




## Specific Internet Disorders in University Students in Taiwan and Hong Kong: Psychometric Properties with Invariance Testing for the Traditional Chinese Version of the Assessment of Criteria for Specific Internet-Use Disorders (ACSID-11)

Yu-Ting Huang<sup>1</sup> · Kamolthip Ruckwongpatr<sup>1</sup> · Ji-Kang Chen<sup>2</sup> · Amir H. Pakpour<sup>3</sup> · Yan-Li Siaw<sup>4</sup> · Siti Rahayu Nadhiroh<sup>5</sup> · Shikha Kukreti<sup>6</sup> · Jung-Sheng Chen<sup>7</sup> · Marc N. Potenza<sup>10,11,12,13,8,9</sup> · Mark D. Griffiths<sup>14</sup> · Chung-Ying Lin<sup>1,15,16,17,6</sup> 

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### Abstract

The Assessment of Criteria for Specific Internet-use Disorder (ACSID-11) is a psychometric instrument assessing different types of problematic internet use. The aim of the present study was to assess the psychometric properties of the traditional Chinese version and evaluate whether the traditional Chinese version showed similar and robust psychometric evidence to that of original ACSID-11 using a German sample. The present study was longitudinal and comprised 1257 university students in the first study and 409 university students in the follow-up study. Cronbach's  $\alpha$  and McDonald's  $\omega$  were used for testing internal consistency of the ACSID-11. A confirmatory factor analysis (CFA) was conducted to examine construct validity. Multi-group CFA was performed to assess the invariance of the factor structure across region and sex. Moreover, Pearson correlations were conducted to examine the test–retest reliability and concurrent validity of ACSID-11. The results suggested satisfactory levels of test–retest reliability, internal consistency, and validity of the ACSID-11. The four-factor structure of the ACSID-11 was replicated and confirmed in both Taiwan and Hong Kong samples. The study findings demonstrated that the traditional Chinese version of the ACSID-11 is reliable and valid for assessing and distinguishing specific internet-use disorders and is applicable across regions and sexes among emerging adults in Taiwan and Hong Kong.

**Keywords** Internet addiction · Problematic internet use · Videogames · Social media · Internet use disorder · Factor analysis · Psychometric validation

## 1. INTRODUCTION

Technological advances have led to a revolution in digitalization. With the access and widespread use of the internet, a convenient and thriving lifestyle has emerged where individuals can engage in multiple online activities including learning, socializing, gaming, gambling, and shopping. Teenagers and young people are especially active online and studies have indicated they

comprise the majority of individuals using the internet (Alimoradi et al., 2019). Although internet use can bring many benefits, problematic use of the internet (PUI), sometimes termed ‘internet addiction’ in its most extreme form (Kaess et al., 2021), may generate psychological, emotional, and physical concerns (Alimoradi et al., 2019; Kakul & Javed, 2023) as well as impairments in educational, occupational, social, and other domains (Ahorsu et al., 2023; Kakul & Javed, 2023; Lin et al., 2023b; Ruckwongpatr et al., 2022). Therefore, public health issues related to PUI warrant attention.

In the multidimensional digital realm, PUI can manifest across various online activities, including use of social media, online shopping, online gaming, online gambling, and pornography consumption (Chen et al., 2024; Griffiths, 2020; Müller et al., 2022; Ruckwongpatr et al., 2022). Generalized PUI refers to a pervasive pattern of interfering or distressing engagement across diverse online dimensions (Ruckwongpatr et al., 2022), whereas specific PUI refers to online behaviors within defined domains. For example, social-network use disorder can be described as a condition in which individuals excessively engage in using social media sites and other online communication applications, with diminished control over the use (Müller et al., 2022). Another example is internet gaming disorder (IGD) which involves a persistent pattern of playing of online videogames that leads to noticeable distress or severe functional impairment (American Psychiatric Association, 2013).

Internet-related behaviors have received increasing attention due to their potential impact for being addictive (Alimoradi et al., 2024; Lee et al., 2024; Leung et al., 2020). IGD was proposed as a tentative addictive disorder in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2013; Chen et al., 2019; Tung et al., 2022). It is categorized by persistent and recurrent gaming behavior, along with tolerance and

withdrawal symptoms (Poon et al., 2021). Gaming disorder (GD; which can occur both online and offline) is defined as a persistent and recurrent pattern of gaming behavior with required diagnostic criteria (impaired control, increasing priority and continued engagement despite negative consequences) and resulting in significant distress or functional impairment (Paschke et al., 2020; Pontes et al., 2019). The World Health Organization (WHO) formally included GD in the eleventh revision of the *International Classification of Diseases* (ICD-11) as a mental health disorder (Chen et al., 2023a; Ghazi et al., 2024; World Health Organization, 2019).

Outside of IGD being included in the appendix of the DSM-5 and GD's inclusion in the ICD-11, specific internet use disorders are not officially defined (Chen et al., 2020), although gambling disorder is in both the DSM-5 and ICD-11 and may be engaged in online. The ICD-11 diagnostic entity of "other specified disorders due to addictive behaviors" has been proposed for diagnosing individuals with non-gambling and non-gaming forms of PUI (Brand et al., 2022), classification and definition regarding specific and generalized internet use disorders lack consensus (Leung et al., 2020; Müller et al., 2022). Moreover, gaming-related disorders may co-occur with other potentially addictive behaviors, such as the problematic online shopping, online pornography use, and especially social networking site (SNS) use (Müller et al., 2022, Yang et al., 2023). These problematic online behaviors share similarities with generalized PUI in terms of their relationship with negative health and functioning consequences (Ruckwongpatr et al., 2022). The lack of consensus and the complex interplay between different types of PUI highlight the potential importance of using similar considerations or diagnostic criteria to define different internet use disorders.

The Assessment of Criteria for Specific Internet-use Disorders (ACSID-11) is a comprehensive instrument with high reliability and validity based on the ICD-11 diagnostic

criteria for gaming disorder, designed to target specific internet use disorders, including gaming disorder, online gambling disorder, online buying-shopping disorder, online pornography use disorder, and social network use disorder (Müller et al., 2022). A four-factor model (i.e., impaired control, increased priority, continuation/escalation, functional impairment) was adopted to align with the ICD-11 criteria. However, given the limitation of the study regarding the availability of reliability and validity with only German and Thai samples (Müller et al., 2022; Yang et al., 2023), further research is needed to confirm its reliability, suitability, and potential utility in other regions.

Asia is estimated to have the largest number of individuals who use the internet and is reported to have a particularly high prevalence of PUI, particularly among adolescents and emerging adults (Alimoradi et al., 2019; Tung et al., 2022). Hong Kong and Taiwan are two Asian regions with large proportions of young adults who have experienced PUI (Leung et al., 2020; Lin et al., 2011). Given that Hong Kong and Taiwan share cultural features and use the same written language system (i.e., traditional or non-simplified Chinese) (Chang et al., 2018), conducting an evaluation of the traditional Chinese version of the ACSID-11 could promote clinical and research efforts relating to PUI.

The way individuals engage with the internet can impact how they interpret and respond to instrument items (Wu et al., 2017). Bujala et al. (2012) suggested that males and females may have different patterns of time spent online. Males are more likely to engage in specific online activities (e.g., online gaming) for longer durations (Ruckwongpatr et al., 2024), whereas females are more likely to engage in social media use for longer hours (Andreassen et al., 2016). This may be because males are driven by more competition and entertainment motives compared to females. In contrast, females are predominantly more driven by social and relationship motives (Krasnova et al., 2017). Gender differences have also shown in their internet use experiences. Males are

reported to have greater overall internet use, and use the internet to perform a wider variety of tasks compared to females (Bujala et al., 2012). Also, males are more dominant online because there is far more male-oriented content on the internet and the males tend to lead online discussions (White, 2019). On the contrary, females tend to be more cautious and less excited about new information technologies (Bujala et al., 2012). Females usually feel less comfortable and have lower confidence in using computers and the internet compared to males, and reporting less positive internet-related attitudes than males (Chou et al., 2011).

Similarly, cultural nuances may influence the interpretation of ACSID-11 scores. Despite Hong Kong and Taiwan sharing a common Chinese cultural background, there are subcultural differences in online behaviors and norms between the two regions. Hong Kong places emphasis on English-language instruction, fostering a multilingual society where Cantonese, English, and Mandarin coexist (Bolton, 2020; Chew, 2005). In contrast, the influence of Japanese language and culture has had a lasting impact on Taiwan's linguistic landscape (Zhou & Zhou, 2019). These regional differences in communication style and digital literacy shape distinct social ideologies and may impact self-perception (Baig et al., 2019; Lee, 2014).

Apart from the aforementioned subcultural differences, the two regions have somewhat different internet subcultures. More specifically, Hong Kong net-bar gaming has been popular among Hong Kong young adults because of the flourishing gaming culture from 2005 onwards. Moreover, Hong Kong youths tend to display socially their gaming skills in net bars (Liao, 2016). In Taiwan, young adults like to go to internet cafés to enjoy various online activities, including chatting, gaming, or simply surfing the internet (Yang et al., 2008). Moreover, societal prejudices are different between Hong Kong and Taiwan in viewing online behaviors. In Hong Kong, there are negative labels given to those who engage in net-bar gaming such as *Dokuos* (a Japanese word

referring to a single man lacking confidence in real social interactions) and *MK boys* (young adults wandering around the Mong Kok area in Hong Kong who are viewed as having connections with gangs). Moreover, net bars attract sex-seeking females (i.e., young women pretending to provide one-to-one instruction on internet use but are actually intending to sell sex services) and teenagers engaging in “delinquent” behaviors (e.g., cigarette smoking, drug dealing, drug use, and speaking foul language) (Liao, 2016). In contrast, there is much less of a negative image for Taiwanese young adults who visit internet cafés, given that internet cafés are often considered places for young adult entertainment and hanging out with friends (Yang et al., 2008).

Government policies may also contribute to the internet subcultures, such as the National Security Law in Hong Kong affecting online discourse and age restrictions in Taiwanese internet cafés regulating access to certain content (Koo, 2022; Ragnedda & Muschert, 2013). Moreover, previous studies have shown that parental influence can impact problematic internet use among their children through behavioral control (Shek et al., 2019; Yu & Luo, 2021). Different parenting styles, with Hong Kong parents leaning towards authoritarianism (Fung et al., 2013) and Taiwanese parents having a more balanced ratio of authoritarian to authoritative styles (Pong et al., 2010), may contribute to varying levels of internet use among children. Due to gender and regional variations, ensuring measurement invariance is crucial when using psychometric instruments in research, guaranteeing consistent assessment of the same construct across different genders and regions.

Considering the wide range of prevalence estimates for different types of PUI (Alimoradi et al., 2022), employing a validated screening instrument could facilitate research into commonalities and differences. Findings could then support consensus criteria for further development and facilitate prevention and intervention for PUI in Hong Kong and Taiwan.

Therefore, the aim of the present study was to translate the ACSID-11 into traditional Chinese, assess the psychometric properties of the traditional Chinese version, and provide a foundation for its use among Taiwanese and Hong Kong populations. Moreover, the traditional Chinese version was examined among emerging adults residing in Taiwan and Hong Kong to see if it showed similar psychometric properties (e.g., a four-factor structure) similar to that of the original ACSID-11 validated using a German sample (Müller et al., 2022). Additionally, invariance testing across genders and regions was conducted to examine if the ACSID-11 can be used across populations with different cultural characteristics.

## **2. METHOD**

### ***2.1. Participants***

The present study comprised two sub-studies: (i) a cross-sectional study recruiting Taiwanese and Hong Kong participants, and (ii) given the support for the psychometric properties of the ACSID-11 in Hong Kong and Taiwanese samples, a follow-up study with Taiwanese participants at a 6-month interval was conducted to explore test-retest reliability. Participants were recruited through online convenience sampling (i.e., *SurveyMonkey* for participants in Taiwan and *Qualtrics* for those in Hong Kong). A total of 1257 university students from Taiwan and Hong Kong participated in the first sub-study (749 females and 508 males; mean age = 25.60 years [SD=4.39], age range 18 to 40 years). A total of 409 university students from Taiwan participated in the second sub-study (236 females, 171 males and 2 others; mean age = 29.68 years [SD=5.83] age range 20 to 40 years). The inclusion criteria included being: (i) a university student in Taiwan or Hong Kong, (ii) aged  $\geq 20$  years, (iii) able to understand and read traditional Chinese characters.

## **2.2. Measures**

### *2.2.1. Demographic information*

The survey assessed participants' age, sex, self-reported weight and height, diseases, and daily hours spent on social media during the past week.

### *2.2.2. Assessment of Criteria for Specific Internet-use Disorders (ACSID-11)*

The ACSID-11 is a psychometric tool assessing specific internet use behaviors (i.e., gaming, shopping, gambling, pornography use, and social media use), adapted from the ICD-11 criteria for disorder due to addictive behaviors (Müller et al., 2022). The scale includes 11 items distributed across three main subscales reflecting (i) impaired control (IC), (ii) increased priority given to the online activity (IP), and (iii) continuation/escalation of the internet use despite negative consequences (CE) (Müller et al., 2022). The scale also includes items assessing functional impairment in daily life (FI) and marked distress (MD) due to the online activity (Müller et al., 2022). Participants were initially asked about their online activities (i.e., gaming, shopping, gambling, pornography use, social media use, and other) in the past year with 'yes'/'no' responses. Additionally, participants answered ACSID-11 questions with two response scales (i) how often (0: never, 1: rarely, 2: sometimes, 3: often) and (ii) how intense (0: not at all intense, 1: somewhat intense, 2: rather intense, 3: intense). An example item from the IC subscale is *"In the past 12 months, have you had trouble keeping track of when you started the activity, for how long, how intensely, or in what situation you did it, or when you stopped?"*. An example item from the IP subscale is *"In the past 12 months, have you given the activity an increasingly higher priority than other activities or interests in your daily life?"*. An example item from the CE subscale is *"In the past 12 months, have you continued or increased the activity even though it has threatened or*

*caused you to lose a relationship with someone important to you?”*. The FI item is *“Thinking about all areas of your life, has your life been noticeably affected by the activity in the past 12 months?”*. The MD item is *“Thinking about all areas of your life, did the activity cause you suffering in the past 12 months?”*. Scores are achieved by summing answered responses, with higher scores reflecting greater severity (Müller et al., 2022). The ACSID-11 had good internal consistency for both frequency and intensity responses in both German (frequency  $\alpha = 0.90\text{--}0.95$ ; intensity  $\alpha = 0.89\text{--}0.94$ ; Müller et al., 2022) and Thai version (frequency  $\alpha = 0.82\text{--}0.86$ ; intensity  $\alpha = 0.87\text{--}0.88$ ; Yang et al., 2023).

### 2.2.3. Gaming Disorder Test (GDT)

The GDT is a brief psychometric tool assessing GD symptoms and severity based on WHO criteria for gaming disorder (Pontes et al., 2019). Participants were asked about their gaming activity on any digital devices (e.g., computers, smartphones, or tablets) both online and offline in the past 12 months (Wu et al., 2023). The GDT comprises four items reflecting GD in the ICD-11: (i) impaired control, (ii) increasing priority (iii) continuation despite negative consequences; and (iv) experience of significant life problems due to gaming (Lin et al., 2023; Pontes et al., 2019). Participants answered GDT questions on a 5 point-Likert scale (1: never, 2: rarely, 3: sometimes, 4: often, 5: very often) (Pontes et al., 2019). An example item of GDT is *“I have continued gaming despite the occurrence of negative consequences.”* Scores are calculated by summing the responses, with higher scores reflecting greater severity of GD (Pontes et al., 2019). The GDT has been reported as having good internal consistency in English ( $\alpha = 0.84$ ) (Pontes et al., 2019), Persian ( $\alpha = 0.73$ ) (Lin et al., 2023a), and Chinese ( $\alpha = 0.90$ ) (Chen et al., 2023a; Wu et al., 2023). Cronbach’s  $\alpha$  in the present study was 0.90; McDonald’s  $\omega$  in the present study was 0.90.

#### 2.2.4. *Depression, Anxiety, and Stress Scale-21 (DASS-21)*

The DASS-21 is a psychometric tool assessing depression, anxiety, and stress across different populations involved clinical and non-clinical participants (Cao et al., 2023a). Participants are asked about their psychological distress in the past week (Cao et al., 2023b). The DASS-21 includes 21 items comprising three main subscales (i.e., depression, anxiety, and stress) each with seven items (Chen et al., 2023b). Participants answer the questions on 4 point-Likert scale (0: did not apply to me at all, 1: applied to me to some degree, or some of the time, 2: applied to me to a considerable degree or a good part of time, 3: applied to me very much or most of the time). An example item from depression subscale is “*I found it difficult to work up the initiative to do things*”. An example item from anxiety subscale is “*I experienced trembling (e.g., in the hands)*”. An example item from stress subscale is “*I tended to overreact to situations*”. Scores are calculated by summing all items of DASS-21 and individually summing into three subscales with each seven-item score multiplied by two, with higher scores reflecting greater severity of psychological distress (Oei et al., 2013). The DASS-21 has been reported as having good internal consistency for all three subscales in both English ( $\alpha = 0.82\text{--}0.90$ ) (Henry & Crawford, 2005), and Chinese ( $\alpha = 0.86\text{--}0.92$ ) (Cao et al., 2023b). Cronbach’s  $\alpha$  in the present study ranged from 0.85 to 0.89; McDonald’s  $\omega$  in the present study ranged from 0.86 to 0.87.

#### 2.2.5. *YouTube Addiction Scale (YAS)*

The YAS is a psychometric tool assessing the severity of problematic use of YouTube (Pakpour et al., 2023). Participants were asked their experience of using YouTube in the past 12 months. The YAS comprises six items based on component model of addiction (Griffiths, 2005).

Participants answer questions using a 5 point-Likert scales (1: never, 2: rarely, 3: sometimes, 4: often, 5: very often) (Pakpour et al., 2023). An example item of YAS is “*Do you think that watching YouTube videos has overtaken your daily life activities?*” The total score is calculated by summing the responses, with higher scores reflecting greater severity of problematic use of YouTube. Although the original psychometric validation study for the YAS was published in 2023, it had already been translated into Chinese before that because the YAS was developed by some of the co-authors of the present study. The YAS has been reported to have good internal consistency in Persian ( $\alpha = 0.85$ ) (Pakpour et al., 2023). Cronbach’s  $\alpha$  in the present study was 0.90; McDonald’s  $\omega$  in the present study was 0.90.

### **2.3. Procedure**

The data were collected over two time periods. The main study was conducted from August 2022 to August 2023 among university students in Taiwan and Hong Kong. The exploratory follow-up study was conducted from February to April 2023 among university students in Taiwan. Both samples were recruited online by providing a survey link for collecting data. For the first data collection, the link was distributed to target participants via a snowballing method. More specifically, the research team posted the survey link on the university website and social media (e.g., *Facebook*) and encouraged individuals to distribute the online survey. Participants received study information (e.g., objectives, inclusion criteria) and provided informed consent on the first page of the online survey. More specifically, participants were required to provide electronic informed consent before beginning the online survey. Additionally, the participants were asked to provide their email address for the follow-up data collection. Except for the email address, the online surveys were completed anonymously. This survey collected data regarding participants’ demographic information and on the ACSID-11, taking approximately 10-15 minutes to complete

all the items. For the follow-up data collection, another link was used to recruit the participants which was sent to the email address of students who took participated in the first sub-study. Participants also received the relevant information of this study and provided their informed consent on the first page of the online survey. The follow-up study collected data regarding participants' demographic information and response from the additional psychometric instruments (i.e., GDT, YAS, and DASS-21), taking approximately 15–20 minutes to complete all the items.

### *2.3.1. The translation procedure*

The ACSID-11 was translated into Chinese by obtaining the permission from Matthias Brand. The translation process was performed in three steps according to well-established guidelines for translation (Beaton et al., 2000). In the first stage, the English version of the ACSID-11 was translated into Chinese by two independent bilingual translators in Chinese and English. This approach generated two Chinese versions, which were used to create one preliminary Chinese version of ACSID-11 through discussion among an expert panel. The expert panel included a psychometrician, psychologist, public health expert, social worker, and pediatrician. In the second stage, the preliminary Chinese version of ACSID-11 was translated back into English by another individual translator fluent in both Chinese and English. This process generated an English version of the ACSID-11 for further evaluation. At the last stage, all ACSID-11 versions (i.e., the two forward translated Chinese versions, the preliminary Chinese version, the back-translated English version of ACSID-11, and the original English ACSID-11) were consolidated and reviewed together by the same expert panel. After consolidation and review, a final version of the Chinese version of the ACSID-11 was generated through consensus of the expert panel considering linguistic and conceptual equivalence to the original version.

#### ***2.4. Statistical analysis***

The demographic data, ACSID-11, GDT, YAS, and DASS-21 scores were analyzed using descriptive statistics. Skewness and kurtosis of each ACSID-11 item were further examined to assess normal distributions. In addition, Mardia's multivariate skewness and kurtosis were calculated to examine if the ACSID-11 items had multivariate normality (Mardia, 1970). Additionally, ACSID-11 item properties were examined using factor loadings derived from confirmatory factor analysis (CFA) together with the corrected item-total correlation, with both values expected to be higher than 0.4 (Hair et al., 2018). If multivariate normality is supported, CFA with a maximum likelihood (ML) estimator would be performed to investigate if the ACSID-11 fitted well with a one-factor structure or a four-factor structure (as identified in the original ACSID-11 study [Müller et al., 2022]). However, if multivariate normality is not supported, CFA would be conducted using the diagonally weighted least squares (DWLS) estimator (Míndrilă, 2010). In order to examine if the ACSID-11 fitted a one-factor or the four-factor structure, model fit was assessed. Model fit in the CFA included the  $\chi^2$  test, root mean error of approximation (RMSEA), Tucker-Lewis index (TLI), and comparative fit index (CFI). Model fit indices in CFA are acceptable when both CFI and TLI are  $> 0.9$  together with RMSEA and SRMR  $< 0.08$  (Lin et al., 2020; Nejati et al., 2021). Internal consistency of the entire scale and each ACSID-11 domain (i.e., IC, IP, CE, and FI) at both baseline and follow-up was examined using both Cronbach's  $\alpha$  and McDonald's  $\omega$  coefficients, with acceptable values higher than 0.7 (Kalkbrenner, 2023; Nunnally, 1978).

Moreover, multi-group CFA (MGCFAs) was conducted to assess invariance of factor structure across regions (Taiwan vs. Hong Kong) and sex (female vs. male). A series of nested

models (i.e., involving configural, metric, and scalar invariance) were performed with increasing degrees of restriction. The configural invariance model did not constrain coefficient estimates between the subgroups (jurisdiction, sex) in a given factor structure (e.g., the four-factor structure of the ACSID-11 in the present study). The metric invariance model based on the configural model constrained the factor loadings to be equal between the subgroups. The scalar invariance model based on the metric invariance model constrained the item intercepts to be equal between the subgroups. The three nested models were then compared to evaluate if the invariance was supported: changes in CFI (i.e.,  $\Delta\text{CFI} < 0.01$ ), RMSEA (i.e.,  $\Delta\text{RMSEA} < 0.015$ ) and SRMR (i.e.,  $\Delta\text{SRMR} < 0.03$  for factor loadings and  $\Delta\text{SRMR} < 0.01$  for intercepts) were used to suggest invariance across regions or sex subgroups (Chen, 2007). However, Chen (2007) based on her Monte Carlo findings, made the suggestion that  $\Delta\text{CFI}$  and  $\Delta\text{RMSEA}$  are the major indices to decide measurement invariance. Similarly, Rutkowski and Svetina (2013) proposed using  $\Delta\text{SRMR}$  in conjunction to supplement the invariance findings. Other research also considers using  $\Delta\text{SRMR} < 0.03$  to indicate invariance for both factor loadings and item intercepts (Lee et al., 2023).

To assess concurrent validity, Pearson correlation coefficients were used to examine associations between each ACSID-11 domain (i.e., IC, IP, CE, and FI) in different online activities and daily hours spent using social media. The criterion of daily hours spent using social media was used because prior evidence indicates that time on social media can predict social media use behaviors (Tuck & Thompson, 2023). Consequently, daily hours spent using social media can be considered as a criterion assessing concurrent validity of the ACSID-11, especially with social-media items. Moreover, time spent on social media was hypothesized to have stronger associations with social-media items on the ACSID-11 than with other activities assessed via the ACSID-11.

Pearson correlation coefficients were used to examine the test-retest reliability of each ACSID-11 domain (i.e., IC, IP, CE, and FI) in different online activities between first and follow-up dataset (in Taiwanese samples only; no data from Hong Kong). Pearson correlation coefficients were further used to examine concurrent validity of the ACSID-11 using the follow-up dataset between each ACSID-11 domain (i.e., IC, IP, CE, and FI) and standardized assessment tools (i.e., GDT, YAS, and DASS-21).

Lastly, regression analyses were performed to evaluate the relationship between daily social media use time and each ACSID-11 domain (i.e., IC, IP, CE, FI) in different online activities (including frequency and intensity ratings). More specifically, daily social media use time was included as an independent variable and all ACSID-11 domains as dependent variables. Furthermore, regression analyses were performed to present how each ACSID-11 domain (i.e., IC, IP, CE, FI) was associated with GDT, YAS, and DASS-21. More specifically, ACSID-11 domains were separately included as independent variables for each regression model, and GDT, YAS, and DASS-21 scores were separately included as dependent variables for each regression model. In the regression models, age and gender were included as the controlled variables. Moreover, the DASS-21 score was used as a dependent variable because prior empirical evidence has shown that PUI assessed at an earlier time point is associated with psychological distress assessed at a later time point (Chang et al., 2022; Chen et al., 2020, 2021, 2022). All statistical analyses were performed using JASP (JASP Team; 2023).

## **2.5. Ethics**

All study procedures were conducted in accordance with the Declaration of Helsinki. Additionally, the study's protocol was reviewed and approved by BLIND FOR REVIEW

(Approval No. BLIND FOR REVIEW) and the BLIND FOR REVIEW (IRB No. BLIND FOR REVIEW) prior to data collection. All participants were informed about the study, and all provided informed consent.

### 3. RESULTS

For the baseline data, there were 1257 participants with a mean age of 25.60 years (SD=4.39) among university students in Taiwan and Hong Kong. The time spent on social media daily was 2.78 hours (SD=1.89). The participants engaged in specific internet-use behaviors including gaming (63.6%), shopping (84.4%), pornography use (46.0%), SNS use (97.1%), gambling (8.1%), and other online behaviors (8.9%). For the follow-up study, there were 409 participants with a mean age of 29.68 years (SD=5.83) among university students in Taiwan. The time spent time on social media daily was 2.66 hours (SD=2.22). The participants engaged in specific internet-use behaviors including gaming (52.6%), shopping (88.8%), pornography use (52.8%), SNS use (92.7%), gambling (7.1%), and other online behaviors (37.7%) (Table 1).

[Insert Table 1 here]

In descriptive analyses (Tables 1 and 2), all ACSID-11 items corresponding to all types of specific internet use behaviors (i.e., gaming, shopping, pornography, social media use, and gambling) presented acceptable values of skewness and kurtosis for both frequency and intensity ratings. All ACSID-11 item properties (factor loading and corrected item-total correlations) were above 0.4.

[Insert Table 2 here]

The level of internal consistency of the ACSID-11 at baseline (Table 2) was very good to excellent with respect to Cronbach's  $\alpha$  and McDonald's  $\omega$  coefficients in entire and each domain of ACSID-11 for all specific types of internet use behaviors in both frequency and intensity ratings.

For gaming behavior, Cronbach's  $\alpha$  and McDonald's  $\omega$  coefficients were 0.83–0.96 (frequency) and 0.85–0.97 (intensity). For online shopping, Cronbach's  $\alpha$  coefficient and McDonald's  $\omega$  coefficients were 0.72–0.95 (frequency) and 0.81–0.96 (intensity). For online pornography use, Cronbach's  $\alpha$  and McDonald's  $\omega$  coefficients were 0.90–0.97 (frequency) and 0.87–0.97 (intensity). For social media use, Cronbach's  $\alpha$  and McDonald's  $\omega$  coefficients were 0.79–0.95 (frequency) and 0.82–0.95 (intensity). For online gambling, Cronbach's  $\alpha$  and McDonald's  $\omega$  coefficients were 0.94–0.99 (frequency) and 0.95–0.99 (intensity).

With regards the CFA, the DWLS estimator was used because the multivariate normality was violated (see Appendix A for details). The results (Table 3) showed that all specific internet use behaviors of ACSID-11 (including frequency and intensity responses) showed good fit with a four-factor structure evidenced by all fit indices (frequency: CFI = 0.997 to 1.000, TLI = 0.996 to 1.002, RMSEA = 0.000 to 0.034, and SRMR = 0.012 to 0.037; intensity: CFI = 0.998 to 1.000, TLI = 0.997 to 1.002, RMSEA = 0.000 to 0.027, and SRMR = 0.011 to 0.034) without adding any modification indices.

[Insert Table 3 here]

Regarding the MGCFA results across regions (Taiwan vs. Hong Kong), the values of changes in CFI and RMSEA all supported measurement invariance (including metric and scalar invariance) for all four-factor models, including frequency and intensity ratings. All  $\Delta$ SRMR values were  $< 0.03$  for testing metric invariance and  $< 0.01$  for testing scalar invariance across regional subgroups. In addition,  $\Delta$ CFI and  $\Delta$ RMSEA indicate metric invariance and scalar invariance across regional subgroups (Table 4). Regarding the MGCFA results across gender subgroups (male vs. female), the values of changes in CFI, RMSEA, and SRMR all supported

measurement invariance (including metric and scalar invariance) for all four-factor models, including frequency and intensity ratings (Table 5).

[Insert Table 4 and Table 5 here]

Table 6 shows that time spent on social media was significantly correlated with all domains of SNS use (i.e., IC, IP, CE and FI) in the ACSID-11. Moreover, the associations between time spent on social media were significantly associated with SNS use in the ACSID-11 (frequency rating:  $r = 0.24-0.26$ ;  $p < .001$ ; intensity rating  $r = 0.22-0.28$ ;  $p < .001$ ). Additionally, after controlling for age and gender, regression analyses showed that time spent on social media remained significant association with SNS use in the ACSID-11 (frequency rating:  $\beta = 0.23-0.28$ ;  $p < .001$ ; intensity rating:  $\beta = 0.23-0.29$ ;  $p < .001$ ).

[Insert Table 6 here]

Similar to psychometric testing of the ACSID-11 at baseline (Table 7), psychometric testing of the ACSID-11 at the follow-up had acceptable to excellent internal consistency with respect to Cronbach's  $\alpha$  and McDonald's  $\omega$  coefficients. This was the case for both the entire scale and each domain subscale of the ACSID-11 for all specific types of internet use behaviors for both frequency and intensity ratings. For social media use, Cronbach's  $\alpha$  and McDonald's  $\omega$  coefficients were 0.71–0.92 (frequency) and 0.74–0.93 (intensity). For online gambling, Cronbach's  $\alpha$  and McDonald's  $\omega$  coefficients were 0.79–0.96 (frequency) and 0.82–0.96 (intensity). For gaming behavior, Cronbach's  $\alpha$  and McDonald's  $\omega$  coefficients were 0.69–0.94 (frequency) and 0.78–0.95 (intensity). For online shopping, Cronbach's  $\alpha$  coefficient and McDonald's  $\omega$  coefficients were 0.70–0.94 (frequency) and 0.76–0.95 (intensity). For online pornography use, Cronbach's  $\alpha$  and McDonald's  $\omega$  coefficients were 0.76–0.94 (frequency) and 0.81–0.95 (intensity).

As shown in Table 7, the test-retest reliability for the ACSID-11 was relatively acceptable over a six-month interval retest. All baseline ACSID-11 domains were significantly correlated with all follow-up ACSID-11 domains except for online gambling: gaming (frequency rating:  $r = 0.59$ – $0.69$ ;  $p < .001$ ; intensity rating:  $r = 0.62$ – $0.69$ ;  $p < .001$ ), online shopping (frequency rating:  $r = 0.44$ – $0.52$ ;  $p < .001$ ; intensity rating:  $r = 0.42$ – $0.51$ ;  $p < .001$ ), online pornography use (frequency rating:  $r = 0.54$ – $0.65$ ;  $p < .001$ ; intensity rating:  $r = 0.51$ – $0.65$ ;  $p < .001$ ), SNS use (frequency rating:  $r = 0.46$ – $0.53$ ;  $p < .001$ ; intensity rating:  $r = 0.40$ – $0.53$ ;  $p < .001$ ), and online gambling (frequency rating:  $r = 0.05$ – $0.53$ ;  $p$ -values between  $< .001$ – $0.327$ ; intensity rating:  $r = 0.20$ – $0.55$ ;  $p$ -values  $< .001$ ).

In addition, the associations between GDT and gaming in the ACSID-11 (frequency rating:  $r = 0.50$ – $0.58$ ;  $p < .001$ ; intensity rating:  $r = 0.49$ – $0.56$ ;  $p < .001$ ) were significant. The associations between YAS score and SNS use in the ACSID-11 (frequency rating:  $r = 0.36$ – $0.42$ ;  $p < .001$ ; intensity rating:  $r = 0.34$ – $0.41$ ;  $p < .001$ ) were significant. Moreover, the DASS-21 score was significantly associated with almost all ACSID-11 domains across online activities (see Table 7). After controlling age and gender, regression analyses showed similar findings to the Pearson correlations in the associations between GDT score, YAS score, DASS-21 score, and every domain of ACSID-11 across different online activities (see Table 7).

[Insert Table 7 here]

#### 4. DISCUSSION

The present study translated the ACSID-11 into traditional Chinese characters. Apart from testing internal consistency using Cronbach's  $\alpha$  and McDonald's  $\omega$ , a CFA examined if the traditional Chinese version of the ACSID-11 demonstrated good validity among university students in Taiwan and Hong Kong. The results suggested good test-retest reliability, internal

consistency, and validity of the ACSID-11 for assessing specific internet use disorders, including gaming, online shopping, online pornography use, social media use, and online gambling. The four-factor structure of the ACSID-11 identified in prior research and based on ICD-11 criteria (Müller et al., 2022; Yang et al., 2023) was supported among both Taiwan and Hong Kong samples with the support of satisfactory fit indices in the CFA. Additionally, the traditional Chinese ACSID-11 showed acceptable to excellent internal consistency for each specific type of PUI, including both frequency and intensity ratings. These findings support the ACSID-11 as a satisfactory instrument for assessing specific internet use behaviors.

Several potential internet use disorders demonstrated similar structures of diagnostic domains (i.e., impaired control, increasing priority, continuation/escalation, functional impairment) (Müller et al., 2022). However, not each domain may contribute equally to the experience of the potential internet use disorders, as Müller et al. (2022) suggested that different behaviors may demonstrate different combinations of the four factors. The adoption of a four-factor model in the ACSID-11 reflects the diverse ways PUI may present while sharing similar psychological properties. Moreover, this structure aligns with the criteria proposed in the ICD-11 (World Health Organization, 2019), offering a consistent framework for assessing a range of internet-related addictive behaviors, consistent with the proposal of the use of “other specified disorders due to addictive behaviors” for making diagnoses (Brand et al., 2022). Therefore, the ACSID-11 may assess common features of potential internet use disorders across different types of online activities, and may be used for more efficient assessment of a range of activities as compared to instruments assessing individual activities, such as the Problematic Pornography Consumption Scale (Bóthe et al., 2018), the Internet Gaming Disorder Scale–Short-Form (Pontes & Griffiths, 2015; Poon et al.,

2021), and the Bergen Social Media Addiction Scale (Andreassen et al., 2016; Pramukti et al., 2023).

While the ACSID-11 adopted the ICD-11 diagnostic framework for assessing a range of internet-related addictive behaviors, it is important to consider broader theoretical frameworks such as the biopsychosocial model of addictive behavior (Griffiths, 2005), and the DSM-5 diagnostic criteria for internet gaming disorder (American Psychiatric Association). The biopsychosocial model provides a broad understanding of addiction by considering biological, psychological, and social factors. This model emphasized the dynamic interplay between biological, psychological, and social factors in shaping addictive behaviors (Griffiths, 2005). The biological factor emphasizes the role of genetics, neurochemistry, and brain physiology in predisposing individuals to addiction (Skewes & Gonzalez, 2013). Psychological factors refer to individual differences in personality traits, cognitive processes, emotional regulation, and coping mechanisms that contribute to addictive behaviors (Skewes & Gonzalez, 2013). Social factors encompass the influence of social environments, interpersonal relationships, cultural norms, socioeconomic status, and life experiences on addictive behaviors (Skewes & Gonzalez, 2013). Within the biopsychosocial model, Griffiths further proposed addiction comprises six components (i.e., salience, mood modification, tolerance, withdrawal, conflict and relapse) and suggested the incorporation of a comprehensive approach for research and clinical practice (Griffiths, 2005).

The DSM-5 proposed nine criteria for evaluating internet addictive disorder related to gaming. These nine criteria incorporate all six of the aforementioned addiction components: (1) preoccupation with gaming (salience); (2) experiencing withdrawal symptoms when unable to game (withdrawal); (3) increased gaming time to satisfy cravings (tolerance); (4) inability to reduce or quit gaming (relapse); (5) loss of interest in other activities due to gaming (conflict); (6)

persisting with gaming despite experiencing problems (conflict); (7) deceiving the amount of time spent gaming to family members or others (conflict); (8) using gaming as a means to alleviate negative emotions (mood modification); and (9) facing risks such as jeopardizing or losing a job or relationship due to gaming (conflict). The ICD-11 criteria focus on functional impairment, and therefore does not include withdrawal and tolerance which are included in the DSM-5 IGD criteria (Jo et al., 2019; Poon et al., 2021). Integrating the broader criteria outlined in the DSM-5 and the addiction components model arguably provide a more comprehensive understanding of addiction.

After verifying the four-factor structure of the ACSID-11 (Müller et al., 2022; Yang et al., 2023), the present study significantly extends the factor structure findings by providing novel evidence through the evaluation of the instrument's measurement invariance. More specifically, using the standard procedure of MGCFA (Chen, 2007), the present findings showed that individuals from Taiwan and Hong Kong interpreted the ACSID-11 similarly, as did males and females. To the best of the present authors' knowledge, no prior evidence of measurement invariance had been conducted for the ACSID-11. Therefore, the data suggest that the psychometric features of the ACSID-11 apply similarly to different regions with subcultural differences and different gender groups. Moreover, given that Taiwan and Hong Kong share similar cultures (i.e., Confucianism elements, with histories of Western colonization experiences, and using similar written language systems [Copeland et al., 2023; Leung et al., 2020; Okazaki et al., 2007]), participants from the two areas may not have large discrepancies with respect to interpreting the ACSID-11, which may explain the satisfactory findings in measurement invariance. However, cultural differences also exist between Hong Kong and Taiwan. In this regard and in broader contexts, future studies are needed to further determine if the ACSID-11 is

measurement invariant across diverse contexts, especially those with larger cultural differences (e.g., Eastern vs. Western regions, and Northern hemisphere vs. Southern hemisphere regions).

The study also explored associations between time spent on social media and SNS measures from the ACSID-11. Individuals may obtain or perceive an additional sense of belonging from social media or turn to social media as an alternative way to build new social connections (Zell & Moeller, 2018), with demands for gaining support from social media platform associated with more time spent using social media (Marengo et al., 2022). The current correlational results suggest that more time spent on social media is associated with more severe symptoms of an SNS disorder as assessed by the ACSID-11. These associations were stronger than those between time spent on social media and symptoms of other internet use disorders assessed by the ACSID-11. The results align with a previous study (Chen et al., 2023a) which also reported no association between other types of internet use disorders and time spent on social media, because social media use may not potentially fulfill desires associated with other internet use behaviors. This finding indicated the ability of ACSID-11 to capture distinct relationships between specific forms of internet use and related concerns.

In the present study, the DASS-21 score was used as a dependent variable because internet-disorder domains assessed using the ACSID-11 may be associated with individuals' levels of psychological distress (a combination of depression, anxiety, and stress as a whole). By treating DASS-21 score as a dependent variable, the study could examine how changes in internet-disorder domains might predict or correlate with changes in psychological distress levels. The theoretical framing is grounded in the established literature concerning internet-related disorders and mental health outcomes. Previous studies adopting a longitudinal design (where PUI was assessed at baseline and psychological distress was assessed at a later time point) have demonstrated the

associations between PUI and psychological distress (Chang et al., 2022; Chen et al., 2020, 2021, 2022). By utilizing the the DASS-21 score as a dependent variable, the present study contributed to this body of research by examining how specific internet-disorder domains, as measured by the ACSID-11, may be linked to psychological distress as demonstrated in the present study.

The present study had several limitations. One limitation of the present study is that the survey initially focused solely on specific internet use and did not encompass an evaluation of overall time spent online. Future research should consider a more comprehensive evaluation of internet use behaviors to provide a more robust understanding of their relationships and potential implications for internet use disorders. Moreover, the study only recruited university students using convenience sampling. Therefore, the results may not be generalizable to all students from these regions and/or to general populations. Future studies should consider including representative participants from various age groups and backgrounds. Furthermore, all data, including that from the ACSID-11, were self-report, and biases related to memory recall and social desirability could have affected the results. Lastly, for the exploratory follow-up study, only data from Taiwanese university students were collected to examine the test-retest reliability, internal consistency, and concurrent validity of the Chinese ACSID-11. Future study should further investigate test-retest reliability, internal consistency, and validity of the Chinese ACSID-11 among university students from both Taiwan and Hong Kong.

## **5. CONCLUSION**

The findings of the present study provide support that the traditional Chinese version of ACSID-11 is a reliable and valid instrument for assessing specific internet use behaviors and is applicable across regions and sex among emerging adults (i.e., in this case, university students) in

Taiwan and Hong Kong. The traditional Chinese version of ACSID-11 may provide practitioners in Hong Kong and Taiwan a robust instrument to understand various specific internet use disorders, especially among young adults studying at a university. Future studies should be conducted to further examine the psychometric properties of the ACSID-11 and its generalization among other populations.

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**Table 1.** The characteristics of participants

	<b>Baseline</b> ( <i>N</i> = 1257)		<b>Follow-up</b> ( <i>N</i> = 409)	
	<b>Mean (SD)</b>	<b>n (%)</b>	<b>Mean (SD)</b>	<b>n (%)</b>
<b>Region</b>				
Taiwan		603 (48.0)		409
Hong Kong		654 (52.0)		--
<b>Age (years)</b>	25.60 (4.39)		29.68(5.83)	
<b>Gender</b>				
Male		508 (40.4)		171 (41.81)
Female		749 (59.6)		236 (57.70)
Others		0 (0.0)		2 (0.5)
<b>BMI (kg/m<sup>2</sup>)</b>	22.08 (3.75)		22.89(3.99)	
<b>Any condition or diseases (Yes)</b>		89 (7.1)		32 (7.8)
<b>Time on social media (hr/day)</b>	2.78 (1.89)		2.66(2.22)	
<b>ACSID-11</b>				
Gaming (Yes)		800 (63.6)		215 (52.6)
Online shopping (Yes)		1061 (84.4)		363 (88.8)
Online pornography use (Yes)		578 (46.0)		216 (52.8)
Social media use (Yes)		1220 (97.1)		379 (92.7)
Online gambling (Yes)		102 (8.1)		29 (7.1)
Others (Yes)		112 (8.9)		154 (37.7)
<b>GDT</b>	--		7.30 (3.16)	
<b>DASS-21 (T)</b>	--		12.61 (10.97)	
<b>YAS</b>	--		14.77 (4.95)	

SD	Standard deviation
BMI	Body mass index
ACSID-11	Assessment of Criteria for Specific Internet-use Disorders
GDT	Gaming Disorder Test
DASS-21(T)	Depression, Anxiety, and Stress Scale-21 (Total score)
YAS	YouTube Addiction Scale

Note. Follow-up data were collected six months later after baseline data collection.

**Table 2.** Psychometric properties of the ACSID-11 at the item level  
**Gaming**

	Frequency rating ( $\alpha=0.96$ ; $\omega=0.96$ for entire ACSID-11)						Intensity rating ( $\alpha=0.97$ ; $\omega=0.97$ for entire ACSID-11)					
	Factor <sup>a</sup> loadings	Item-total correlation	Skewness	Kurtosis	$\alpha^b$	$\omega^c$	Factor <sup>a</sup> loadings	Item-total correlation	Skewness	Kurtosis	$\alpha^b$	$\omega^c$
AC-IC					0.90	0.90					0.91	0.90
Item 1	0.82	0.76	0.20	-0.96			0.85	0.79	0.38	-0.51		
Item 2	0.88	0.85	0.43	-0.71			0.88	0.85	0.66	-0.14		
Item 3	0.90	0.80	0.77	0.02			0.93	0.84	0.85	0.44		
AC-IP					0.90	0.90					0.91	0.87
Item 4	0.85	0.74	0.51	-0.54			0.86	0.76	0.66	-0.09		
Item 5	0.87	0.84	0.92	0.58			0.88	0.85	0.96	0.93		
Item 6	0.88	0.84	0.92	0.51			0.90	0.85	0.98	0.93		
AC-CE					0.91	0.91					0.91	0.91
Item 7	0.86	0.82	1.08	1.82			0.87	0.83	1.06	1.86		
Item 8	0.90	0.81	0.98	0.73			0.91	0.82	1.01	0.97		
Item 9	0.88	0.83	1.14	1.82			0.88	0.84	1.12	2.00		
AC-FI					0.83	0.84					0.85	0.86
Item 10	0.88	0.72	0.84	0.25			0.89	0.74	0.94	0.78		
Item 11	0.83	0.72	1.14	1.81			0.84	0.74	1.17	2.17		

<sup>a</sup>Factor loadings derived by standardized coefficients in the confirmatory factor analysis

<sup>b</sup> $\alpha$  and <sup>c</sup> $\omega$  Reliability analysis for each domain

ACSID-11 Assessment of Criteria for Specific Internet-use Disorders

AC-IC Assessment of Criteria for Specific Internet-use Disorders (impaired control domain score)

AC-IP Assessment of Criteria for Specific Internet-use Disorders (increased priority given to the online activity domain score)

AC-CE Assessment of Criteria for Specific Internet-use Disorders (continuation/escalation domain score)

AC-FI Assessment of Criteria for Specific Internet-use Disorders (functional impairment domain in daily life and marked distress score)

SD Standard deviation

$\alpha$  Cronbach alpha coefficient

$\omega$  McDonald omega coefficient

**Online shopping**

	Frequency rating ( $\alpha=0.95$ ; $\omega=0.95$ for entire ACSID-11)						Intensity rating ( $\alpha=0.95$ ; $\omega=0.96$ for entire ACSID-11)					
	Factor <sup>a</sup> loadings	Item-total correlation	Skewness	Kurtosis	$\alpha^b$	$\omega^c$	*Factor loadings	Item-total correlation	Skewness	Kurtosis	$\alpha^b$	$\omega^c$
AC-IC					0.86	0.79					0.88	0.81
Item 1	0.68	0.67	0.002	-0.68			0.73	0.71	0.34	-0.28		
Item 2	0.86	0.79	0.45	-0.44			0.85	0.81	0.61	-0.09		
Item 3	0.93	0.74	0.78	0.25			0.94	0.76	0.85	0.53		
AC-IP					0.87	0.88					0.88	0.88
Item 4	0.78	0.68	0.54	-0.06			0.80	0.71	0.65	0.20		
Item 5	0.86	0.80	0.82	0.88			0.87	0.82	0.83	0.95		
Item 6	0.88	0.80	0.83	0.93			0.89	0.80	0.80	0.90		
AC-CE					0.92	0.92					0.92	0.92
Item 7	0.87	0.84	0.76	0.95			0.88	0.85	0.72	1.38		
Item 8	0.89	0.82	0.83	1.21			0.91	0.84	0.69	0.62		
Item 9	0.89	0.83	1.02	2.10			0.90	0.85	0.89	1.48		
AC-FI					0.72	0.73					0.84	0.83
Item10	0.84	0.71	0.81	0.69			0.86	0.73	0.89	1.12		
Item11	0.84	0.71	0.97	1.72			0.85	0.73	0.94	1.57		

<sup>a</sup>Factor loadings derived by standardized coefficients in the confirmatory factor analysis

<sup>b</sup> $\alpha$  and <sup>c</sup> $\omega$  Reliability analysis for each domain

ACSID-11

Assessment of Criteria for Specific Internet-use Disorders

AC-IC

Assessment of Criteria for Specific Internet-use Disorders (impaired control domain score)

AC-IP

Assessment of Criteria for Specific Internet-use Disorders (increased priority given to the online activity domain score)

AC-CE

Assessment of Criteria for Specific Internet-use Disorders (continuation/escalation domain score)

AC-FI

Assessment of Criteria for Specific Internet-use Disorders (functional impairment domain in daily life and marked distress score)

SD

Standard deviation

$\alpha$

Cronbach alpha coefficient

$\omega$

McDonald omega coefficient

## Online pornography use

	Frequency rating ( $\alpha=0.97$ ; $\omega=0.97$ for entire ACSID-11)					Intensity rating ( $\alpha=0.97$ ; $\omega=0.97$ for entire ACSID-11)						
	Factor <sup>a</sup> loadings	Item-total correlation	Skewness	Kurtosis	$\alpha^b$	$\omega^c$	Factor <sup>a</sup> loadings	Item-total correlation	Skewness	Kurtosis	$\alpha^b$	$\omega^c$
AC-IC					0.90	0.90					0.91	0.87
Item 1	0.81	0.76	0.63	-0.25			0.82	0.79	0.79	0.34		
Item 2	0.88	0.85	0.98	0.72			0.89	0.86	1.01	0.92		
Item 3	0.93	0.82	1.13	1.46			0.95	0.84	1.15	1.85		
AC-IP					0.90	0.90					0.91	0.94
Item 4	0.84	0.76	0.98	1.12			0.84	0.77	1.07	1.50		
Item 5	0.88	0.85	0.93	1.62			0.89	0.87	0.99	2.06		
Item 6	0.90	0.84	0.96	2.02			0.92	0.85	0.95	1.99		
AC-CE					0.94	0.94					0.93	0.93
Item 7	0.91	0.88	0.98	2.56			0.90	0.87	1.02	2.98		
Item 8	0.92	0.88	1.12	2.78			0.91	0.88	1.00	2.33		
Item 9	0.92	0.86	1.06	2.22			0.92	0.85	1.11	2.43		
AC-FI					0.90	0.90					0.90	0.91
Item 10	0.91	0.82	1.03	1.65			0.93	0.82	1.09	2.18		
Item 11	0.89	0.82	1.09	2.49			0.88	0.82	1.29	3.23		

<sup>a</sup>Factor loadings derived by standardized coefficients in the confirmatory factor analysis

<sup>b</sup> $\alpha$  and <sup>c</sup> $\omega$  Reliability analysis for each domain

ACSID-11 Assessment of Criteria for Specific Internet-use Disorders

AC-IC Assessment of Criteria for Specific Internet-use Disorders (impaired control domain score)

AC-IP Assessment of Criteria for Specific Internet-use Disorders (increased priority given to the online activity domain score)

AC-CE Assessment of Criteria for Specific Internet-use Disorders (continuation/escalation domain score)

AC-FI Assessment of Criteria for Specific Internet-use Disorders (functional impairment domain in daily life and marked distress score)

SD Standard deviation

$\alpha$  Cronbach alpha coefficient

$\omega$  McDonald omega coefficient

**Social media use**

	Frequency rating ( $\alpha=0.95$ ; $\omega=0.95$ for entire ACSID-11)					Intensity rating ( $\alpha=0.95$ ; $\omega=0.95$ for entire ACSID-11)						
	Factor <sup>a</sup> loadings	Item-total correlation	Skewness	Kurtosis	$\alpha^b$	$\omega^c$	Factor <sup>a</sup> loadings	Item-total correlation	Skewness	Kurtosis	$\alpha^b$	$\omega^c$
AC-IC					0.86	0.89					0.88	0.90
Item 1	0.73	0.67	-0.39	-0.82			0.78	0.71	-0.06	-0.74		
Item 2	0.86	0.81	0.17	-1.01			0.87	0.82	0.30	-0.77		
Item 3	0.88	0.75	0.46	-0.72			0.88	0.78	0.58	-0.40		
AC-IP					0.86	0.82					0.88	0.84
Item 4	0.78	0.65	0.22	-0.90			0.82	0.70	0.36	-0.63		
Item 5	0.83	0.79	0.88	0.41			0.84	0.82	0.94	0.71		
Item 6	0.85	0.78	0.84	0.30			0.87	0.81	0.91	0.62		
AC-CE					0.87	0.88					0.87	0.87
Item 7	0.80	0.77	1.05	1.35			0.80	0.77	0.96	1.15		
Item 8	0.85	0.75	0.83	0.05			0.85	0.74	0.86	0.31		
Item 9	0.86	0.77	1.11	1.16			0.86	0.77	1.08	1.17		
AC-FI					0.79	0.80					0.82	0.82
Item10	0.83	0.66	0.51	-0.55			0.85	0.70	0.60	-0.32		
Item11	0.80	0.66	0.98	0.70			0.82	0.70	1.10	1.10		

<sup>a</sup>Factor loadings derived by standardized coefficients in the confirmatory factor analysis

<sup>b</sup> $\alpha$  and <sup>c</sup> $\omega$  Reliability analysis for each domain

ACSID-11 Assessment of Criteria for Specific Internet-use Disorders

AC-IC Assessment of Criteria for Specific Internet-use Disorders (impaired control domain score)

AC-IP Assessment of Criteria for Specific Internet-use Disorders (increased priority given to the online activity domain score)

AC-CE Assessment of Criteria for Specific Internet-use Disorders (continuation/escalation domain score)

AC-FI Assessment of Criteria for Specific Internet-use Disorders (functional impairment domain in daily life and marked distress score)

SD Standard deviation

$\alpha$  Cronbach alpha coefficient

$\omega$  McDonald omega coefficient

**Online gambling**

	Frequency rating ( $\alpha=0.99$ ; $\omega=0.99$ for entire ACSID-11)					Intensity rating ( $\alpha=0.99$ ; $\omega=0.99$ for entire ACSID-11)						
	Factor <sup>a</sup> loadings	Item-total correlation	Skewness	Kurtosis	$\alpha^b$	$\omega^c$	Factor <sup>a</sup> loadings	Item-total correlation	Skewness	Kurtosis	$\alpha^b$	$\omega^c$
AC-IC					0.94	0.96					0.96	0.96
Item 1	0.90	0.87	1.13	2.54			0.93	0.89	0.98	2.06		
Item 2	0.93	0.91	1.35	3.60			0.93	0.92	1.25	3.44		
Item 3	0.93	0.87	1.24	3.18			0.95	0.91	0.99	2.07		
AC-IP					0.97	0.95					0.96	0.96
Item 4	0.94	0.91	0.99	2.15			0.94	0.90	0.99	2.35		
Item 5	0.96	0.94	0.99	2.49			0.94	0.93	0.91	2.51		
Item 6	0.95	0.93	0.93	2.25			0.95	0.93	0.89	2.45		
AC-CE					0.97	0.97					0.97	0.97
Item 7	0.94	0.93	0.94	2.57			0.95	0.93	0.68	1.70		
Item 8	0.97	0.94	0.79	1.94			0.97	0.95	0.43	-0.13		
Item 9	0.95	0.93	0.73	1.79			0.96	0.94	0.42	0.03		
AC-FI					0.94	0.95					0.95	0.95
Item 10	0.94	0.89	0.91	1.88			0.95	0.90	0.71	1.29		
Item 11	0.94	0.89	1.06	2.98			0.96	0.90	0.71	1.21		

<sup>a</sup>Factor loadings derived by standardized coefficients in the confirmatory factor analysis

<sup>b</sup> $\alpha$  and <sup>c</sup> $\omega$  Reliability analysis for each domain

ACSID-11 Assessment of Criteria for Specific Internet-use Disorders

AC-IC Assessment of Criteria for Specific Internet-use Disorders (impaired control domain score)

AC-IP Assessment of Criteria for Specific Internet-use Disorders (increased priority given to the online activity domain score)

AC-CE Assessment of Criteria for Specific Internet-use Disorders (continuation/escalation domain score)

AC-FI Assessment of Criteria for Specific Internet-use Disorders (functional impairment domain in daily life and marked distress score)

SD Standard deviation

$\alpha$  Cronbach alpha coefficient

$\omega$  McDonald omega coefficient

**Table 3.** Fit indices of confirmatory factor analysis for one-factor or four-factor structure of the ACSID-11

Structure	Frequency rating						Intensity rating						
	Domain	$\chi^2$ (df)	p-value	CFI	TLI	RMSEA (90%CI)	SRMR	$\chi^2$ (df)	P-value	CFI	TLI	RMSEA (90%CI)	SRMR
<b>One-factor</b>													
Gaming	106.46(44)	< .001	<b>0.997</b>	<b>0.996</b>	<b>0.034</b> (0.026, 0.042)	<b>0.046</b>	84.25(44)	< .001	<b>0.998</b>	<b>0.997</b>	<b>0.027</b> (0.018, 0.036)	<b>0.043</b>	
Online shopping	226.08(44)	< .001	<b>0.990</b>	<b>0.987</b>	<b>0.057</b> (0.050, 0.065)	<b>0.064</b>	200.11(44)	< .001	<b>0.991</b>	<b>0.989</b>	<b>0.053</b> (0.046, 0.061)	<b>0.061</b>	
Online pornography use	77.94(44)	0.001	<b>0.998</b>	<b>0.997</b>	<b>0.025</b> (0.015, 0.034)	<b>0.044</b>	77.42(44)	0.001	<b>0.998</b>	<b>0.997</b>	<b>0.025</b> (0.015, 0.033)	<b>0.045</b>	
Social media use	178.36(44)	< .001	<b>0.993</b>	<b>0.992</b>	<b>0.049</b> (0.042, 0.057)	<b>0.053</b>	167.16(44)	< .001	<b>0.994</b>	<b>0.992</b>	<b>0.047</b> (0.040, 0.055)	<b>0.054</b>	
Online gambling	13.57(44)	1.000	<b>1.000</b>	<b>1.002</b>	<b>0.000</b> (0.000, 0.000)	<b>0.022</b>	15.95(44)	1.000	<b>1.000</b>	<b>1.001</b>	<b>0.000</b> (0.000, 0.000)	<b>0.022</b>	
<b>Four-factor</b>													
Gaming	60.60(38)	0.011	<b>0.999</b>	<b>0.999</b>	<b>0.022</b> (0.010, 0.032)	<b>0.032</b>	40.19(38)	0.374	<b>1.000</b>	<b>1.000</b>	<b>0.007</b> (0.000, 0.021)	<b>0.027</b>	
Online shopping	88.81(38)	< .001	<b>0.997</b>	<b>0.996</b>	<b>0.033</b> (0.024, 0.042)	<b>0.037</b>	71.86(38)	< .001	<b>0.998</b>	<b>0.997</b>	<b>0.027</b> (0.017, 0.036)	<b>0.034</b>	
Online pornography use	31.83(38)	0.749	<b>1.000</b>	<b>1.001</b>	<b>0.000</b> (0.000, 0.015)	<b>0.026</b>	28.06(38)	0.881	<b>1.000</b>	<b>1.001</b>	<b>0.000</b> (0.000, 0.010)	<b>0.025</b>	
Social media use	94.40(38)	< .001	<b>0.997</b>	<b>0.996</b>	<b>0.034</b> (0.026, 0.043)	<b>0.036</b>	70.09(38)	0.001	<b>0.998</b>	<b>0.998</b>	<b>0.026</b> (0.016, 0.035)	<b>0.032</b>	
Online gambling	4.69(38)	1.000	<b>1.000</b>	<b>1.002</b>	<b>0.000</b> (0.000, 0.000)	<b>0.012</b>	4.41(38)	1.000	<b>1.000</b>	<b>1.002</b>	<b>0.000</b> (0.000, 0.000)	<b>0.011</b>	

Note. **bolded** values indicate acceptable fit (i.e., CFI and TLI > 0.9; RMSEA and SRMR < 0.08)

ACSID-11 Assessment of Criteria for Specific Internet-use Disorders

CFI Comparative fit index

TLI Tucker-Lewis index

RMSEA Root mean square error of approximation

SRMR Standardized root mean square residual

CI Confidence interval

**Table 4.** Measurement invariance of the ACSID-11 across Taiwan and Hong Kong participants

Gaming	Frequency					Intensity				
	M1 (df=76)	M2 (df=83)	M3 (df=89)	M2-M1 ( $\Delta$ df=7)	M3-M2 ( $\Delta$ df=6)	M1 (df=76)	M2 (df=83)	M3 (df=89)	M2-M1 ( $\Delta$ df=7)	M3-M2 ( $\Delta$ df=6)
$\chi^2$ or $\Delta\chi^2$	131.41	158.92	177.64	27.51	18.72	84.34	107.36	118.64	23.02	11.28
p-value	< .001	< .001	< .001	0.0003	0.005	0.240	0.037	0.020	0.002	0.08
CFI or $\Delta$ CFI	0.995	0.994	0.993	-0.001	-0.001	0.999	0.998	0.997	-0.001	-0.001
RMSEA or $\Delta$ RMSEA	0.034	0.038	0.040	0.004	0.002	0.013	0.022	0.023	0.009	0.001
SRMR or $\Delta$ SRMR	0.055	0.061	0.057	0.006	-0.004	0.048	0.056	0.052	0.008	-0.004
Online shopping	M1 (df=76)	M2 (df=83)	M3 (df=87)	M2-M1 ( $\Delta$ df=7)	M3-M2 ( $\Delta$ df=4)	M1 (df=76)	M2 (df=83)	M3 (df=88)	M2-M1 ( $\Delta$ df=7)	M3-M2 ( $\Delta$ df=5)
$\chi^2$ or $\Delta\chi^2$	153.50	198.53	208.07	45.03	9.54	101.96	143.74	179.51	41.78	35.77
p-value	< .001	< .001	< .001	< .001	0.049	0.025	< .001	< .001	< .001	< .001
CFI or $\Delta$ CFI	0.991	0.987	0.986	-0.004	-0.001	0.997	0.993	0.989	-0.004	-0.004
RMSEA or $\Delta$ RMSEA	0.040	0.047	0.047	0.007	0.000	0.023	0.034	0.041	0.011	0.007
SRMR or $\Delta$ SRMR	0.059	0.064	0.060	0.005	-0.004	0.051	0.060	0.058	0.009	-0.002
Online pornography use	M1 (df=76)	M2 (df=83)	M3 (df=88)	M2-M1 ( $\Delta$ df=7)	M3-M2 ( $\Delta$ df=5)	M1 (df=76)	M2 (df=83)	M3 (df=88)	M2-M1 ( $\Delta$ df=7)	M3-M2 ( $\Delta$ df=5)
$\chi^2$ or $\Delta\chi^2$	38.68	64.08	110.65	25.4	46.57	35.65	57.36	66.37	21.71	9.01
p-value	1.000	0.939	0.052	0.001	< .001	1.000	0.986	0.959	0.003	0.109

<b>CFI or <math>\Delta</math>CFI</b>	1.000	1.000	0.995	0.000	-0.005	1.000	1.000	1.000	0.000	0.000
<b>RMSEA or <math>\Delta</math>RMSEA</b>	0.000	0.000	0.020	0.000	0.02	0.000	0.000	0.000	0.000	0.000
<b>SRMR or <math>\Delta</math>SRMR</b>	0.048	0.060	0.064	0.012	0.004	0.048	0.060	0.057	0.012	-0.003
<b>Social media use</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M2-M1</b>	<b>M3-M2</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M2-M1</b>	<b>M3-M2</b>
	<b>(df=76)</b>	<b>(df=83)</b>	<b>(df=87)</b>	<b>(<math>\Delta</math>df=7)</b>	<b>(<math>\Delta</math>df=4)</b>	<b>(df=76)</b>	<b>(df=83)</b>	<b>(df=88)</b>	<b>(<math>\Delta</math>df=7)</b>	<b>(<math>\Delta</math>df=5)</b>
<b><math>\chi^2</math> or <math>\Delta\chi^2</math></b>	214.08	245.47	253.76	31.39	8.29	152.26	175.79	188.84	23.53	13.05
<b>p-value</b>	< .001	< .001	< .001	< .001	0.082	< .001	< .001	< .001	0.001	0.023
<b>CFI or <math>\Delta</math>CFI</b>	0.986	0.984	0.983	-0.002	-0.001	0.992	0.991	0.990	-0.001	-0.001
<b>RMSEA or <math>\Delta</math>RMSEA</b>	0.054	0.056	0.055	0.002	-0.001	0.040	0.042	0.043	0.002	0.001
<b>SRMR or <math>\Delta</math>SRMR</b>	0.060	0.065	0.060	0.005	-0.005	0.054	0.058	0.055	0.004	-0.003
<b>Online gambling</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M2-M1</b>	<b>M3-M2</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M2-M1</b>	<b>M3-M2</b>
	<b>(df=76)</b>	<b>(df=83)</b>	<b>(df=84)</b>	<b>(<math>\Delta</math>df=7)</b>	<b>(<math>\Delta</math>df=1)</b>	<b>(df=76)</b>	<b>(df=83)</b>	<b>(df=86)</b>	<b>(<math>\Delta</math>df=7)</b>	<b>(<math>\Delta</math>df=3)</b>
<b><math>\chi^2</math> or <math>\Delta\chi^2</math></b>	9.97	11.61	11.63	1.64	0.02	8.36	16.53	19.67	8.17	3.14
<b>p-value</b>	1.000	1.000	1.000	0.977	0.888	1.000	1.000	1.000	0.318	0.371
<b>CFI or <math>\Delta</math>CFI</b>	1.000	1.000	1.000	0.000	0.000	1.000	1.000	1.000	0.000	0.000
<b>RMSEA or <math>\Delta</math>RMSEA</b>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<b>SRMR or <math>\Delta</math>SRMR</b>	0.039	0.041	0.038	0.002	-0.003	0.038	0.051	0.051	0.013	0.000

CFI = Comparative fit index; RMSEA = Root mean square error of approximation; SRMR = Standardized root mean square residual; M1 = Configural model; M2 = Model with factor loadings constrained equal across groups; M3 = Model with both factor loadings and item intercepts constrained to be equal across groups

**Table 5.** Measurement invariance of the ACSID-11 across male and female participants

Gaming	Frequency					Intensity				
	M1	M2	M3	M2-M1	M3-M2	M1	M2	M3	M2-M1	M3-M2
	(df=76)	(df=83)	(df=89)	( $\Delta$ df=7)	( $\Delta$ df=6)	(df=76)	(df=83)	(df=89)	( $\Delta$ df=7)	( $\Delta$ df=6)
$\chi^2$ or $\Delta\chi^2$	67.09	84.64	89.60	17.55	4.96	46.50	63.53	66.54	17.03	3.01
p-value	0.758	0.429	0.462	0.014	0.549	0.997	0.945	0.964	0.017	0.808
CFI or $\Delta$ CFI	1.000	1.000	1.000	0.000	0.000	1.000	1.000	1.000	0.000	0.000
RMSEA or $\Delta$ RMSEA	0.000	0.006	0.003	0.006	-0.003	0.000	0.000	0.000	0.000	0.000
SRMR or $\Delta$ SRMR	0.035	0.040	0.037	0.005	-0.003	0.031	0.037	0.035	0.006	-0.002
Online shopping	M1	M2	M3	M2-M1	M3-M2	M1	M2	M3	M2-M1	M3-M2
	(df=76)	(df=83)	(df=87)	( $\Delta$ df=7)	( $\Delta$ df=4)	(df=76)	(df=83)	(df=88)	( $\Delta$ df=7)	( $\Delta$ df=5)
$\chi^2$ or $\Delta\chi^2$	82.41	88.67	101.91	6.26	13.24	71.56	82.05	91.93	10.49	9.88
p-value	0.288	0.315	0.131	0.510	0.010	0.623	0.509	0.366	0.163	0.079
CFI or $\Delta$ CFI	1.000	1.000	0.999	0.000	-0.001	1.000	1.000	1.000	0.000	0.000
RMSEA or $\Delta$ RMSEA	0.012	0.010	0.017	-0.002	0.007	0.000	0.000	0.008	0.000	0.008
SRMR or $\Delta$ SRMR	0.039	0.040	0.039	0.001	-0.001	0.036	0.039	0.037	0.003	-0.002
Online pornography use	M1	M2	M3	M2-M1	M3-M2	M1	M2	M3	M2-M1	M3-M2
	(df=76)	(df=83)	(df=88)	( $\Delta$ df=7)	( $\Delta$ df=5)	(df=76)	(df=83)	(df=88)	( $\Delta$ df=7)	( $\Delta$ df=5)
$\chi^2$ or $\Delta\chi^2$	39.67	53.66	76.15	13.99	22.49	35.18	68.72	85.36	33.54	16.64
p-value	1.000	0.995	0.812	0.051	0.0004	1.000	0.870	0.560	< .001	0.005

<b>CFI or <math>\Delta</math>CFI</b>	1.000	1.000	1.000	0.000	0.000	1.000	1.000	1.000	0.000	0.000
<b>RMSEA or <math>\Delta</math>RMSEA</b>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<b>SRMR or <math>\Delta</math>SRMR</b>	0.028	0.032	0.033	0.004	0.001	0.026	0.035	0.035	0.009	0.000
<b>Social media use</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M2-M1</b>	<b>M3-M2</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M2-M1</b>	<b>M3-M2</b>
	<b>(df=76)</b>	<b>(df=83)</b>	<b>(df=87)</b>	<b>(<math>\Delta</math>df=7)</b>	<b>(<math>\Delta</math>df=4)</b>	<b>(df=76)</b>	<b>(df=83)</b>	<b>(df=88)</b>	<b>(<math>\Delta</math>df=7)</b>	<b>(<math>\Delta</math>df=5)</b>
<b><math>\chi^2</math> or <math>\Delta\chi^2</math></b>	102.46	110.03	113.59	7.57	3.56	78.59	84.48	87.59	5.89	3.11
<b>p-value</b>	0.023	0.025	0.029	0.372	0.469	0.397	0.434	0.492	0.553	0.683
<b>CFI or <math>\Delta</math>CFI</b>	0.999	0.999	0.999	0.000	0.000	1.000	1.000	1.000	0.000	0.000
<b>RMSEA or <math>\Delta</math>RMSEA</b>	0.024	0.023	0.022	-0.001	-0.001	0.007	0.005	0.000	-0.002	-0.005
<b>SRMR or <math>\Delta</math>SRMR</b>	0.040	0.041	0.038	0.001	-0.003	0.037	0.038	0.036	0.001	-0.002
<b>Online gambling</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M2-M1</b>	<b>M3-M2</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M2-M1</b>	<b>M3-M2</b>
	<b>(df=76)</b>	<b>(df=83)</b>	<b>(df=84)</b>	<b>(<math>\Delta</math>df=7)</b>	<b>(<math>\Delta</math>df=1)</b>	<b>(df=76)</b>	<b>(df=83)</b>	<b>(df=86)</b>	<b>(<math>\Delta</math>df=7)</b>	<b>(<math>\Delta</math>df=3)</b>
<b><math>\chi^2</math> or <math>\Delta\chi^2</math></b>	6.62	12.06	12.07	5.44	0.01	6.45	20.28	20.59	13.83	0.31
<b>p-value</b>	1.000	1.000	1.000	0.606	0.920	1.000	1.000	1.000	0.054	0.958
<b>CFI or <math>\Delta</math>CFI</b>	1.000	1.000	1.000	0.000	0.000	1.000	1.000	1.000	0.000	0.000
<b>RMSEA or <math>\Delta</math>RMSEA</b>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<b>SRMR or <math>\Delta</math>SRMR</b>	0.014	0.019	0.017	0.005	-0.002	0.012	0.021	0.020	0.009	-0.001

CFI = Comparative fit index; RMSEA = Root mean square error of approximation; SRMR = Standardized root mean square residual; M1 = Configural model; M2 = Model with factor loadings constrained equal across groups; M3 = Model with both factor loadings and item intercepts constrained to be equal across groups

**Table 6.** Correlations between domains of the ACSID-11 and daily time spent using social media

ACSID-11 domain	$r/\beta^a$				
	Gaming	Online shopping	Online pornography use	Social media use	Online gambling
<b>Frequency rating</b>					
AC-IC	-0.02 /0.002	0.10* /0.09	0.03 /0.09*	0.24***/0.23***	-0.01 /-0.003
AC-IP	-0.06 /-0.03	0.11* /0.11*	0.09 /0.15**	0.26***/0.26***	-0.02 /-0.005
AC-CE	0.05 /0.08	0.10 /0.11*	0.09 /0.14**	0.26***/0.28***	-0.02 /-0.007
AC-FI	-0.05 /-0.02	0.11* /0.12*	0.08 /0.12**	0.26***/0.27***	-0.04 /-0.03
<b>Intensity rating</b>					
AC-IC	-0.02 /0.01	0.12*/0.11*	-0.003 /0.06	0.25***/0.25***	-0.01 /-0.005
AC-IP	-0.07 /-0.04	0.11*/0.11*	0.10* /0.15***	0.22***/0.23***	-0.01 /-0.001
AC-CE	0.01 /0.03	0.08 /0.09	0.09 /0.14**	0.24***/0.26***	-0.04 /-0.03
AC-FI	-0.05 /-0.02	0.11* /0.11*	0.07 /0.11*	0.28**/0.29***	-0.02 /-0.01

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

AC-IC Assessment of Criteria for Specific Internet-use Disorders (impaired control domain score)

AC-IP Assessment of Criteria for Specific Internet-use Disorders (increased priority given to the online activity domain score)

AC-CE Assessment of Criteria for Specific Internet-use Disorders (continuation/escalation domain score)

AC-FI Assessment of Criteria for Specific Internet-use Disorders (functional impairment domain in daily life and marked distress score)

<sup>a</sup> Standardized coefficients derived from regression models with adjustments of age and gender.

**Table 7.** Test-retest reliability, convergent validity, and divergent validity using the follow-up data.

	ACSID-11 domain	$r$		$r / \beta^a$	
		Test-retest reliability	GDT	YAS	DASS-21
Gaming	<b>Frequency rating (<math>\alpha=0.93</math>; <math>\omega=0.94</math>)</b>				
	AC-IC ( $\alpha=0.76$ ; $\omega=0.78$ )	0.59***	0.55*** / 0.53***	0.26*** / 0.23***	0.12* / 0.14**
	AC-IP ( $\alpha=0.86$ ; $\omega=0.88$ )	0.69***	0.58*** / 0.56***	0.24*** / 0.21***	0.20*** / 0.22***
	AC-CE ( $\alpha=0.89$ ; $\omega=0.89$ )	0.66***	0.50*** / 0.49***	0.28*** / 0.27***	0.20*** / 0.22***
	AC-FI ( $\alpha=0.69$ ; $\omega=0.71$ )	0.66***	0.51*** / 0.49***	0.27*** / 0.25***	0.15** / 0.17***
	<b>Intensity rating (<math>\alpha=0.95</math>; <math>\omega=0.95</math>)</b>				
	AC-IC ( $\alpha=0.83$ ; $\omega=0.84$ )	0.62***	0.54*** / 0.51***	0.24*** / 0.20***	0.09 / 0.11*
	AC-IP ( $\alpha=0.89$ ; $\omega=0.90$ )	0.68***	0.56*** / 0.54***	0.24*** / 0.22***	0.19*** / 0.21***
	AC-CE ( $\alpha=0.91$ ; $\omega=0.91$ )	0.69***	0.50*** / 0.49***	0.26*** / 0.25***	0.20*** / 0.22***
	AC-FI ( $\alpha=0.78$ ; $\omega=0.79$ )	0.64***	0.49*** / 0.47***	0.29*** / 0.27***	0.13** / 0.15**
Online shopping	<b>Frequency rating (<math>\alpha=0.93</math>; <math>\omega=0.94</math>)</b>				
	AC-IC ( $\alpha=0.81$ ; $\omega=0.82$ )	0.46***	0.15*** / 0.18***	0.26*** / 0.30***	0.16** / 0.16**
	AC-IP ( $\alpha=0.87$ ; $\omega=0.89$ )	0.50***	0.23*** / 0.26***	0.22*** / 0.25***	0.20*** / 0.20***
	AC-CE ( $\alpha=0.91$ ; $\omega=0.91$ )	0.52***	0.26*** / 0.28***	0.24*** / 0.26***	0.15** / 0.15**
	AC-FI ( $\alpha=0.70$ ; $\omega=0.72$ )	0.44***	0.20*** / 0.23***	0.24*** / 0.27***	0.17*** / 0.23***
	<b>Intensity rating (<math>\alpha=0.94</math>; <math>\omega=0.95</math>)</b>				
	AC-IC ( $\alpha=0.86$ ; $\omega=0.87$ )	0.49***	0.15** / 0.18***	0.27*** / 0.30***	0.18*** / 0.17***
	AC-IP ( $\alpha=0.88$ ; $\omega=0.89$ )	0.48***	0.20*** / 0.22***	0.22*** / 0.25***	0.14** / 0.14**
	AC-CE ( $\alpha=0.83$ ; $\omega=0.84$ )	0.51***	0.26*** / 0.27***	0.24*** / 0.26***	0.15** / 0.16**
	AC-FI ( $\alpha=0.76$ ; $\omega=0.78$ )	0.42***	0.19*** / 0.21***	0.25*** / 0.27***	0.15** / 0.22***
Online pornography use	<b>Frequency rating (<math>\alpha=0.93</math>; <math>\omega=0.94</math>)</b>				
	AC-IC ( $\alpha=0.80$ ; $\omega=0.82$ )	0.65***	0.26*** / 0.17***	0.29*** / 0.23***	0.17*** / 0.26***
	AC-IP ( $\alpha=0.85$ ; $\omega=0.87$ )	0.62***	0.29*** / 0.23***	0.32*** / 0.29***	0.22*** / 0.28***
	AC-CE ( $\alpha=0.88$ ; $\omega=0.89$ )	0.57***	0.28*** / 0.23***	0.32*** / 0.29***	0.20*** / 0.24***
	AC-FI ( $\alpha=0.76$ ; $\omega=0.77$ )	0.54***	0.27*** / 0.22***	0.26*** / 0.23***	0.21*** / 0.26***
	<b>Intensity rating (<math>\alpha=0.94</math>; <math>\omega=0.95</math>)</b>				
	AC-IC ( $\alpha=0.86$ ; $\omega=0.87$ )	0.65***	0.27*** / 0.28***	0.29*** / 0.23***	0.19*** / 0.29***
	AC-IP ( $\alpha=0.87$ ; $\omega=0.89$ )	0.60***	0.28*** / 0.22***	0.30*** / 0.27***	0.19*** / 0.25***
	AC-CE ( $\alpha=0.90$ ; $\omega=0.90$ )	0.55***	0.27*** / 0.22***	0.28*** / 0.25***	0.18*** / 0.22***
	AC-FI ( $\alpha=0.81$ ; $\omega=0.82$ )	0.51***	0.27*** / 0.22***	0.26*** / 0.23***	0.19*** / 0.23***
Social media use	<b>Frequency rating (<math>\alpha=0.91</math>; <math>\omega=0.92</math>)</b>				
	AC-IC ( $\alpha=0.76$ ; $\omega=0.78$ )	0.53***	0.20*** / 0.22***	0.42*** / 0.43***	0.20*** / 0.20***
	AC-IP ( $\alpha=0.82$ ; $\omega=0.84$ )	0.50***	0.26*** / 0.28***	0.39*** / 0.40***	0.24*** / 0.24***
	AC-CE ( $\alpha=0.86$ ; $\omega=0.86$ )	0.48***	0.28*** / 0.28***	0.39*** / 0.39***	0.24*** / 0.25***
	AC-FI ( $\alpha=0.71$ ; $\omega=0.72$ )	0.46***	0.26*** / 0.28**	0.36*** / 0.37***	0.25*** / 0.25***
	<b>Intensity rating (<math>\alpha=0.93</math>; <math>\omega=0.93</math>)</b>				
	AC-IC ( $\alpha=0.82$ ; $\omega=0.83$ )	0.53***	0.17*** / 0.18***	0.41*** / 0.41***	0.21*** / 0.21***
	AC-IP ( $\alpha=0.85$ ; $\omega=0.87$ )	0.48***	0.25*** / 0.26***	0.38*** / 0.39***	0.23*** / 0.23***
	AC-CE ( $\alpha=0.87$ ; $\omega=0.87$ )	0.47***	0.28*** / 0.27***	0.35*** / 0.35***	0.23*** / 0.24***
	AC-FI ( $\alpha=0.74$ ; $\omega=0.75$ )	0.40***	0.26*** / 0.27***	0.34*** / 0.35***	0.22*** / 0.22***
Online gambling	<b>Frequency rating (<math>\alpha=0.95</math>; <math>\omega=0.96</math>)</b>				

AC-IC ( $\alpha=0.88$ ; $\omega=0.88$ )	0.53***	0.14** /0.13**	0.01 /-0.001	0.12* /0.12*
AC-IP ( $\alpha=0.91$ ; $\omega=0.91$ )	0.47***	0.14** /0.14**	0.001 /-0.01	0.15** /0.16**
AC-CE ( $\alpha=0.91$ ; $\omega=0.92$ )	0.33***	0.11* /0.10*	0.03 /0.02	0.12* /0.12*
AC-FI ( $\alpha=0.79$ ; $\omega=0.79$ )	0.05	0.27*** /0.27***	0.25*** /0.24***	0.27*** /0.28***
<b>Intensity rating (<math>\alpha=0.95</math>; <math>\omega=0.96</math>)</b>				
AC-IC ( $\alpha=0.87$ ; $\omega=0.88$ )	0.55***	0.15** /0.13**	0.005 /-0.01	0.11* /0.12*
AC-IP ( $\alpha=0.92$ ; $\omega=0.92$ )	0.54***	0.12* /0.12*	-0.01 /-0.02	0.13** /0.13**
AC-CE ( $\alpha=0.82$ ; $\omega=0.84$ )	0.45***	0.12* /0.12*	-0.002 /-0.01	0.13** /0.13**
AC-FI ( $\alpha=0.93$ ; $\omega=0.93$ )	0.20***	0.12* /0.11*	-0.04 /-0.05	0.11* /0.12*

\* $p<0.05$ , \*\* $p<0.01$ , \*\*\* $p<0.001$

**Note.** Follow-up data were collected six months later of baseline data collection.

<sup>a</sup> Standardized coefficients derived from regression models with adjustments of age and gender.

AC-IC	Assessment of Criteria for Specific Internet-use Disorders (impaired control domain score)
AC-IP	Assessment of Criteria for Specific Internet-use Disorders (increased priority given to the online activity domain score)
AC-CE	Assessment of Criteria for Specific Internet-use Disorders (continuation/escalation domain score)
AC-FI	Assessment of Criteria for Specific Internet-use Disorders (functional impairment domain in daily life and marked distress score)
GDT	Gaming Disorder Test
YAS	YouTube Addiction Scale
DASS-21	Depression, Anxiety, Stress Scale-21

**Appendix A.** Mardia's multivariate skewness and kurtosis values

<b>Online activity</b>	<b>Frequency rating</b>		<b>Intensity rating</b>	
	<b>Skewness coefficient (<i>p</i>-value)</b>	<b>Kurtosis coefficient (<i>p</i>-value)</b>	<b>Skewness coefficient (<i>p</i>-value)</b>	<b>Kurtosis coefficient (<i>p</i>-value)</b>
Gaming	31.20(< .001)	255.93(< .001)	34.74(< .001)	290.24(< .001)
Online shopping	33.26(< .001)	273.65(< .001)	38.54(< .001)	297.56(< .001)
Online pornography use	76.84(< .001)	489.37(< .001)	85.65(< .001)	528.72(< .001)
Social media use	17.99(< .001)	196.68(< .001)	22.07(< .001)	216.14(< .001)
Online gambling	279.25(< .001)	1196.69(< .001)	265.04(< .001)	1199.01(< .001)