, p<0.01$; Table 2).

Internet addiction

The percentage of students with Internet addiction was 6.3% (1,523/24,013) of the total sample and 11.7% (1,523/12,993) among Internet users. The following percentages were calculated based on Internet users only. The percentage of Internet addiction was lower among females: 14.8% among males, and 7.0% among females ($z=13.13, p<0.01$). The percentage of elementary school students addicted to the Internet was 11.5%, and the percentage of addicted middle school students was 0.4% higher, but the difference was not statistically significant ($z=0.44, p>0.05$). In addition, the number of participants who were Internet addicts in rural schools (12.1%) was more than that of urban schools (10.6%; $z=2.25, p<0.05$). Moreover, the prevalence of Internet addiction in regions one through four was 9.6%, 11.5%, 12.3%, and 11.1% respectively. No statistically

TABLE 2. DEMOGRAPHIC FEATURES OF INTERNET USE AND INTERNET ADDICTION

	<i>Internet use</i>		<i>Internet addiction</i>	
	<i>Internet users % (SE)</i>	<i>Nonusers % (SE)</i>	<i>Addicted Internet users % (SE)</i>	<i>Normal Internet users % (SE)</i>
<i>Total</i>	54.2 (1.05)	45.8 (1.05)	11.7 (0.33)	88.3 (0.33)
<i>Gender</i>				
Male	61.7 (1.04)	38.3 (1.04)	14.8 (0.44)	85.2 (0.44)
Female	45.7 (1.18)	54.3 (1.18)	7.0 (0.39)	93.0 (0.39)
<i>Grade</i>				
Elementary school	42.0 (1.10)	58.0 (1.10)	11.5 (0.51)	88.5 (0.51)
Middle school	66.5 (1.50)	33.5 (1.50)	11.9 (0.52)	88.1 (0.52)
<i>Location of school</i>				
Urban	81.8 (1.78)	18.2 (1.78)	10.6 (0.54)	89.4 (0.54)
Rural	48.5 (1.15)	51.5 (1.15)	12.1 (0.45)	87.9 (0.45)
<i>Region</i>				
1st region	86.6 (1.10)	13.4 (1.10)	9.7 (0.79)	90.3 (0.79)
2nd region	62.3 (1.94)	37.7 (1.94)	11.5 (0.62)	88.5 (0.62)
3rd region	59.0 (1.64)	41.0 (1.64)	12.3 (0.51)	87.7 (0.51)
4th region	39.2 (2.12)	60.8 (2.12)	11.1 (0.56)	88.9 (0.56)

Note. SE, standard error.

significant difference was found among the four regions ($z=0.39-2.75, p>0.05$; Table 2).

Internet addiction among Internet users with different usages

The percentages of users with Internet addiction by usage are presented in Table 3.

As the frequency of Internet use per week increased, the score of Internet addiction ("4-5 times/week" vs. "6-7 times/week," $z=1.16, p>0.05$; all other differences, $z=5.00-19.47, p<0.01$) and the percentage of Internet addicts ("2-3 times/week" vs. "6-7 times/week," $z=1.84, p>0.05$; "4-5 times/week" vs. "6-7 times/week," $z=0.58, p>0.05$; all other differences, $z=3.06-12.40, p<0.01$) increased. Among those participants who surfed the Internet more than seven times weekly, the percentage of Internet addicts was 31.9%.

As the time spent online per week increased, the score of Internet addiction ($z=3.21-21.39, p<0.01$) and the percentage of Internet addicts ("3-6 hours/week" vs. "6-10 hours/week," $z=1.07, p>0.05$; all other differences, $z=3.92-13.42, p<0.01$) also increased. For students who were on the Internet for more than 10 hours weekly, the percentage of Internet addicts was 37.6%.

Furthermore, there were statistically significant differences in both the score of Internet addiction ($z=2.96-13.82, p<0.05$) and the percentage of Internet addicts ("School's computer room" vs. "Other place," $z=0.91, p>0.05$; all other differences, $z=4.76-9.22, p<0.01$) among students surfing in different places. Generally, students surfing in Internet cafes reported the highest Internet addiction, and the percentage of Internet addicts was 18.1%. The percentages of Internet addicts for students surfing at home and school were 11.2% and 6.3% respectively.

In addition, the scores of Internet addiction were significantly different according to the purposes of using the Internet ($z=3.26-36.84, p<0.05$). At the same time, the percentages of addicts were also different ("Search for Information" vs. "Others," $z=2.22, p>0.05$; "General Entertainment" vs. "Others," $z=1.89, p>0.05$; all other differences, $z=5.33-21.12, p<0.01$). The highest percentages of Internet addiction were found in students who played online games (22.5%) and communicated with others (13.5%).

Discussion

In the present research based on a nationally representative sample of Chinese elementary and middle school students, the percentage of students who had surfed the Internet was only 54.2%, which was much lower than the prevalence of Internet use among youth in the United States (93%) and European countries (79.1-98.5%).^{33,34} In this study, among students who had used the Internet before, half of them accessed it no more than once weekly (52.0%), using it on average for less than 1 hour (52.0%). The above information indicates that the rate of Internet use is relatively low and that the Internet is still a somewhat scarce resource in China. Furthermore, the prevalence of Internet use in different types of schools and in different regions within China differs because of imbalances in the levels of development. For example, 81.8% urban students had used the Internet compared with just 48.5% of rural students. In the first region in which economy, health, education, and social environment were well developed, the percentage of Internet use was 88.6%. In contrast, the percentage of Internet use was only 39.2% in the fourth region, which was the most underdeveloped region in these four aspects. It is known that the Internet is important for the development of children and adolescents.³⁵ The

TABLE 3. INTERNET ADDICTION AMONG INTERNET USERS WITH DIFFERENT USAGES

	Internet usage % (SE)	YDQ score mean (SE)	Addicted Internet users % (SE)
Frequency of Internet usage			
1 or less than 1 time/week	52.0 (0.88)	1.52 (0.03)	7.8 (0.44)
2-3 times/week	31.5 (0.61)	2.02 (0.03)	12.7 (0.72)
4-5 times/week	7.8 (0.32)	2.52 (0.07)	17.6 (1.43)
6-7 times/week	3.2 (0.18)	2.67 (0.10)	16.3 (1.80)
More than 7 times/week	5.4 (0.27)	3.33 (0.09)	31.9 (1.89)
Hours used per week			
Less than 1 hour/week	52.0 (0.96)	1.49 (0.03)	7.9 (0.43)
1-3 hours/week	32.1 (0.67)	1.99 (0.04)	11.2 (0.56)
3-6 hours/week	9.0 (0.44)	2.72 (0.06)	21.1 (1.23)
6-10 hours/week	3.4 (0.23)	3.11 (0.11)	24.2 (2.64)
More than 10 hours/week	3.5 (0.21)	3.67 (0.10)	37.6 (2.17)
Place of Internet usage			
Home	36.9 (1.21)	1.86 (0.03)	11.2 (0.46)
School's computer room	13.8 (0.96)	1.35 (0.05)	6.3 (0.78)
Internet cafe	29.0 (1.01)	2.43 (0.06)	18.1 (1.01)
Other place	20.2 (0.51)	1.55 (0.04)	7.3 (0.68)
Purposes of Internet usage			
Search for information	22.1 (0.54)	0.97 (0.03)	2.9 (0.37)
Online communication	22.3 (0.65)	2.15 (0.05)	13.5 (0.89)
Play online games	28.2 (0.61)	2.82 (0.04)	22.5 (0.77)
General entertainment	20.3 (0.55)	1.57 (0.04)	7.0 (0.69)
Others	7.1 (0.28)	1.20 (0.07)	4.9 (0.87)

Note. SE, standard error.

Chinese government should supply more opportunities and Internet resources for elementary and middle school students, especially for the underdeveloped regions and rural schools.

In previous studies, Internet addiction was 1.6% in Korean high school students in 2006,¹⁰ 4.0% in Norwegian youth (12 to 18 years old) in 1999,²⁰ and 8.2% in Greek adolescent students (12 to 18 years old) in 2008.²³ In this study, the percentage of Internet addiction was 6.3% in the total sample and 11.7% among Internet users. The difference of sample ages makes it difficult to compare these data with each other. It appears as if the potential danger of Internet addition is more serious among Chinese elementary and middle school students. Although the percentage of Internet use in Chinese students was quite low, the percentage of Internet addiction was relatively high. This special phenomenon also existed in different places. Relatively fewer students in rural schools had accessed the Internet. However, the percentage of Internet addictions in rural schools was higher than in urban schools. There are two possible reasons for the phenomenon. First, parents in rural areas lack the knowledge about the Internet to instruct their children. Second, a large number of students gained access to the Internet in Internet cafes because of a lack of computers at home. Previous research indicated that surfing in Internet cafes was one of the risk factors leading to Internet addiction.³⁶ There was no significant difference between the four regions characterized by different levels of economy, health, education, and social environment. It is difficult to understand the complicated relationship between Internet addiction and the level of regional development. The relationship between Internet addiction and the family and individual factors may be stronger. Our data are consistent with previous research that found more males than females with Internet addiction.^{20,23,37} Gender difference in Internet addiction can be explained by males' lower levels of self-control compared with females' levels of self-control,³⁸ and differences in the usage of the Internet between males and females, with males being more likely to play Internet games.³⁹ It is worth noting that the percentage of Internet addicts in elementary school students (11.5%) was not significantly lower than middle school students (11.9%). Parents and teachers should monitor and guide the Internet activities of adolescents to help them form good Internet habits, especially elementary school students, who have not engaged in using the Internet for a long time.

Analysis indicated that the possibility of Internet addiction was positively associated with the frequency and length of time spent surfing the Internet per week. With regard to the location of the Internet, the percentage of Internet addiction was highest (18.1%) in Internet cafes. Although those under 18 years old are not allowed into Internet cafes according to regulations in China, 29.0% of the students were mainly using these places to gain access to the Internet. The government should take measures to monitor and manage the operation of cafes strictly. At the same time, other opportunities for Internet use should be provided for students, such as more Internet resources in schools and communities for students. Moreover, it was found that elementary and middle school students mainly playing games and communicating on the Internet were more likely to become addicted to the Internet. The percentages were 22.5% and 13.5% respectively. The Internet is attractive to these users, especially because Internet games can satisfy their needs for self-fulfillment,⁴⁰ and In-

ternet communicating can make up for insufficient communication in the real world to gain online social support and improve self-esteem.^{5,7} To protect elementary and middle school students from Internet addiction, parents and teachers should instruct students to use the Internet reasonably, supervise their activities on the Internet appropriately, and limit the amount of time spent online. In addition, more systematic research is needed in these areas to help parents, teachers, and policy makers to maximize the positive effects and minimize the negative effects of the Internet on elementary and middle school students' lives.

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