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Adolescent Internet Use, Academic Performances, and Problem Behaviors: Findings from a national sample of rural and urban China

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ADOLESCENT INTERNET USE, ACADEMIC PERFORMANCES, AND PROBLEM BEHAVIORS: FINDINGS FROM A NATIONAL SAMPLE OF RURAL AND URBAN CHINA

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ADOLESCENT INTERNET USE, ACADEMIC PERFORMANCES, AND PROBLEM BEHAVIORS: A NATIONAL SAMPLE FROM RURAL AND URBAN CHINA

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Adolescent internet use in non-western countries and its association with behavioral problems are understudied. Informed by Bronfenbrenner's socioecological framework and displacement hypothesis, the present study explored adolescent internet use in rural and urban China, and examined the mediation of academic performances between internet use and problem behaviors. Drawn from a nationally representative program, samples for this study included 3,379 adolescents aged between 9-17 years from 29 provinces. Results showed that rural adolescents had less access to mobile phones and internet, as well as a lower frequency of internet use than urban peers. Hybrid structural equation modeling results revealed that academic grade rankings fully mediated the association between internet use and externalizing behaviors. Academic self-rating negatively associated with both internalizing and externalizing behaviors. Stepwise regression results indicated rural adolescents who have internet access were more vulnerable to negative influences of increased internet entertainment time than urban peers. Findings contributed to the understanding of internet use and developmental outcomes of adolescents in rural and urban residency in China. Implications are discussed for practices, policies, and future research.

Table of Contents

List of Multimedia Objects

CHAPTER 1: INTRODUCTION, PURPOSE OF STUDY, AND SIGNIFICANCE

The generalization of internet use around the globe has drastically changed people's daily life. Both opportunities and challenges have been brought to individuals, families, and contemporary society (Sun & McMillan, 2018). The rapid increases in internet and technology use of adolescents across the globe raised concerns regarding the development and well-being of the younger generations (Sarmiento et al., 2020). However, large resource discrepancies in internet access were shown across different countries and regions. According to the American Community Survey (United States Census Bureau, 2019), approximately 95% of children and youths aged from 3-18 years have internet access at home in the United States, while this number for global youths aged from 0-25 years is only 33% (UNICEF, 2020). The disparities in internet and technology use between high-income and low-income, typically non-western countries were significant, yet the within-country data on adolescent internet use between rural and urban areas are still insufficient (UNICEF, 2020).

Previous studies have addressed the associations between adolescents' internet use and their internalizing and externalizing problem behaviors (Holtz & Appel, 2011; Riehm et al., 2019). Research findings suggested that problematic internet and technology use could lead to various negative developmental outcomes, such as depression, anxiety, and delinquency at school (Hessel et al., 2017; Muñoz-Miralles et al., 2016). However, large gaps remained regarding internet use and adolescent developmental outcomes in non-western cultural settings (Odgers & Jensen, 2020). The present study thus aims to explore the current internet use of Chinese adolescents in rural

and urban areas, and investigate the association of adolescent's internet use with academic performances and both internalizing and externalizing problem behaviors.

CHAPTER 2: LITERATURE REVIEW

Adolescent Internet Use

Adolescent internet use in this review is a broad term that refers to various online activities such as using social media, social networking, entertaining, information searching, and instant messaging. Adolescent internet use and its related consequences to individuals and families have received much attention, especially in western cultural settings where the use of technology devices is prevalent in people's daily life. In the report published by American Academy of Child & Adolescent Psychiatry (AACAP, 2020), children and teenagers in the U.S. on average spend 4-9 hours using technologies and watching screens per day. However, fewer studies of adolescent's frequency of internet use had focused on non-western and middle- or low-income sociocultural contexts. Given the disparities and deficiency of research, studies are needed to investigate contextual factors in terms of the effects of adolescent internet use (Anderson et al., 2017). China is noted for having one of the largest adolescent populations in the world, yet data on adolescent internet access and use based on a nationally representative sample are still lacking (Liu, 2011). The gap between rural and urban areas is also significant due to the disparity in economics and uneven distribution of resources (Liu, 2011). Lai and Kwan (2017) examined how socioeconomic factors may contribute to problematic internet use, but rural and urban districts have not been considered due to the unrepresentativeness of the sampling.

There is no clear consensus on general and excessive internet use (Anderson et al., 2017). The terms describing heavy internet use are usually interchangeable among pathological, problematic, and excessive internet use (Strong et al., 2018). Excessive internet use has been defined by its negative consequences, including being dysfunctional in daily life, and impaired overall well-being and interpersonal relationships, while general internet use refers to online activities for different purposes such as for studying, working, entertainment, and communication (Anderson et al., 2017; Strong et al., 2018). While excessive internet use have been widely investigated across the globe (Anderson et al., 2016; Liu et al., 2019), studies examining the impact of general use and the access to the internet in adolescents have been largely overlooked. Researchers have found significant associations between youth's excessive internet use and negative developmental outcomes, such as increased levels of depression, anxiety, school burnout (Anderson et al., 2017; Banjanin et al., 2015; Salmela-Aro et al., 2017), and decreased academic performance (Lepp et al., 2015). However, many earlier studies merely highlighted the negative outcomes of excessive internet use for adolescents rather than the general use of internet. Research investigating non-pathological internet use has received little attention and is much needed, as it will provide practical information about how modern technology and internet influence adolescent development in daily life besides the probabilities of pathological consequences (Kim et al., 2017).

Internet use should be a multi-dimensional rather than single dimensional construct. Previous studies suggest that using multiple aspects provides a better understanding of the internet use instead of adopting a single aspect like internet use frequency (Akar, 2017; Gordon et al., 2007). In addition to frequency, perceived

importance of using the internet is a dimension that has been overlooked in research. Another dimension of internet use is time spent on internet. Furthermore, the time can be categorized according to the purposes of using the internet, such as obtaining information, taking online classes, entertaining, and communicating with others. Therefore, the general internet use do not always associate with negative outcomes (Kim et al., 2017; Park & Kwon, 2018). Considering the lack of multi-dimensional measures in assessing the internet use, it is worth exploring adolescents' internet use by frequency and importance degree of internet use, as well as online time for entertainment. Early internet use was mainly for the purpose of studying. Adolescents' time spent on the internet for non-study purposes reflects the expansion of the internet use over time. Research on Chinese adolescent internet use has seldom adopted a multi-dimensional approach. Therefore, the current study investigates the perceived importance of using the internet, frequency of using the internet, and online playing-time in Chinese adolescents.

Problem Behaviors

Adolescence is a crucial developmental stage that involves significant physical, cognitive, and psychological changes (Branje, 2018). Given the challenges for adolescents to adjust to various changes, the likelihood of experiencing increased levels of internalizing (e.g., depression, anxiety, loneliness) and externalizing (e.g., aggressive behaviors, substance use, risky sexual behavior) problems enlarge rapidly during adolescence (Graber & Sontag, 2009; Kelly et al., 2015; Mastrotheodoros et al., 2020). Previous studies have reported the associations between excessive internet use and both internalizing and externalizing problem behaviors (Fontana et al., 2022; Graber & Sontag, 2009; Holtz & Appel, 2011; Sarmiento et al., 2020). Sarmiento and colleagues

(2020) found that internet use enabled adolescents to remain in constant communication with others, but it also increased the risks of cyberbullying, online sexual harassment, and isolated social networks which could contribute to high internalizing symptoms. Adolescents who have more online-only friends and spend more time playing online games report higher levels of loneliness and decreased motivations to engage in daily activities (Holtz & Appel, 2011; Sarmiento et al., 2020). Moreover, frequent use of social media on the internet is also positively associated with social anxiety, body anxiety, and depression (Fontana et al., 2022).

In addition to internalizing symptoms, internet use is also tied to externalizing symptoms. Violent online gaming has been the focus of the connection between internet use and adolescent externalizing problem behaviors. Holtz and Appel (2011) found that playing first-person shooting games can predict adolescent's aggressive behaviors and delinquency. Coyne and colleagues (2018) documented that adolescent's early exposure to violent video games was associated with lower levels of prosocial behavior and higher levels of externalizing problems. Moreover, adolescents with problematic internet tend to use more substances, report poor psychological well-being, and have lower academic performances (Rücker et al., 2015). Problematic internet use is also tied to aggression dysregulation, which could further account for high levels of aggression (Fontana et al., 2022). Although the connection between internet use and problem behaviors was studied in Western samples, research is rare using non-western sociocultural samples.

Academic Performances

Academic performance has been considered an important indicator to understand various developmental outcomes of adolescents. Excessive internet use has been

demonstrated to be closely correlated with increased problem behaviors. A large number of empirical studies have found a significant negative relationship between individual's internet and technology use and their academic performances across sociocultural contexts (e.g., Blum-Ross & Livingstone, 2016; Felisoni & Godoi, 2018; Ladrón de Guevara Rodríguez et al., 2022; May & Elder, 2018). Through examining and tracking adolescent's actual time spent on the internet and social media, Felisoni and Godoi (2018) found a high negative association between adolescent excessive smartphone use and academic performance (i.e., grade rankings and grade point average). Jackson et al. (2011) also found that online video games are associated with a lower grade point average for adolescents. Chung, Sum, and Chan (2019) investigated Hong Kong adolescents' internet use and found that youth's good academic performance could be one of the protective factors against negative outcomes of internet addiction. However, findings from existing research presented mixed results regarding the relationship between general internet use and adolescent academic performances.

In contrast to the research on poor academic performance resulting from internet use, Kim et al. (2017) suggested that increased internet use does not necessarily correlate with negative academic outcomes as the public previously thought, because technology also brought loads of learning opportunities to adolescents which could promote their wellbeing and knowledge. Previous research has found academic performance positively related to internet use, in particular, the association between academic self-efficacy and digital learning (Mehrvarz et al., 2021; Zhu et al., 2011). Zhu et al. (2011) found that the positive association between internet use for seeking information and students' academic performance is mediated by academic self-efficacy, and adolescents with low academic

self-efficacy could benefit more in academic achievement from using the Internet for seeking information. Moreover, the longitudinal empirical evidence from Li et al. (2020) using CFPS data showed that, even though mostly insignificant, internet use was related to some learning outcomes of adolescents in rural Chinese adolescent samples. Therefore, it would be worth further exploring the relationship between general internet use and academic performance. The current study includes both adolescent academic ranking in the class and academic self-rating as indicators for academic performance. This study also adopts academic performance as a mediator to examine the complex relationship between internet use and adolescents' internalizing and externalizing problem behaviors.

Chinese Context

Adolescent developmental context in rural and urban China is different. People who live in rural areas usually have lower socioeconomic status than the urban population, lack various resources, and have limited opportunities (e.g., educational, medical, and technological) (Liu, 2011). With China's urbanization in recent decades, the living standards of rural China have improved due to enhanced opportunities to open or be employed in businesses. However, the social economic status and educational attainment levels of people in rural areas are still low, compared with people in cities. High-quality educational resources are also disproportionally located within the urban instead of rural areas. Even though the technology devices are more accessible in recent years in China (Liu et al., 2019), the limited development opportunities and regional socioeconomic situation remain concerning. With disparities in information and resources between rural and urban areas, adolescents' development could be different across contexts.

Internalizing and externalizing problems of adolescent are of rising concern in contemporary Chinese society. The modernization and industrialization in China have only accelerated in recent years with multiple political and sociocultural transformations. It has not only brought rapid changes in economic development, but also lead to higher rates of depressive symptoms, anxiety (Cohen et al., 2015), and juvenile delinquency (Weng et al., 2016) for adolescents. The increased rate of emotional distress is also particularly concerning for Chinese rural adolescents (Cohen et al., 2015). Although different symptoms of problem behaviors have been studied by scholars, the influential consequences of internet use in the current information era on adolescents are still insufficient. The distinguishing features of Chinese society, including fast changes and widening gaps in rural and urban areas, thus need to be included to further analyze adolescent development.

Theoretical Framework

The current study integrates socioecological framework and displacement hypothesis. According to Bronfenbrenner's socioecological framework (Bronfenbrenner, 2005; Bronfenbrenner & Morris, 2006), adolescent development needs to be considered within surrounding environments that are embedded in multiple social systems, which include both immediate (e.g., family, school) and indirect contextual (e. g., culture, social norms) settings. Academic performance and commitment are indicators that may reflect the school environment perceived by students favorably or unfavorably. Previous studies have identified academic performance as both protective and risk factors to explain adolescent problem behaviors. Jessor and colleagues (1997) found that positive perception of academic achievement is a protective factor against adolescent problem

behaviors, while low academic performance is found as a risk factor. Low academic achievement and little commitment to school are considered universal risk factors across cultural settings (Arthur et al., 2002; Duncan et al., 2000; Piko et al., 2005).

The displacement hypothesis suggests that technology use affects individuals' well-being by taking away time from engaging themselves in other activities and regular daily functioning (Huang et al. 2022; Kushlev & Leitao, 2020; Twenge et al., 2019; Winstone et al., 2021). The concept of displacement was first brought up by Sigmund Freud to describe the shift of emphasis involved with human behaviors, emotions, and needs (Neubauer, 1994). Displacement has been widely studied in psychology, especially in the field of psychoanalysis. In recent years, many scholars adopt this concept as displacement hypothesis to study internet and social media use (e.g., Huang et al. 2022; Kushlev & Leitao, 2020; Twenge et al., 2019; Winstone et al., 2021). Several studies found that technology use could impact adolescents' academic performances (Tang & Patrick, 2018) and problem behaviors (Houghton et al., 2018; McDaniel & Radesky, 2018; Wong et al., 2020) through replacing the activities such as learning opportunities. Even though many studies examine internet use through displacement hypothesis recently, these studies rarely use non-western samples. Thus, the present study is informed by the ecological perspective and displacement hypothesis to investigate the complex connections among internet use, problem behaviors, and academic performances by rural/urban residency in Chinese adolescents.

Based on the current literature and research gaps, the purposes of the present study are as follows: (1) to explore the current internet use of Chinese adolescents in rural and urban areas; (2) to investigate how internet use is associated with adolescents'

academic performances and internalizing and externalizing problem behaviors; (3) to examine the mediating roles of academic performance between internet use and adolescent's problem behaviors; (4) to examine the moderating role of family residency (i.e., urban versus rural) between internet use and problem behaviors of adolescents.

CHAPTER 3: METHODS

Participants and Procedures

The present study used secondary data from China Family Panel Studies (CFPS data website: https://doi.org/10.18170/DVN/45LCSO), the first large-scale longitudinal research project in China that was sponsored by the Institute of Social Science Survey (ISSS) of Peking University. The CFPS launched its baseline wave surveys in 2010 and continues to collect data every other year, with the target baseline sample covering 25 provinces, autonomous regions, and municipalities which represent 95% of the Chinese population. Due to the COVID-19 pandemic, the release of the newest wave of 2020 data was postponed. The present study thus used the wave in 2018 with 15,051 households completing the family roster questionnaires, and the overall response rate was 69.3%.

The participants for the current study included 3,379 Chinese adolescents (1,482 females and 1,718 males) aged from 9-17 years (M = 13.33, SD = 2.27) come from 29 provinces, autonomous regions, and municipalities in China. Based on the Chinese Census Bureau's definition, 58.6% of participants (n = 1,886) live in rural areas, and 41.4% of participants (n = 1,335) live in urban areas. The access to internet in rural and urban areas of China was examined based on this total sample. Only adolescents aged from 9-15 years (n = 2,478) completed the problem behaviors questionnaires, and 1,007 participants did not respond to the internet use situation due to the inapplicability.

Therefore, the current study included 1,471 adolescents (667 females and 804 males) aged from 10-15 years (M = 12.82, SD = 1.60) to examine their internet use situation (i.e., frequency, importance, and time spent on internet besides studying), and in further steps of correlations, stepwise regression, and hybrid structural equation modeling to explore the association of internet use. Among the selected participants, 52.6% of adolescents (n = 773) live in the rural area, and 47.4% of participants (n = 696) live in the urban area.

Measurement

Access and internet use situation. This study adopted 10 items in CFPS questionnaires that assessed two aspects of internet use: access and internet use situation (i.e., frequency, importance, and time spent on internet besides studying).

Access. Three items measured *access* to internet use, i.e., whether or not adolescents used mobile phones or ever had access to internet use, items including "Do you use mobile phone", "Do you use mobile devices, e.g., mobile phone, tablet PC, to access the Internet", and "Do you use computer to access the Internet". All participants in this study responded to these three items by answering either 1 (yes) or 5 (no).

Internet use. Internet use scale included seven items, of which three items measured the *frequency* of internet use (e.g., "In general, how frequently do you use Internet to study/socializing/entertain"), three items measured the degree of *importance* of internet use (e.g., "How important to you in terms of study/socializing/entertain while using the Internet"), and one item measure the *time spent on internet besides study online* (i.e., "In general, how many hours do you use Internet besides study"). The selected participants responded frequency of using the internet on a seven-point scale from 1

(*everyday*) to 7 (*never*), and responded importance degree of internet use on a five-point scale from 1 (*very unimportant*) to 5 (*very important*). Exploratory factor analysis (EFA) extracted three major indicators and confirmatory factor analysis (CFA) results (see Table 3.1) supported the internet use as a three-indicator latent variable including internet use frequency, perceived importance, and time spent for non-study on internet. The model was identified as a saturated model due to zero degrees of freedom, therefore, no goodness-of-fit index could be provided for the current model.

Table 3.1
Factor Loading Estimates of Confirmatory Factor Analysis Model

Indicators	Unstandardized Factor Loading Estimates	Standardized Factor Loading Estimates
Frequency of internet use	1.00	.45
Importance degree of internet use	.64	.44
Time spent on internet besides study	8.53	.46

Academic performances. Adolescents' academic performances were measured by four items. Participants reported their rankings both in class (i.e., "What was your rank in your class in the most recent examination, mid-term or final") and in grade (i.e., "What was your rank in your grade in the most recent examination, mid-term or final") with responses from 1 (*Top 10%*) to 5 (*Bottom 24%*). They responded to academic self-rating (i.e., "How would you rate your academic performance", "How good a student do you think you are") on a five-point Likert scale from 1 (*extremely unsatisfied/very bad*) to 5 (*extremely satisfied/excellent*).

Problem behaviors. Internalizing and externalizing problem behaviors were adopted to measure adolescents' behavioral problems. It includes 14 items in total, with 8

items measuring internalizing problems (e.g., “I feel angry when I have trouble learning”) and 6 items measuring externalizing problems (e.g., “I often argue with other kids”). Participants responded their behavioral problems on a five-point Likert scale from 1 (*Strongly disagree*) to 5 (*Strongly agree*). The problem behaviors scale showed a good reliability ($\alpha = .79$) in the present study.

CHAPTER 4: RESULTS

The descriptive statistics, independent samples T-test, correlation analysis, and stepwise linear regression were conducted using SPSS version 28. CFA and hybrid structural equation modeling were conducted using the Mplus version 8 (Muthén & Muthén, 1998-2017). The stepwise linear regression was performed where the residency was treated as a moderator of the relation between internet use and problem behaviors, and age and gender were treated as covariates. The assumptions of stepwise linear regression (i.e., normality, linearity, independence of errors, and homoscedasticity) were all met. For the regression analysis, age and gender were entered in the first block, and only time spent on the internet and rural/urban residency were entered in the second block due to the correlation’s significance. The dependent variable was externalizing problem behaviors. CFA was performed before adding three indicators of internet use into the model. Hybrid structural equation modeling with the maximum likelihood estimator was adopted to test the mediating roles of academic performances between adolescents’ internet use and behavioral problems. The significance of the mediating effect of academic performances was tested using the Bootstrap estimation procedure with 5,000 bootstrap samples (Preacher & Kelley, 2011).

Access and internet use of Chinese adolescents. This study explored the current internet use of Chinese adolescents in rural and urban areas. The descriptive results for all participants showed that 61.7% of adolescents (n = 1,972) reported access to internet via mobile devices, followed by 57.1% using mobile phone (n = 1,846) and 30.05% using internet via computer (n = 961). The independent samples T-test results showed that rural adolescents have less access to mobile phone and internet than urban peers, on three items including whether use mobile phone, $t(2874.20) = -4.34$, $p < 0.001$; whether use internet on mobile devices, $t(2930.30) = -6.49$, $p < 0.001$; and whether use internet on computer, $t(2567.68) = -9.63$, $p < 0.001$. Results also showed rural adolescents (M = 4.98, SD = 1.27) use internet less frequently than urban counterparts (M = 5.17, SD = 1.25), $t(1467) = -2.94$, $p < 0.01$. No significant difference was found in perceived internet use importance and time spent on internet for entertainment between rural and urban adolescents.

Internet use, academic performances, and problem behaviors. This study investigated how internet use, specifically, internet use frequency, perceived internet use importance, and time spent on internet entertainment are associated with adolescent's academic performances and internalizing and externalizing problem behaviors. Based on the correlations analysis results (shown in Table 4.1), the negative association was found between importance of internet use and adolescents' grade ranks, yet a significant positive correlation was found between importance of internet use and academic self-rating. The time spent on internet besides study was negatively associated with both grade ranking and academic self-rating and also was positively associated with adolescent externalizing problems. Both adolescents' grade ranks and academic self-

rating were negatively correlated with their internalizing and externalizing problem behaviors, respectively. No significant correlations were found between internet use frequency and adolescent academic performance plus problem behaviors, nor between importance of internet use and problem behaviors.

Table 4.1

Bivariate Correlations of Internet Use, Academic Performances, and Problem Behaviors

Variables	1	2	3	4	5	6	7
1. Frequency of internet use	-						
2. Importance degree of internet use	.20***	-					
3. Time spent on internet besides study online	.21***	.20***	-				
4. Rankings	.02	-.07*	-.09**	-			
5. Academic self-rating	.03	.11***	-.06*	.39***	-		
6. Internalizing problem behaviors	.00	.05	-.02	-.10***	-.18***	-	
7. Externalizing problem behaviors	-.04	.02	.09***	-.22***	-.25***	.51***	-

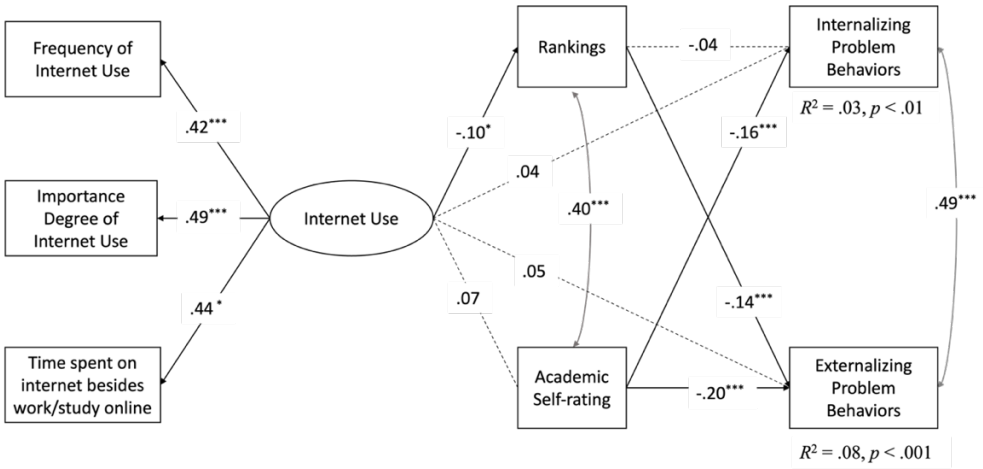
Note. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

The current study examined the mediating roles of ranking standing in the class of the year and academic self-rating between internet use and adolescent's problem behaviors. The hybrid structural equation modeling results (see Figure 1) showed that adolescent academic performance mediates the association between internet use and externalizing problem behaviors. The model fitted the data well with $\chi^2(8) = 62.42$, $p < .001$. CFI = 0.945, TLI = 0.855, RMSEA = .068, and SRMR = .029. In the measurement model, the internet use importance rated by adolescents contributes the most to the latent variable, internet use ($\beta = .49$, $p < .001$), followed by time spent on

internet besides online study (β = .44, p < .05) and frequency of internet use (β = .42, p < .001). The test of the path model shows that academic ranking fully mediates the association between internet use (β = -.10, p < .05) and externalizing problems (β = -.14, p < .001), but not internalizing problems, indicating good grades serve as a buffer for aggression or other behavioral problems but not for depressive or anxious symptoms. The indirect effect of internet use to externalizing problems through academic rankings is significant as indirect effect = .01, p = .05, 95% CI [0.00, 0.03]. No mediating effects of academic self-rating were found between internet use and both problem behaviors, indicating only good grades at school is a protective factor of internet use while subjective self-rating is not. However, academic self-rating was significantly and negatively associated with internalizing (β = -.16, p < .001) and externalizing problem behaviors (β = -.20, p < .001), suggesting the better adolescents felt about their school performance, the fewer behavioral problems they experienced emotionally and behaviorally.

Figure 4.1

Hybrid Structural Equation Modeling of Internet Use, Academic Performance, and Problem Behaviors



Note. All structural coefficients are standardized. Dashed lines represent non-significant path coefficients. N = 1,471. $^{*}p < .05$. $^{***}p < .001$.

Moderating effect of rural and urban residency. This study examined the moderating role of family residency of rural and urban areas between internet use and problem behaviors of adolescents. Based on the correlations analysis results (shown in Table 4.1), there is one significant relation between internet use and adolescent problem behaviors. Therefore, the stepwise linear regression is only performed using time spent on internet as predictor and externalizing problem behavior as outcome with age and gender as covariates (see Table 4.2). Stepwise regression results revealed that time spent on internet besides study predicted the adolescent externalizing behavior. The main effect of rural/urban residency is not significant (β = -.04, p = .28) in predicting externalizing behavior after adding the interaction term of residency and time spent. The interaction term between time spent on internet and rural/urban residency in predicting adolescent externalizing behavior was significant (β = -.08, $p < .05$). The relationship between time spent on internet besides study and externalizing problem behavior depends on rural and urban residency. The interaction analysis (see Figure 4.2) showed that rural adolescents had more externalizing problems than urban peers when spending more time on internet besides study while urban adolescents' externalizing problems remained unchanged with spending time on internet besides study.

Table 4.2

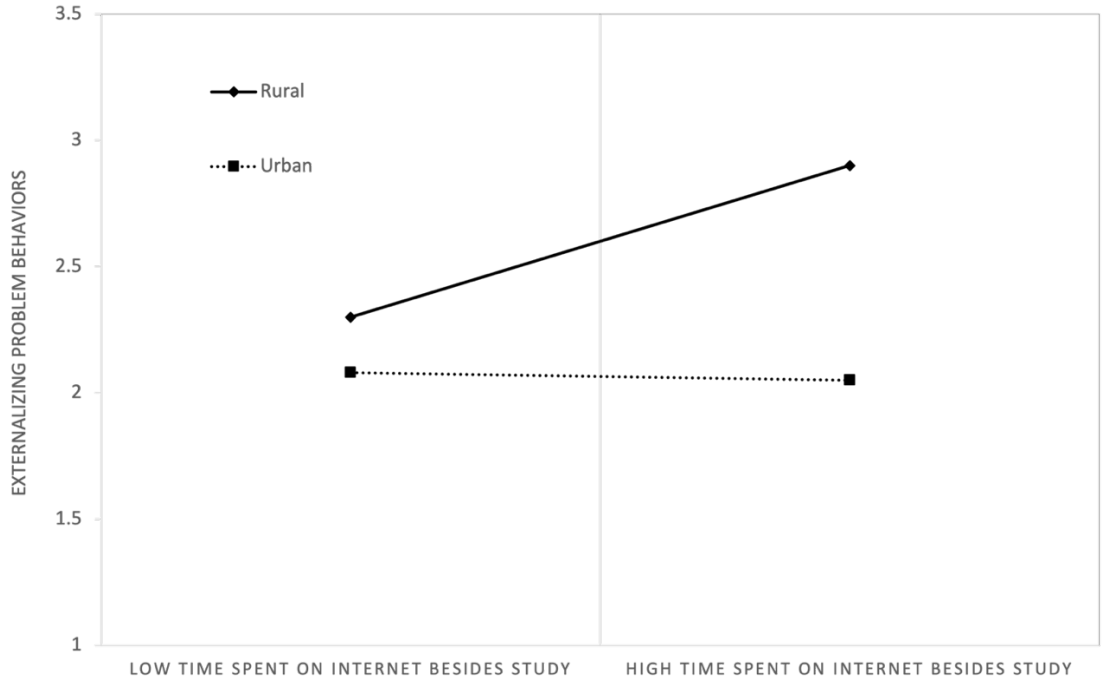
Stepwise Regression of Externalizing Problem Behaviors on Age, Gender, Time Spent on Internet besides Study, and Rural/urban Residency

Dependent Variable	Predictive Variables	B	β	R^2 Change
Externalizing Problem Behaviors	Step 1			$.02^{***}$
	Age	-	.03	
	Gender	$-.04^{***}$	-.14	
	Step 2			$.01^{**}$
	Time spent on internet besides study	$.01^{***}$	.13	
	Rural/urban residency	-	-.04	
	Time spent on internet besides study × Rural/urban residency	$-.01^{*}$	-.08	
	Adjusted R^2 total			$.03^{*}$

Note. The unstandardized coefficients of age and rural/urban residency were nonsignificant and were excluded from the model by SPSS. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Figure 4.2

Interaction of Rural/urban Residency by Time Spent on Internet besides Study on Externalizing Problem Behaviors



CHAPTER 5: CONCLUSIONS

The popularity of internet use brings numerous opportunities to the modern technology era, meanwhile, it also broadens the existing discrepancies in internet access across different countries and regions. By far, adolescent internet use in non-western countries and its association with developmental outcomes have received less attention. The present study thus investigated adolescent internet use in rural and urban China and examined the mediating roles of academic performances between internet use and problem behaviors using a nationally representative sample. The findings of this study provided general information regarding the Chinese adolescent's internet access and use situation and demonstrated the significant differences in internet access between rural and urban adolescents. Bivariate correlation results showed multiple significant associations among variables. The stepwise regression results confirmed the moderation effect of rural/urban residency of family context on relation between time spent on internet for entertainment and externalizing behaviors. The hybrid structural equation modeling results supported the mediating role of adolescent academic performance between internet use and externalizing problem behaviors, and further confirm the negative associations between adolescent academic performances and both internalizing and externalizing problem behaviors.

This study first explored the current internet use situation of Chinese adolescents in rural and urban areas. The results helped to further confirm the growing gaps in internet and technology access between western and non-western countries, and between rural and urban areas out of the uneven distribution of resources and economics (Lai & Kwan, 2017; Liu, 2011; UNICEF, 2020). Nearly two-thirds of participants reported they

had access to the internet via mobile devices, followed by slightly over half using mobile phones, and then only less than one-third had access to internet via computer. Even though the data was above the global average rate (33%) according to the UNICEF (2020) report, internet access is less prevalent for Chinese adolescent when compared with the high internet access rate in the United States and other high-income countries (United States Census Bureau, 2019). Discrepancies of internet access and technological resources in other non-western countries could also exist and need to be paid with more attention.

The results also provided evidence about the differences in internet access between rural and urban adolescents in China. According to China Internet Network Information Center (CNNIC, 2021), 74.6% of the urban population are internet users in 2018, while for the rural population in China this number is only 38.4%. Aligning with earlier findings and reports, the present study found adolescents living in rural areas of China are found to have significantly less access to mobile devices, internet, and computer compared with their urban peers (Liu, 2011). In addition, rural adolescents use internet less frequently than their urban counterparts, which also indicates the lack of technological resources in rural areas. There is no significant difference in internet use importance between rural and urban adolescents for the present study. It could indicate the widespread agreement on the importance of internet and technology use in contemporary society, which is also in line with previous research (Li et al., 2020; Liu, 2011; May & Elder, 2018). There is no significant difference in non-study time spent on internet between rural and urban participants. Even though rural adolescents have less access to internet and mobile devices than urban peers, among those who have internet

access and use it, it appears that they spent similar time on internet for entertainment purposes regardless of their family residency in rural or urban areas.

This study further investigated the mediating effect of academic performances on the associations between internet use and problem behavior. The current study found a negative association between adolescent internet use and academic rankings. It appeared that Chinese adolescents with the increased level of internet use spent less time studying, and thus lost learning opportunities, which further led to low grades. This result is in accordance with previous research, which stated that adolescents who spent more time on internet for entertainment purposes tend to have poor academic performance and academic self-efficacy (Blum-Ross & Livingstone, 2016; May & Elder, 2018). Academic grade rankings were found to be negatively associated with adolescent externalizing problem behaviors. Adolescents with high-grade rankings show fewer externalizing symptoms, and adolescents with low rankings have more risks of being engaged in aggressive and risky behaviors (Salmela-Aro et al., 2017). It is interesting that this study observed that grade rankings fully mediated the relationship between internet use and externalizing problem behaviors. This indicates that the good grade may serve as a buffer for adolescent externalizing behaviors but not for internalizing problems in this Chinese sample. The protective role of adolescents' academic performance on the negative effects of internet use on development has been reported in different studies (Mehrvarz et al., 2021; Zhu et al., 2011). The finding support the claim of the displacement hypothesis that increased internet use could contribute to adolescents' externalizing problems through decreased learning opportunities and poor academic performances (Houghton et al., 2018; McDaniel & Radesky, 2018; Tang & Patrick, 2018; Wong et al, 2020).

The good academic grade only buffered the effects of externalizing problems rather than internalizing problems. One possible explanation is that internalizing problems mainly are individuals' implicit psychological suffering. Some Chinese adolescents who are depressed or anxious may try hard to suppress their pains and to feel normal by maintaining their grades. Some other Chinese adolescents who are depressed and stressed trying to cope with emotional issues by spending time on online gaming and entertainment (Lu et al., 2021), which hurts their school performance. Another possibility is that when Chinese adolescents are not feeling well, they feel angry rather than sad. Being aggressive may be a sign of depression as well as a way of coping (Lu et al., 2021). This may also explain why there is a significant correlation only between internalizing problems and academic self-rating instead of grade ranking. Academic self-rating is about the perceived academic performance that stemmed from inner perceptions and self-concepts. Even though no mediating effects of academic self-rating were found in this study, the importance of self-perceived academic performance is significant. Compared with actual academic rankings, self-rated academic performance could be more helpful to cultivate in addressing the internalizing symptoms of adolescents. The findings support the negative associations between adolescent academic self-rating and both internalizing and externalizing problem behaviors. It demonstrates adolescents with high academic self-rating in the school context could contribute to low levels of internalizing and externalizing problem behaviors (Rashid & Asghar, 2016; Zhu et al., 2011).

There is also no significant association found between adolescent internet use and academic self-rating, yet the relation in the model is positive between internet use and

academic self-rating. A previous study conducted by Rashid and Asghar (2016) found that technology use has a positive effect on youth's self-directed learning and academic engagement. It suggests that future studies could differentiate and compare adolescent academic actual performance and their self-rating of academic performance. Moreover, three indicators constitute the latent variable of the overall internet use situation for the present study. The comparisons among the coefficients of three indicators revealed that importance degree of internet use is the most important indicator, compared with time spent on internet besides online study and frequency of internet use. It suggests the detailed classification of internet time spent and researching perceptions of internet use for future studies (Anderson et al., 2017; Kim et al., 2017). Future studies with classified internet and technology use may better clarify the paths and effects of internet use perceptions and actual use on adolescent developmental outcomes.

Lastly, the study examined the moderating role of family residency in rural and urban areas on the relation between adolescent internet use and problem behaviors. Given that there was only a significant relationship between internet use and externalizing behaviors, the stepwise linear regression was only performed on the correlation between time spent on internet and externalizing problem behavior with age and gender as covariates. When spending a high amount of time on the internet for entertainment purposes, rural adolescents show significantly more externalizing problems compared with their urban peers. The lack of resources and low socioeconomic status prevent rural adolescents from learning more skills on coping with stress and emotional pain as well as properly managing technology and internet use. Because of this lack of resources in

villages, rural adolescents are more vulnerable to the daily functioning displacement of increased internet use.

The absence of significant associations and effects of other relations between internet use and problem behaviors could also be due to insufficient internet access and technology resources in rural areas (Anderson et al., 2017; CNNIC, 2021; Liu, 2011). Impacted by the current information and technology era, the resource gaps between rural and urban areas are not only reflected in the different access, but also could be on the developmental outcomes resulting from multiple layers of sociocultural contexts in the long run. In addition to helping decrease the access discrepancies between rural and urban areas, practitioners and policymakers also need to address how to equip rural adolescents with the necessary skills and knowledge to adapt to this information era when they have more access to the technology and internet, and to copy positively with stresses resulted from developmental changes and social contextual barriers.

Limitations

Several limitations of the current study require further scrutinization. First, the CFPS program adopted self-report questionnaires to measure adolescent's internet use and their developmental outcomes. Since there might be discrepancies between their self-perceptions and the real time spent on the internet, it might be helpful to provide more accurate data if future programs or studies could adopt multiple sources of data collection. Second, family socioeconomic status (SES) is one of the possible important factors related to the resources of the internet and technologies, however, the measures of SES of rural and urban families were not included in the current study, and thus were not controlled in the analysis when comparing rural and urban adolescent internet use. Third,

even though the CFPS is a longitudinal data program with multiple waves of data collection, the present study limits the scope of the cross-sectional study. The casual effects thus could not be drawn based on the current topic. Future steps could be made regarding the longitudinal data and further explore how Chinese adolescent internet use may contribute to various developmental outcomes across the years. Moreover, even though this study examined the rural and urban differences in adolescents' internet access and use, their impacts on adolescents' developmental outcomes (i.e., both academic performances and problem behaviors) by rural and urban residency were not examined. The next step of this study could focus on examining the mediating roles of academic performances between internet use and problem behaviors by rural and urban residency. In addition, the displacement hypothesis has its limits in providing explanations for individuals' internet use and their problem behaviors. While it could be the case for adolescents that spending a long time on the internet takes away their studying time, the reasons and mechanisms behind their academic performances and internalizing and externalizing problem behaviors could be diverse and complicated. Internet and technology use could also impact adolescent development and their families through other pathways, and there could be more influential factors under school and family contexts that can contribute to adolescent academic performances and problem behaviors. Finally, the CFPS program used larger-scale questionnaires for the distribution and targeting of the different age groups. Therefore, several items in internet use questionnaires were not included in this study's analysis due to their workplace and commercial activity-related topics, which are irrelevant to the adolescent age group. It

ended up with fewer items compared with the original questionnaires. Increased numbers of items in the questionnaires for the measurement would be beneficial for future studies.

Implications

The present study contributes evidence-based implications to future research, practice, and policies. The findings confirmed the significance of family and school contextual factors in the investigation of adolescent internet use and problematic internet use (Anderson et al., 2017). Due to the uneven distribution of resources and access among different regions and countries, this study advocates researchers who study the impacts of technology on adolescents to be more sociocultural-context sensitive. Given adolescents may access the internet for different purposes, their frequency and overall time of using the internet do not necessarily and solely relate to online activities for entertainment. Therefore, the study suggests taking adolescents' perceptions of online activities and the importance degree of using the internet into consideration when conducting technology-related research. The findings added to the literature with further evidence of the mediating roles of Chinese adolescents' academic performance in general, and uniquely for the effects of internet use on problem behaviors. It also supports the protective function of improving school grades in the previous literature (Riehm et al., 2019; Wong et al., 2020). It further supports the displacement hypothesis that internet use for entertainment purposes could contribute to adolescents' externalizing problems across sociocultural contexts (McDaniel & Radesky, 2018; Wong et al., 2020). Future studies may focus on the parental roles in adolescents' internet use and developmental outcomes to understand nuances of cultural differences in non-western sociocultural contexts.

The lacks and insufficiencies of internet access and technological resources in non-western middle- or low-income countries also need to be reinforced by global policymakers and practitioners. The uneven distribution of internet access between rural and urban districts needs to be addressed as well, as the absence of the internet could prevent adolescents from having various opportunities to obtain information for skill-learning purposes (Li et al., 2020; UNICEF, 2020). Future efforts are required to understand the problem behaviors tied to internet use. Specifically, educators and parents need to be cautious about mentoring or controlling the use of their children and adolescents. This study also suggests educators and parents pay more attention to adolescents' self-concept regarding their academic performance. Afterschool programs keep supporting students in improving grades as a key component of curricula besides life and socioemotional skills training. Having policies that invest in equitable access to internet use is also critical. It is important for practitioners and policy-makers that are working on adolescent's internet addiction prevention or intervention programs to be more aware of the negative developmental outcomes. Finding the balance between how to make sure increasing internet access while preventing adolescents from internet addiction around the globe would be beneficial for the future younger generations.

The current study described up-to-date Chinese adolescents' internet use and added new knowledge about its association with behavioral problems using a nationally representative sample. Results indicated significantly inequitable and insufficient access to mobile phones and internet for rural adolescents who used the internet less frequently than urban peers. Results also found rural adolescents who have internet access are more vulnerable to negative influences of increased internet entertainment time than urban

peers. The present study contributes to the understanding of the associations between internet use and developmental outcomes of understudied adolescents from families living in rural and urban areas. The next step will focus on the parental influences on adolescents' internet use and their developmental outcomes in non-western sociocultural context, especially to explore how parental internet use could impact adolescents' internet use, and how parental monitoring of internet use could affect family dynamics. Future research that uses longitudinal data to investigate the relations between internet use and adolescents' developmental outcomes would largely contribute to the field of technology and families.

References

Akar, F. (2017). Purposes and characteristics of internet use of adolescents. *Journal of Education and Instruction*, *7*(2), 257. https://doi.org/10.14527/pegegog.2017.010

American Academy of Child & Adolescent Psychiatry. (2020). *Screen Time and Children.* American Academy of Child & Adolescent Psychiatry. https://www.aacap.org/AACAP/Families_and_Youth/Facts_for_Families/FFF-Guide/Children-And-Watching-TV-054.aspx

Anderson, E. L., Steen, E., & Stavropoulos, V. (2017). Internet use and problematic internet use: A systematic review of longitudinal research trends in adolescence and emergent adulthood. *International Journal of adolescence and youth*, *22*(4), 430-454. https://doi.org/10.1080/02673843.2016.1227716

Arthur, M. W., Hawkins, J. D., Pollard, J. A., Catalano, R. F., & Baglioni Jr, A. J. (2002). Measuring risk and protective factors for use, delinquency, and other adolescent problem behaviors: The communities that care youth survey. *Evaluation review*, *26*(6), 575-601. https://doi.org/10.1177/0193841X0202600601

Banjanin, N., Banjanin, N., Dimitrijevic, I., & Pantic, I. (2015). Relationship between internet use and depression: Focus on physiological mood oscillations, social networking and online addictive behavior. *Computers in Human Behavior*, 43, 308-312. https://doi.org/10.1016/j.chb.2014.11.013

Blum-Ross, A., & Livingstone, S. (2016). *Families and screen time: Current advice and emerging research.* Media Policy Brief 17. London: Media Policy Project, London School of Economics and Political Science.

http://eprints.lse.ac.uk/66927/1/Policy%20Brief%2017-%20Families%20%20Screen%20Time.pdf

Branje, S. (2018). Development of parent-adolescent relationships: Conflict interactions as a mechanism of change. *Child Development Perspectives*, *12*(3), 171–176. https://doi.org/10.1111/cdep.12278

Bronfenbrenner, U. (2005). *Making human beings human: Bioecological perspectives on human development.* Thousand Oaks, CA: Sage Publications (pp. ix-59)

Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. In R. M. Lerner & W. Damon (Eds.), *Handbook of child psychology: Theoretical models of human development* (pp. 793–828). John Wiley & Sons Inc.

China Internet Network Information Center. (2021). *The 47th Statistical Report on China's Internet Development (February, 2021).* China Internet Network Information Center. https://www.cnnic.com.cn/IDR/ReportDownloads/202104/P020210420557302172744.pdf

Chung, T. W., Sum, S. M., & Chan, M. W. (2019). Adolescent internet addiction in Hong Kong: Prevalence, psychosocial correlates, and prevention. *Journal of Adolescent Health*, *64*(6), S34-S43. https://doi.org/10.1016/j.jadohealth.2018.12.016

Cohen, J. R., Sheshko, D. M., Ames, A. M., Young, J. F., Hansford, A. P., Zhu, X., ... & Abela, J. R. (2015). Self-perceived competence in mainland China: A multiwave longitudinal examination of internalizing symptoms in Chinese

adolescents. *Journal of research on adolescence*, *25*(3), 564-579. https://doi.org/10.1111/jora.12146

Coyne, S. M., Warburton, W. A., Essig, L. W., & Stockdale, L. A. (2018). Violent video games, externalizing behavior, and prosocial behavior: A five-year longitudinal study during adolescence. *Developmental Psychology, 54*(10), 1868–1880. https://doi.org/10.1037/dev0000574

Duncan, S. C., Duncan, T. E., & Strycker, L. A. (2000). Risk and protective factors influencing adolescent problem behavior: A multivariate latent growth curve analysis. *Annals of Behavioral Medicine*, *22*(2), 103-109. https://doi.org/10.1007/BF02895772

Felisoni, D. D., & Godoi, A. S. (2018). Cell phone usage and academic performance: An experiment. *Computers & Education*, *117*, 175-187. https://doi.org/10.1016/j.compedu.2017.10.006

Fontana, A., Benzi, I. M. A., & Cipresso, P. (2022). Problematic internet use as a moderator between personality dimensions and internalizing and externalizing symptoms in adolescence. *Current psychology,* 1-10. https://doi.org/10.1007/s12144-021-02409-9

Gordon, C. F., Juang, L. P., & Syed, M. (2007). Internet use and well-being among college students: Beyond frequency of use. *Journal of College Student Development*, *48*(6), 674-688. https://doi.org/10.1353/csd.2007.0065

Graber, J. A., & Sontag, L. M. (2009). Internalizing problems during adolescence. In R. M. Lerner & L. Steinberg (Eds.), *Handbook of adolescent psychology: Individual*

bases of adolescent development (pp. 642–682). John Wiley & Sons Inc. https://doi.org/10.1002/9780470479193.adlpsy001020

Hessel, H., He, Y., & Dworkin, J. (2017). Paternal monitoring: The relationship between online and in-person solicitation and youth outcomes. *Journal of Youth and Adolescence*, *46*(2), 288-299. https://doi.org/10.1007/s10964-016-0490-6

Holtz, P., & Appel, M. (2011). Internet use and video gaming predict problem behavior in early adolescence. *Journal of Adolescence*, 34(1), 49-58. https://doi.org/10.1016/j.adolescence.2010.02.004

Houghton, S., Lawrence, D., Hunter, S. C., Rosenberg, M., Zadow, C., Wood, L., & Shilton, T. (2018). Reciprocal relationships between trajectories of depressive symptoms and screen media use during adolescence. *Journal of youth and adolescence*, *47*(11), 2453-2467. https://doi.org/10.1007/s10964-018-0901-y

Huang, S., Lai, X., Zhao, X., Dai, X., Yao, Y., Zhang, C., & Wang, Y. (2022). Beyond screen time: Exploring the associations between types of smartphone use content and adolescents' social relationships. *International Journal of Environmental Research and Public Health*, *19*(15), 8940. https://doi.org/10.3390/ijerph19158940

Institute of Social Science Survey. (2018). *China Family Panel Studies (CFPS).* Peking University Open Research Data Platform, V41, Peking University, 2010. [Data set]. https://doi.org/10.18170/DVN/45LCSO

Jackson, L. A., Von Eye, A., Witt, E. A., Zhao, Y., & Fitzgerald, H. E. (2011). A longitudinal study of the effects of Internet use and videogame playing on academic performance and the roles of gender, race and income in these

relationships. *Computers in Human Behavior*, *27*(1), 228-239. https://doi.org/10.1016/j.chb.2010.08.001

Jessor, R., Van Den Bos, J., Vanderryn, J., Costa, F. M., & Turbin, M. S. (1997). Protective factors in adolescent problem behavior: Moderator effects and developmental change. In G. A. Marlatt & G. R. VandenBos (Eds.), *Addictive behaviors: Readings on etiology, prevention, and treatment* (pp. 239–264). https://doi.org/10.1037/10248-008

Kelly, E. V., Newton, N. C., Stapinski, L. A., Slade, T., Barrett, E. L., Conrod, P. J., & Teesson, M. (2015). Suicidality, internalizing problems and externalizing problems among adolescent bullies, victims and bully-victims. *Preventive Medicine*, 73, 100-105. https://doi.org/10.1016/j.ypmed.2015.01.020

Kim, S. Y., Kim, M. S., Park, B., Kim, J. H., & Choi, H. G. (2017). The associations between internet use time and school performance among Korean adolescents differ according to the purpose of internet use. *PloS one*, 12(4), e0174878. https://doi.org/10.1371/journal.pone.0174878

Kushlev, K., & Leitao, M. R. (2020). The effects of smartphones on well-being: Theoretical integration and research agenda. *Current opinion in psychology*, *36*, 77-82. https://doi.org/10.1016/j.copsyc.2020.05.001

Ladrón de Guevara Rodríguez, M., Lopez-Agudo, L. A., Prieto-Latorre, C., & Marcenaro-Gutierrez, O. D. (2022). Internet use and academic performance: An interval approach. *Education and Information Technologies*, 1-43. https://doi.org/10.1007/s10639-022-11095-4

Lai, F. T., & Kwan, J. L. (2017). Socioeconomic influence on adolescent problematic Internet use through school-related psychosocial factors and pattern of Internet use. *Computers in Human Behavior*, *68*, 121-136. https://doi.org/10.1016/j.chb.2016.11.021

Lepp, A., Barkley, J. E., & Karpinski, A. C. (2015). The relationship between cell phone use and academic performance in a sample of U.S. college students. *SAGE Open*. https://doi.org/10.1177/2158244015573169

Li, L., Zeng, Y., Zhang, Z., & Fu, C. (2020). The impact of internet use on health outcomes of rural adults: evidence from China. *International Journal of Environmental Research and Public Health*, *17*(18), 6502. https://doi.org/10.3390/ijerph17186502

Liu, F. (2011). The internet with Chinese characteristics. In *Urban youth in China: Modernity, the Internet and the self* (pp. 45-66). Routledge. https://doi.org/10.4324/9780203833049

Liu, Q., Lin, Y., Zhou, Z., & Zhang, W. (2019). Perceived parent–adolescent communication and pathological Internet use among Chinese adolescents: A moderated mediation model. *Journal of Child and Family Studies*, *28*(6), 1571-1580. https://doi.org/10.1007/s10826-019-01376-x

Lu, G. L., Ding, Y. M., Zhang, Y. M., Huang, H. T., Liang, Y. P., & Chen, C. R. (2021). The correlation between mobile phone addiction and coping style among Chinese adolescents: A meta-analysis. *Child and adolescent psychiatry and mental health*, *15*(1), 1-11. https://doi.org/10.1186/s13034-021-00413-2

Mastrotheodoros, S., Canário, C., Cristina Gugliandolo, M., Merkas, M., & Keijsers, L. (2020). Family functioning and adolescent internalizing and externalizing problems: Disentangling between-, and within-family associations. *Journal of youth and adolescence*, *49*(4), 804-817. https://doi.org/10.1007/s10964-019-01094-z

May, K. E., & Elder, A. D. (2018). Efficient, helpful, or distracting? A literature review of media multitasking in relation to academic performance. *International Journal of Educational Technology in Higher Education*, *15*(1), 1-17. https://doi.org/10.1186/s41239-018-0096-z

McDaniel, B. T., & Radesky, J. S. (2018). Technoference: Parent distraction with technology and associations with child behavior problems. *Child development*, 89(1), 100-109. https://doi.org/10.1111/cdev.12822

Mehrvarz, M., Heidari, E., Farrokhnia, M., & Noroozi, O. (2021). The mediating role of digital informal learning in the relationship between students' digital competence and their academic performance. *Computers & Education*, *167*, 104184. https://doi.org/10.1016/j.compedu.2021.104184

Muthén, L. K., & Muthén, B. O. (1998-2017). *Mplus User's Guide*. Eighth Edition. Los Angeles, CA: Muthén & Muthén.

Muñoz-Miralles, R., Ortega-González, R., López-Morón, M. R., Batalla-Martínez, C., Manresa, J. M., Montellà-Jordana, N., ... & Torán-Monserrat, P. (2016). The problematic use of Information and Communication Technologies (ICT) in adolescents by the cross sectional JOITIC study. *BMC pediatrics*, *16*(1), 1-11. https://doi.org/10.1186/s12887-016-0674-y

Neubauer, P. B. (1994). The role of displacement in psychoanalysis. *The Psychoanalytic Study of the Child*, *49*(1), 107-119. https://doi.org/10.1080/00797308.1994.11823054

Odgers, C. L., & Jensen, M. R. (2020). Annual research review: Adolescent mental health in the digital age: Facts, fears, and future directions. *Journal of Child Psychology and Psychiatry*, 61(3), 336-348. https://doi.org/10.1111/jcpp.13190

Park, E., & Kwon, M. (2018). Health-related internet use by children and adolescents: Systematic review. *Journal of medical Internet research*, *20*(4), e7731. https://doi.org/10.2196/jmir.7731

Piko, B. F., Fitzpatrick, K. M., & Wright, D. R. (2005). A risk and protective factors framework for understanding youth's externalizing problem behavior in two different cultural settings. *European child & adolescent psychiatry*, *14*(2), 95-103. https://doi.org/10.1007/s00787-005-0437-z

Preacher, K. J., & Kelley, K. (2011). Effect size measures for mediation models: quantitative strategies for communicating indirect effects. *Psychological methods*, *16*(2), 93. https://doi.org/10.1037/a0022658

Rashid, T., & Asghar, H. M. (2016). Technology use, self-directed learning, student engagement and academic performance: Examining the interrelations. *Computers in Human Behavior*, *63*, 604-612. https://doi.org/10.1016/j.chb.2016.05.084

Riehm, K. E., Feder, K. A., Tormohlen, K. N., Crum, R. M., Young, A. S., Green, K. M., ... & Mojtabai, R. (2019). Associations between time spent using social media and internalizing and externalizing problems among US youth. *JAMA psychiatry*, 76(12), 1266-1273. https://doi.org/10.1001/jamapsychiatry.2019.2325

Rücker, J., Akre, C., Berchtold, A., & Suris, J. C. (2015). Problematic Internet use is associated with substance use in young adolescents. *Acta paediatrica*, 104(5), 504-507. https://doi.org/10.1111/apa.12971

Salmela-Aro, K., Upadyaya, K., Hakkarainen, K., Lonka, K., & Alho, K. (2017). The dark side of internet use: Two longitudinal studies of excessive internet use, depressive symptoms, school burnout and engagement among Finnish early and late adolescents. *Journal of Youth and Adolescence*, *46*(2), 343-357. https://doi.org/10.1007/s10964-016-0494-2

Sarmiento, I. G., Olson, C., Yeo, G., Chen, Y. A., Toma, C. L., Brown, B. B., ... & Mares, M. L. (2020). How does social media use relate to adolescents' internalizing symptoms? Conclusions from a systematic narrative review. *Adolescent Research Review*, *5*(4), 381-404. https://doi.org/10.1007/s40894-018-0095-2

Strong, C., Lee, C. T., Chao, L. H., Lin, C. Y., & Tsai, M. C. (2018). Adolescent Internet use, social integration, and depressive symptoms: Analysis from a longitudinal cohort survey. *Journal of Developmental & Behavioral Pediatrics*, *39*(4), 318-324. https://doi.org/10.1097/DBP.0000000000000553

Sun, X., & McMillan, C. (2018). Interplay between families and technology: Future investigations. In *Families and technology* (pp. 177-187). Springer, Cham. https://doi.org/10.1007/978-3-319-95540-7_10

Tang, S., & Patrick, M. E. (2018). Technology and interactive social media use among 8th and 10th graders in the US and associations with homework and school

grades. *Computers in human behavior*, *86*, 34-44. https://doi.org/10.1016/j.chb.2018.04.025

Twenge, J. M., Martin, G. N., & Spitzberg, B. H. (2019). Trends in U.S. adolescents' media use, 1976–2016: The rise of digital media, the decline of TV, and the (near) demise of print. *Psychology of Popular Media Culture, 8*(4), 329–345. https://doi.org/10.1037/ppm0000203

United Nations Children's Fund and International Telecommunication Union. (2020). *How many children and young people have internet access at home? Estimating digital connectivity during the COVID-19 pandemic.* UNICEF, New York, 2020. http://202.1.196.72/jspui/bitstream/123456789/8093/1/How%20many%20children%20and%20young%20people%20have%20internet%20access%20at%20home%3F%20%3A%20estimating%20digital%20connectivity%20during%20the%20COVID-19%20pandemic.pdf

United States Census Bureau. (2019). *American Community Survey Data (ACS).* U.S. Department of Commerce, Census Bureau. https://www.census.gov/programs-surveys/acs/data.html

Weng, X., Ran, M. S., & Chui, W. H. (2016). Juvenile delinquency in Chinese adolescents: An ecological review of the literature. *Aggression and violent behavior*, 31, 26-36. https://doi.org/10.1016/j.avb.2016.06.016

Winstone, L., Mars, B., Haworth, C., & Kidger, J. (2021). Social media use and social connectedness among adolescents in the United Kingdom: A qualitative exploration of displacement and stimulation. *BMC public health*, *21*(1), 1-15. https://doi.org/10.1186/s12889-021-11802-9

Wong, R. S., Tung, K. T., Rao, N., Leung, C., Hui, A. N., Tso, W. W., ... & Ip, P. (2020). Parent technology use, parent–child interaction, child screen time, and child psychosocial problems among disadvantaged families. *The Journal of Pediatrics*, 226, 258-265. https://doi.org/10.1016/j.jpeds.2020.07.006

Zhu, Y. Q., Chen, L. Y., Chen, H. G., & Chern, C. C. (2011). How does Internet information seeking help academic performance?–The moderating and mediating roles of academic self-efficacy. *Computers & Education*, *57*(4), 2476-2484. https://doi.org/10.1016/j.compedu.2011.07.006