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# MEDIA MULTITASKING AND SELF-ESTEEM: MEDIATING FACTORS

**Relationship between media multitasking and self-esteem among Chinese adolescents: Mediating roles of peer**

**influence and family functioning**

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### **Compliance with Ethical Standards**

#### **Conflict of Interest**

The authors declare that they have no conflict of interest.

#### **Ethical Approval**

All procedures performed in studies involving human participants were in accordance with the ethical standards of the Human Research Ethics Committee, the University of Hong Kong (EA1707026) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

#### **Informed Consent**

Written informed consent was obtained from all individual participants included in this study.

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## Abstract

### Objective

Media multitasking has been found to have a negative relationship with young people's psychological well-being.

However, its relationship with self-esteem is only examined among adults, and the mechanism that underlies the

association with adolescents' well-being remains unclear. The purpose of this study was to investigate the

relationship between media multitasking and self-esteem and explore the effects of peer influence and family

functioning as potential mediators of this association.

### Methods

A sample of 725 Chinese adolescents (55.6% girls;  $M_{\text{age}} = 14.71$ ,  $SD = 1.41$ ) completed a paper-based survey

including questions on demographics, media multitasking, peer influence, family functioning, and self-esteem.

Structural equation modeling and multigroup analyses were performed on the collected data.

### Results

Media multitasking (MM) showed a negative association with self-esteem (SE) ( $r = -.17$ ,  $p < .001$ ); however, peer

influence (PI) and family functioning (FF) entirely mediated this relationship, i.e.,  $MM \rightarrow FF \rightarrow SE$  ( $\beta = -.059$ ,

$p < .05$ ) and  $MM \rightarrow PI \rightarrow FF \rightarrow SE$  ( $\beta = -.025$ ,  $p < .01$ ). In addition, significant differences were found in

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specific mediation pathways among gender and age groups.

### **Conclusion**

Overall, these findings have important implications for understanding the relationship between media multitasking and self-esteem among adolescents, as well as the age and gender differences.

**Keywords:** *media multitasking; self-esteem; peer influence; family functioning; mediating role; adolescents*

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## **Relationship between media multitasking and self-esteem among Chinese adolescents: Mediating roles of peer influence and family functioning**

### **Introduction**

In the past decade, media multitasking—a specific type of media use behavior in which users simultaneously perform at least two media activities or frequently change from one media activity to another—has attracted much research interest (Baumgartner, Lemmens, Weeda, & Huizinga, 2017; Cain, Leonard, Gabrieli, & Finn, 2016; Courage, Bakhtiar, Fitzpatrick, Kenny, & Brandeau, 2015; Ophir, Nass, & Wagner, 2009). Since Ophir et al. (2009) initiated the study of media multitasking, evidence has accumulated on the negative effects of media multitasking on cognitive ability (Baumgartner, Weeda, Van Der Heijden, & Huizinga, 2014; Murphy, McLauchlan, & Lee, 2017) and academic performance (Lau, 2017; Luo, Yeung, & Li, in press). Media multitasking has also been found to be associated with impulsivity and sensation seeking (Chang, 2016; Luo & Liang, 2018; Sanbonmatsu, Strayer, Medeiros-Ward, & Watson, 2013) and with negative psychological factors (Pea et al., 2012; Uncapher et al., 2017; Yang, Xu, & Zhu, 2015), including depression and social anxiety (Becker, Alzahabi, & Hopwood, 2013). In view of the increasing global prevalence of media multitasking behavior (Luo, Sun, Yeung, & Li, 2018; V. Rideout, 2015; V. J. Rideout, Foehr, & Roberts, 2010), it is essential to further our understanding of its effects on adolescents.

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Adolescence is a critical transitional period to adulthood, and adolescents' psychological well-being is particularly susceptible to the negative impact of social and psychological factors (Steinberg, 2008). Although concerns have been raised about the negative impact of media multitasking on adolescents' mental well-being, little is known about the mechanism that underlies the relationship between media multitasking and psychological well-being.

Furthermore, new media (e.g., social media) are changing how people communicate and interact with each other and influencing interpersonal relationships (e.g., Subrahmanyam & Greenfield, 2008; Walther, 1996). Media multitasking behaviors include scenarios such as listening to music/playing electronic games while talking on the phone, talking to another person face-to-face, or responding to friends' instant messages despite being occupied doing something else (e.g., Baumgartner et al., 2017; Lim & Shim, 2016; Luo et al., 2018). Media multitasking behaviors might influence adolescents' interpersonal communication and social interactions, which in turn may affect their social relationships. Some researchers have suggested that social relationships could mediate the association between media use and psychological well-being (e.g., Goodman-Deane, Mieczkowski, Johnson, Goldhaber, & Clarkson, 2016; Li, Shi, & Dang, 2014; Valkenburg & Peter, 2007). According to developmental-ecological theory (e.g., Baker, Dilly, Aupperlee, & Patil, 2003), individual development is influenced by the social contexts in which the individual participates and the interactions among these social contexts. Adolescents'

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psychological well-being can be affected by their relationships with others, such as peers and family (Dohnt & Tiggemann, 2006; Emam & Abu-Serei, 2014; Lam, 2017; Shi, Wang, & Zou, 2017). However, to the best of our knowledge, no study has been published on whether and how social relationships mediate the relationship between media multitasking and psychological well-being, specifically self-esteem, among adolescents.

Among the aspects of psychological well-being potentially affected by media multitasking, self-esteem—a self-concept that describes a person’s overall sense of self-worth (Rosenberg, 1965; Smith & Mackie, 2007)—was selected as the focus of our study for two main reasons. First, self-esteem has been consistently deemed to be an important indicator of individuals’ self-evaluation of their value and abilities and their acceptance of themselves during socialization (Rosenberg, 1965; J. Shi et al., 2017). Repeated studies have found positive relationships between self-esteem and mental health (e.g., Bolognini, Plancherel, Bettschart, & Halfon, 1996), that is, psychological well-being. Second, media multitasking has been associated with psychological indicators (e.g., Sanbonmatsu et al., 2013) and self-esteem (Hatchel, Negriff, & Subrahmanyam, 2018) among adults (Beuckels, Cauberghe, & Hudders, 2017). The negative relationship between media multitasking and self-esteem is also consistent with related literature on the negative impact of Internet use or social media use on self-esteem (Andreassen, Pallesen, & Griffiths, 2017; Best, Manktelow, & Taylor, 2014; Huang, 2010). It is widely believed that



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people are particularly vulnerable to experiences and transitions during adolescence (Cauffman, 2004). Thus, it is highly plausible that the reported negative relationship between media multitasking and self-esteem also exists among adolescents.

To further understand the relationship between self-esteem and its underlying mechanism, we investigated possible mediators of the relationship between media multitasking and self-esteem. Although few studies have examined the factors that mediate media multitasking and psychological well-being, we were able to draw on insights and findings from studies of social media use because media multitasking is linked to increased Internet, smartphone, and social media use (Lim & Shim, 2016; Luo et al., 2018; Ophir et al., 2009).

From a developmental-ecological perspective (e.g., Baker et al., 2003), adolescents' psychological well-being can be affected by their social interactions with peers and families (e.g., Dohnt & Tiggemann, 2006; Emam & Abu-Serei, 2014; Lam, 2017). Studies have shown that the relationship between media use and psychological well-being can be mediated by social relationships with peers or family (Goodman-Deane et al., 2016; Lee, 2009; Valkenburg & Peter, 2007). However, evidence shows that the effects of media use on peer and family relationships could differ (Steinberg, 2008). For example, Lee (2009) reported that Internet use and mobile instant messaging might displace time with the family, but not time with peers. Furthermore, media use, especially text and instant messaging,

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negatively predict satisfaction with immediate families (Goodman-Deane et al., 2016), whereas online communication, including video calls, positively predicts satisfaction with close friendships (Goodman-Deane et al. 2016; Lee 2009). Because media multitasking increases adolescents' time spent online and the frequency of online activity, it will inevitably affect relationships with family and peers (Pea et al., 2012).

On the one hand, family functioning—an indicator of family cohesion and intimacy (J. Shi et al., 2017)—was found to show a negative relationship with excessive Internet use in some studies (e.g., X. Shi et al., 2017; Yan, Li, & Sui, 2014). Moreover, decreased family satisfaction caused by media use also is usually associated with reduced family functioning (Goodman-Deane et al., 2016). And family functioning tends to have a positive impact on self-esteem (e.g., J. Shi et al., 2017); therefore, it might be an essential mediator between media multitasking and self-esteem.

On the other hand, peer influence, an indicator of the extent to which individuals are influenced by or want to please their peers (Steinberg & Monahan, 2007), has repeatedly been found to be associated with risk-taking behavior in adolescence (Gardner & Steinberg, 2005; Shulman et al., 2016; Steinberg & Monahan, 2007). Media multitasking has also been reported to be associated with “fear of missing out”—the sense of missing something important and lacking a sense of belonging with friends (Carrier, Rosen, Cheever, & Lim, 2015; Luo & Liang, 2018)

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and a tendency to seek and engage in dangerous activities through sensation-seeking and impulsivity (Luo & Liang, 2018; Sanbonmatsu et al., 2013). These findings suggest that people who engage in more media multitasking behaviors will also engage more with their peers' online activities. As a result, media multitasking is likely to be positively related to peer influence. The findings of a recent study suggest that peer influence has a negative relationship with self-esteem among Chinese undergraduates (Chen, Shi, & Wang, 2016).

In addition, it is to be expected that increased media use, especially with online peers, will increase parents' worry about the friendships their children make and will reduce family interactions during adolescence (Sultana, 2017). The increased time with peers and vulnerability to peer influence is often at the expense of intimacy with parents (Subrahmanyam & Greenfield, 2008), which will eventually cause a reduction in family functioning. All these findings jointly indicated a possible sequential mediation effect of peer influence and family functioning in the relationship between media multitasking and self-esteem. It means that media multitasking will increase adolescents' vulnerability to peer influence, which will further reduce their family functioning and ultimately harm their self-esteem. Empirical studies are necessary to confirm the effect of media multitasking on self-esteem and the underlying potential impact of peer influence and family functioning.

Last but not least, the existing studies indicate that adolescents' media and Internet use differ with gender and

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age. For example, boys are more likely to play computer games and watch videos online (V. J. Rideout et al., 2010), whereas girls are more likely to create and share videos and engage in mobile communication behaviors (e.g., texting and video chatting) (Lenhart, 2012). In addition to such gender differences, early and middle adolescents also face different developmental issues in their daily life (Steinberg, 2008). Significant differences were found between patterns of video game playing at different stages of adolescence (Subrahmanyam, Greenfiel, Kraut, & Gross, 2001) and types of media use (V. J. Rideout et al., 2010, p.12). These results are thought to reflect the fact that the psychological needs and mechanisms of related issues (e.g., Internet addiction) differ between boys and girls and among adolescents from various age groups (X. Shi et al., 2017).

The literature on media multitasking has focused only on gender differences in the frequency of media multitasking. In general, girls tend to perform more media multitasking than boys for media activities such as instant messaging, email and listening to music (Cotten, Shank, & Anderson, 2014; Foehr, 2006; V. J. Rideout et al., 2010). Little is known about the relationship between age and media multitasking, especially during adolescence, or whether the relationships among media multitasking, peer influence, family functioning, and self-esteem differ between boys and girls and between early and late adolescents. An exploration of gender and age differences in adolescents in terms of the relationships among media multitasking, peer influence, family functioning, and self-

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esteem has potential benefits for both theory and practice. In particular, it will help to identify specific groups of adolescents who are more vulnerable to the effects of media multitasking via peer influence and family functioning.

To this end, this study examined the relationship between media multitasking and self-esteem and the underlying mechanism between media multitasking and self-esteem among adolescents. Three specific objectives were addressed. First, we examined the relationship between media multitasking and self-esteem among Chinese adolescents. Second, we examined the mediation role of peer influence and family functioning in the relationship between media multitasking and self-esteem among Chinese adolescents. Based on the literature review, we hypothesized one direct pathway by which media multitasking has a negative impact on adolescents' self-esteem (Hypothesis 1), and three indirect mediation pathways: a) peer influence mediates the link between media multitasking and self-esteem among adolescents (Hypothesis 2); b) family functioning mediates the link between media multitasking and adolescents' self-esteem (Hypothesis 3); and c) peer influence and family functioning, sequentially, mediate the relationship between media multitasking and adolescents' self-esteem (Hypothesis 4).

Figure 1 shows the hypothesized model. Third, the gender and age differences in the individual pathways were examined. Given the exploratory nature of this study and the lack of evidence on this topic, we do not provide any specific hypotheses regarding gender and age differences. Instead, the results are reported and interpreted based on

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our data analysis.

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Insert Figure 1 about here

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## **Methods**

### **Participants**

A sample of 725 adolescents was recruited to complete a paper-based survey at school. The participants were from four different secondary schools in Shenzhen, a city in the south of China; 55.6% were girls ( $n = 403$ ) and 44.4% boys ( $n = 322$ ), and 39.7% were early adolescents (aged 12–14 years,  $n = 288$ ) and 60.3% were middle adolescents (aged 15–17 years,  $n = 437$ ). The average age of the entire sample was 14.71 years ( $SD = 1.41$  years). The mean age of the early adolescent group was 13.25 ( $SD = .69$ ), and the mean age of the middle adolescent group was 15.68 ( $SD = .78$ ).

### **Procedure**

This research was approved by the Human Research Ethics Committee of the first author's institution. After receiving the consent from school principals, teachers, parents and students themselves, the paper-based

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questionnaire was distributed to students at school. The students were asked to finish this questionnaire during the weekend, and it usually took about 30 minutes to complete. All the participants were given a small gift (about 2 RMB) after finishing the questionnaire. In addition, this report only contains the cross-sectional data from a large project which aims to examine the longitudinal impact of media multitasking on users' learning, psychology and cognition. Data from this project, which discussed longitudinal relationships among media multitasking, academic performance and self-esteem have been reported in other places (Luo et al., in press).

### **Measures**

#### **Media Multitasking**

We used a media multitasking scale that includes 14 items, in Chinese, about daily media multitasking behavior (Luo et al., 2018). The scale has three subdimensions: 1) multitasking with two media activities (e.g., “While watching TV/video, I check or send (voice) messages”); 2) multitasking with media and non-media activities (e.g., “While talking to someone face-to-face (e.g., friends, family), I watch TV/video”); and 3) concentration without multitasking (e.g., “I can focus on walking without getting distracted by media (e.g., my smartphone)”, reverse-coded). The adolescents were asked to report how often they engage in these scenarios using a 5-point Likert scale (1 = never; 5 = always). A development and validation study indicated that the scale was reliable and valid (Luo et

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al., 2018), with a Cronbach's alpha of 0.80 in this study. In our sample, the difference between age groups, that is, early and middle adolescents, was significant ( $Mean_{early} = 2.09$ ;  $Mean_{middle} = 2.36$ ,  $t = -5.74$ ,  $p < .001$ ), whereas the difference between genders was marginally significant ( $Mean_{boys} = 2.20$ ;  $Mean_{girls} = 2.29$ ,  $t = -1.85$ ,  $p = .063$ ).

### **Family Functioning**

We used the General Chinese Family Assessment Instrument (Dong & Lin, 2011; cited in X. Shi et al., 2017) to measure family functioning among Chinese adolescents. The participants were asked to respond to six items (e.g., "Family members can express their feelings to each other" and "My family is very harmonious") on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). The reliability of this scale was 0.92 in this study.

### **Peer Influence**

We adapted the Resistance to Peer Influence Scale developed by Steinberg and Monahan (2007) to measure adolescents' tendency to be influenced by their peers (i.e., peer influence). The modified scale consisted of four items (e.g., "I hide my true opinion from my friends if I think my friends will make fun of me because of it") measured on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree). The participants were asked to report to what extent they want to please their peers. A higher score indicated a higher tendency to be influenced by peers. The reliability of this scale was 0.66 in this study. According to this literature, this is an acceptable value for



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Cronbach's alpha (see Taber, 2017; van Griethuijsen et al., 2015).

### **Self-esteem**

The self-esteem scale used in this study consisted of four items adapted from Rosenberg (1965). It measured overall self-esteem, (e.g., "I feel that I am a person of worth, at least on an equal plane with others"). All items were measured on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree) and the reliability was 0.78 in this study.

### **Data Analyses**

This study adopted a stepwise data analysis approach. First, descriptive, reliability and correlational analyses were conducted using SPSS. Then, we performed structural equation modeling (SEM) with Amos using a maximum likelihood estimator to test the hypothesized model shown in Figure 1. Missing data were generated using regression imputation in Amos. A measurement model with the latent constructs and observed variables was tested before the SEM analysis was performed. The criteria for satisfactory model fit were set as  $\chi^2/df$  between 1 and 3, Tucker-Lewis Index (TLI) and comparative fit index (CFI) both at or above 0.95, and root mean square error of approximation (RMSEA) below 0.06 (Carmines & McIver, 1981; Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999). Two multigroup SEM analyses were then performed to estimate the model fit by gender (i.e., boys and girls) and age (i.e.,

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early and middle adolescents) groups. Finally, a series of  $\chi^2$  differences tests was performed to compare the model fit of the different groups and examine the differences in specific pathways (i.e., direct and indirect effects) between each paired group.

### Results

Table 1 shows the results of descriptive and correlational analyses. Media multitasking had a positive association with peer influence ( $r = .23, p < .001$ ) but a negative relationship with family functioning ( $r = -.18, p < .001$ ) and self-esteem ( $r = -.17, p < .001$ ). In addition, peer influence had a negative association with family functioning ( $r = -.19, p < .001$ ) and self-esteem ( $r = -.08, p < .05$ ). Finally, family functioning was also found to have a positive relationship to self-esteem ( $r = .40, p < .001$ ).

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Insert Table 1 about here

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Before performing the SEM analyses, we estimated the model fit of the measurement model, which consisted of four latent constructs (media multitasking, peer influence, family functioning, and self-esteem) and 28 observed variables. Media multitasking was a second-order construct containing three subconstructs. A test of the initial

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measurement model revealed a very satisfactory fit to the data:  $\chi^2/df = 1.903$ ;  $p < .001$ ; CFI = .960; TLI = .956;

RMSEA = .035. All factor loadings were significant at the .001 level. These results indicate that all latent factors were well represented by their observed variables.

We performed SEM with gender and age groups controlled to estimate the hypothesized model and its pathways. The results showed a satisfactory fit to the data:  $\chi^2/df = 2.004$ ;  $p < .001$ ; CFI = .950; TLI = .944; RMSEA = .037. The latent constructs are shown without their measurements (see Figure 2). All pathways with standardized regression were reported. The results show that media multitasking positively predicted peer influence ( $\beta = .33$ ,  $p < .001$ ) and negatively predicted family functioning ( $\beta = -.14$ ,  $p < .05$ ). Peer influence also negatively predicted family functioning ( $\beta = -.18$ ,  $p < .001$ ), and family functioning positively predicted self-esteem ( $\beta = .42$ ,  $p < .001$ ). Finally, a test of the indirect mediation pathways (based on 2000 bootstrapped resamples) showed that, generally, there were two significant mediation pathways in the model: family functioning mediated the link between media multitasking and self-esteem, and peer influence and family functioning sequentially mediated the link between media multitasking and self-esteem (see Table 2, first column).

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Insert Figure 2 about here

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Insert Table 2 about here

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To analyze gender differences, we first allowed the pathways to vary across gender and then constrained them to be equal and compared the two models. All factor loadings, intercepts, and structural covariance were constrained to be equal. A significant chi-square difference was found between the two models ( $\Delta\chi^2(64, n = 725) = 181.888, p < .001$ ), which suggests that boys and girls differed on the specified model. The standardized regression weights for the gender groups are shown in Figure 3 (left), and standardized indirect effects are shown in Table 2.

We then further compared the differences among every significant pathway in the subgroup models (i.e., boys or girls) one by one. The chi-square difference test results show that the structural pathway from family functioning to self-esteem was marginally significant ( $\Delta\chi^2 = 3.741, p = .053$ ) between boys and girls, and the predictive effect of family functioning on self-esteem was stronger for boys ( $\beta_{\text{boys}} = .47, p < .001; \beta_{\text{girls}} = .40, p < .001$ ). The predictive effect of media multitasking on family functioning was only significant for girls ( $\beta_{\text{boys}} = -.04, p > .05; \beta_{\text{girls}} = -.19, p < .01$ ), even though no significant difference was seen in the chi-square difference test results of these two models

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( $\Delta\chi^2 = 1.087, p = .297$ ). The test of mediation pathways found no differences between boys and girls for any of the three mediation pathways. Moreover, indirect mediation via family functioning (i.e., MM-FF-SE) was only significant for girls ( $\beta_{\text{boys}} = -.019, p > .05$ ;  $\beta_{\text{girls}} = -.076, p < .05$ ).

To analyze age differences, we used a similar two-step analysis. First, we allowed the pathways to vary across age and then constrained them to be equal and compared these two models to examine whether there were age differences. All factor loadings, intercepts, and structural covariance were constrained to be equal. A significant chi-square difference was found between the two models ( $\Delta\chi^2(64, n = 725) = 133.887, p < .001$ ), indicating a difference in the specified model. The standardized regression weights are shown in Figure 3 (right) for each age group, and standardized indirect effects are shown in Table 2.

Further comparisons of the different pathways revealed that only the structural pathway from media multitasking to family functioning was significantly different ( $\Delta\chi^2 = 9.406, p < .01$ ) between early and middle adolescence, and the effect of media multitasking on family functioning was stronger for early adolescents ( $\beta_{\text{early}} = -.32, p < .001$ ;  $\beta_{\text{middle}} = .03, p > .05$ ). The regression weight of this association was not significant for middle adolescents. Finally, a test of mediation pathways found no differences between early and middle adolescents for any of the three mediation pathways. Moreover, indirect mediation via family functioning (i.e., media multitasking

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→ family functioning → self-esteem) was only significant for early adolescents ( $\beta_{\text{early}} = -.106, p < .01; \beta_{\text{middle}} = .013, p > .05$ ).

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Insert Figure 3 about here

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### **Discussion**

This study investigated the relationship between media multitasking and self-esteem among Chinese adolescents, and its underlying mechanisms (i.e., the mediation effects of peer influence and family functioning). Gender and age differences were also examined. The findings and implications of the study are discussed in this section.

#### **Relationship between Media Multitasking and Self-Esteem**

Correlational analysis revealed a significant negative correlation between media multitasking and self-esteem. This negative relationship has not only been directly reported in the literature (e.g., Hatchel et al., 2018), it is also indirectly implied by studies on the general relationship between media multitasking and psychological well-being (Xu, Wang, & David, 2016; Yang et al., 2015) and by studies on the relationship between social media use and self-

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esteem (e.g., Andreassen et al., 2017).

However, the direct relationship between media multitasking and self-esteem was not significant in the mediation model. Therefore, Hypothesis 1 was not supported. This result is not consistent with the previous studies, which indicate that media multitasking negatively relates to self-esteem in adults (Beuckels et al., 2017; Hatchel et al., 2018). Nevertheless, another study of this research project has found that media multitasking indirectly affected self-esteem through adolescents' academic performance (Luo et al., in press). All these findings jointly suggest that in this Chinese sample, the direct impact of media multitasking on self-esteem might be entirely mediated by peer influence and family functioning in a complicated manner. A mediation effect was apparent for both family functioning (Hypothesis 3) and the sequential effect of peer influence and family functioning (Hypothesis 4).

### **Underlying Mechanisms of the Association between Media Multitasking and Self-Esteem**

#### **The mediating role of family functioning**

For the first significant mediation pathway (media multitasking → family functioning → self-esteem), the result indicates that media multitasking negatively predicts family functioning, the protective factor for adolescents' self-esteem. For the first part of this important pathway, our finding provides the first empirical evidence that media multitasking negatively predicts family functioning. There are two possible explanations for this result. First,

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increased media multitasking is usually associated with increased media use time (e.g., Ophir et al., 2009), which will reduce face-to-face family time and therefore reduce the adolescents' perceived family cohesion. This supports the argument that media use negatively impact on family relationships, and shares the reported concerns about separate physical environments for family members and reduced time with immediate families (e.g., Goodman-Deane et al., 2016; Lee, 2009; Subrahmanyam et al., 2001). Second, media multitasking involves frequent changes among various media activities or between media and non-media activities (Luo et al., 2018), which will interrupt face-to-face communication with families and further decrease adolescents' perceived family intimacy and even increase family conflicts. In line with these results, Goodman-Deane et al. (2016) reported that texting and instant messaging—two main causes of media multitasking—negatively influence family satisfaction.

These two explanations are not necessarily alternatives. It is also possible that both can co-exist; therefore, further explorations on how family functioning can be affected by media multitasking are needed. Finally, the second part of this mediation pathway further confirms that decreased family cohesion and intimacy and increased family conflict contribute to lower family functioning and could ultimately be harmful to adolescents' self-esteem (e.g., J. Shi et al., 2017).



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### **The sequential mediating effect of peer influence and family functioning**

For the second significant mediation pathway (media multitasking → peer influence → family functioning → self-esteem), the results show that media multitasking positively predicted peer influence first, then negatively predicted family functioning, and eventually reduced adolescents' self-esteem. This result indicates that media multitasking positively predicts peer influence, which is consistent with the existing finding that social media use and online communication might contribute to peer closeness (Subrahmanyam et al., 2001; Subrahmanyam & Greenfield, 2008). For example, adolescents have been shown to mostly use social media for entertainment and communication with friends (Lu, Luo, Liang, & Jing, 2019). Specific to media multitasking, two possible explanations can be given for this positive relationship.

First, one common media multitasking practice among adolescents is to reply to messages regardless of what else they are doing (Luo et al., 2018), and these messages mostly come from their peers. Young people who use social media a lot and perform media multitasking behavior will be more likely to keep up with their friends online and afraid of missing out on something important, especially compared to their peers (Carrier et al., 2015; Fox & Moreland, 2015; Luo & Liang, 2018; Przybylski, Murayama, Dehaan, & Gladwell, 2013). In this case, adolescents might actively track, follow, and imitate their peers' online activities, and media multitasking, therefore, indicates an

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increase in peer influence.

Second, media multitasking is associated with risk-taking behaviors (Sanbonmatsu et al., 2013), which can involve peer pressure and reduce adolescents' ability to resist peer influence (Steinberg & Monahan, 2007).

Neurological processes associated with media multitasking and peer influence (Brechwald & Prinstein, 2011;

Uncapher & Wagner, 2018) might be involved in this phenomenon. For example, media multitasking might impact

the development of executive function (e.g., Cain et al., 2016; for a review see Uncapher et al., 2017) and reduce

self-control (Minear, Brasher, McCurdy, Lewis, & Younggren, 2013), both of which are considered to protect against

adverse peer influence (Brechwald & Prinstein, 2011).

Studies are needed to further examine the impact of media multitasking and explain how it links with adolescents' peer influence tendency from a neuroscience perspective. The second part of this sequential mediation pathway indicates that peer influence is negatively related to adolescents' family functioning. This is consistent with previous reports that increased peer influence might harm family functioning during adolescence, especially when it comes to online situations (Subrahmanyam et al., 2001; Subrahmanyam & Greenfield, 2008). Finally, as discussed above, reduced family functioning can ultimately lead to low self-esteem among adolescents (e.g., J. Shi et al., 2017).

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It should be noted that the mediation effect of peer influence was not significant in this study (Hypothesis 2) because the relationship between peer influence and self-esteem was not significant in this Chinese model. Although peer influence has been suggested to be negatively related to self-esteem (Chen et al., 2016), it does not directly mediate the relationship between media multitasking and self-esteem. It is possible that peer influence has an effect via family functioning, in the sequential mediation effect noted above. Nevertheless, this result highlights the important role of family functioning in self-esteem and is consistent with the existing finding that self-esteem is protected in a Chinese way that is different from Western culture (Cai, Feng, & Feng, 2011). Further studies are needed to confirm cultural differences in how peer influence contributes to self-esteem among adolescents.

In conclusion, both peer influence and family functioning are important to explain the relationship between media multitasking and self-esteem. The critical role of family functioning suggests that if we cannot stop adolescents from media multitasking, we can at least take actions to provide support for parents to protect and improve family functioning. Teaching adolescents to be independent and mindful of peer influence can also contribute to family functioning. These strategies could eventually mitigate the negative effect of media multitasking on self-esteem and even on a broader range of negative effects, such as learning and cognition.

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### **Gender and Age Differences**

Our results reveal that overall, the mediating role of family functioning was stronger for girls and for early adolescents. We found that worse family functioning reduced self-esteem for both gender and age groups, whereas higher media multitasking caused significantly worse family functioning among girls and early adolescents. The finding that worse family functioning reduced self-esteem more for boys is consistent with the study conducted by X. Shi et al. (2017). Both studies suggest that among Chinese adolescents, boys' self-esteem is affected more than girls' is by family functioning. In addition, it is understandable that early adolescents' family functioning could be influenced more by media use behaviors, such as media multitasking because they are less independent than middle adolescents. Finally, because girls tend to engage more with peer-related activities such as online communication (Lenhart, 2012) and to be more interpersonally oriented (X. Shi et al., 2017), their family functioning might be affected more by media multitasking behaviors. However, this study only provides a preliminary comparison of gender and age differences; further studies are needed to verify these results and continue this exploration.

### **Limitations and Future Research Directions**

This study has some limitations that should be addressed. First, due to the cross-sectional design of the study, we cannot draw any conclusions about causal relationships among the variables. Further studies with longitudinal

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and experimental methods are needed to show a causal effect. Second, the cross-sectional self-reported survey, which only permits an examination of relationships between validated measures without inferring directionality, is often subject to common method bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Therefore, multiple data collections methods should be considered, and more stakeholders, i.e., parents, should be recruited in future studies. Last but not least, the sample only included Chinese adolescents, so it is not clear whether this model can be applied to other populations or age groups. Cross-cultural and multigroup (e.g., children and young adults) comparisons are needed to test the model further.

Despite these limitations, our study makes a significant contribution to understanding the mechanism underlying the link between media multitasking and self-esteem. The empirical evidence provided by this study increases knowledge about the impact of media multitasking on psychological well-being and suggests how educational practitioners could design and implement effective interventions to mitigate the negative effects of media multitasking among adolescents.

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### Tables

Table 1. Descriptive statistics, intercorrelations, and reliabilities among variables

Variable	1	2	3	4	Cronbach's alpha
MM	—				.80
PI	.23***	—			.66
FF	-.18***	-.19***	—		.92
SE	-.17***	-.08*	.40***	—	.78
Mean (SD)	2.25 (.62)	2.62 (.75)	3.95 (.80)	3.98 (.63)	

*Note.* MM = Media multitasking, PI = Peer influence, FF = Family functioning, SE = Self-esteem.

\*  $p < .05$ ; \*\*\*  $p < .001$

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Table 2. Standardized indirect effects for the general and multigroup models

Model pathway	General	Gender		Age group	
		Male	Female	Early adolescent	Middle adolescent
MM → PI → SE	-.007	.025	-.025	.015	-.015
MM → FF → SE	-.059*	-.019	-.076*	-.106**	.013
MM → PI → FF → SE	-.025**	-.034 <sup>+</sup>	-.024**	-.021*	-.020*

*Note.* Standardized estimates are shown. MM = Media multitasking, PI = Peer influence, FF = Family functioning,

SE = Self-esteem, Early adolescent = 12–14 years, Middle adolescents = 15–17 years.

<sup>+</sup>  $p < .06$ ; \*  $p < .05$ ; \*\*  $p < .01$

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## Figures

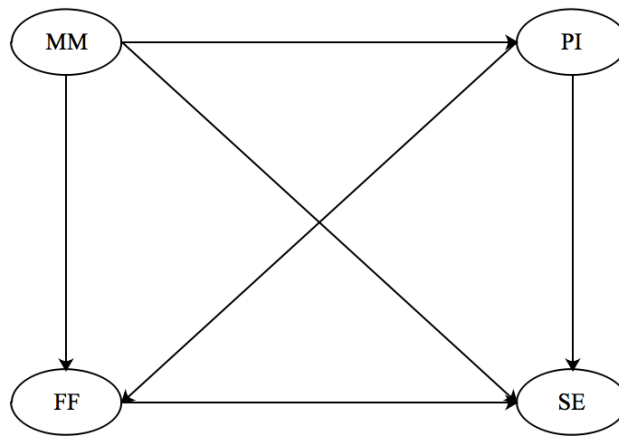


Fig. 1 Hypothesized model

*Note. MM = Media multitasking, PI = Peer influence, FF = Family functioning, SE = Self-esteem.*

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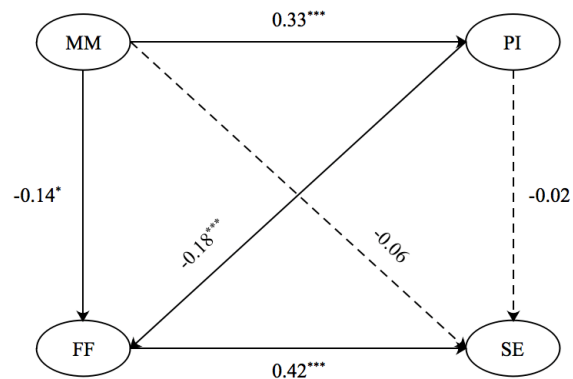


Fig. 2 Finalized structural model

*Note. MM = Media multitasking, PI = Peer influence, FF = Family functioning, SE = Self-esteem. The model was estimated with gender and age group under control. For reasons of clarity, the full measurement model is not shown. All of the pathways were standardized.*

*\*  $p < .05$ ; \*\*\*  $p < .001$*

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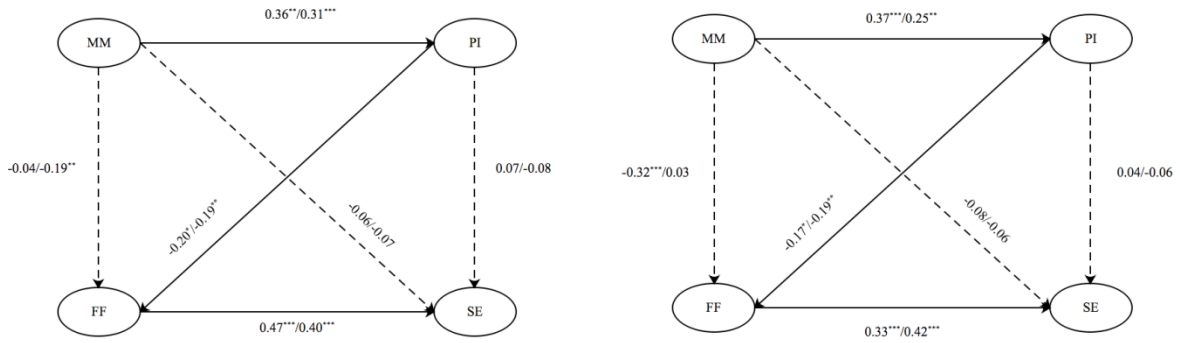


Fig. 3 Complex mediation models for gender (left) and age (right) groups

*Note. MM = Media multitasking, PI = Peer influence, FF = Family functioning, SE = Self-esteem. The models were estimated with gender and age group, respectively, under control. For reasons of clarity, the full measurement model is not shown. All of the pathways were standardized. The two coefficients separated by a forward slash are for boys and girls, respectively (left), and for early adolescents and middle adolescents, respectively (right).*

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$