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Social networking sites addiction and adolescent depression: A moderated mediation model of rumination and self-esteem



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ABSTRACT

Recent research has shown that social networking sites (SNS) use is a risk factor for depression, but little research has studied the relation between SNS addiction and depression, and less is known about the mediating and moderating mechanisms underlying this relation. The present study examined whether rumination mediated the relation between SNS addiction and depression, and whether the mediating effect was moderated by self-esteem. Our theoretical model was tested using concurrent data collected from 365 Chinese adolescents. The participants completed the measures of SNS addiction, depression, rumination, and self-esteem. The results indicated that SNS addiction was positively associated with depression. Mediation analysis indicated that rumination mediated the relation between SNS addiction and depression. Moderated mediated analysis further revealed that the path between rumination and depression was stronger for individuals with lower self-esteem than individuals with higher self-esteem. Limitations and implications of this study were discussed.

1. Introduction

Social networking sites (SNS), which allow users to communicate with others in diverse forms, such as updating status, posting comments, sending messages, and viewing the information uploaded by others (Kuss & Griffiths, 2011), are changing the way people connect with each other in recent years. SNS usage is becoming a worldwide phenomenon. However, a large number of studies find that SNS use can undermine individuals' well-being (Okeeffe & Clarke-Pearson, 2011; Sampasa-Kanyinga & Lewis, 2015), such as damaging academic performance and causing interpersonal-relationship conflicts (Griffiths, Kuss, & Demetrovics, 2014). SNS addiction (i.e., problematic and compulsive online social networking) is getting increasing academic attention because it is found to have more adverse impacts than the normal SNS use (Kuss & Griffiths, 2011), and SNS addiction rate is found to be 34% in a previous study (Griffiths, Kuss, & Demetrovics, 2014). Depression can damage individuals' personal relationships, life qualities, and other social functions, and it might even lead people to commit suicide (Maalouf, Atwi, & Brent, 2011). Moreover, depression rate in adolescence is relatively high (Cairns, Yap, Pilkington, & Jorm, 2014), and evidence showed that depressive symptoms in adolescence could predict depression in adulthood (Pine, Cohen, Cohen, & Brook,

1999). Therefore, it is necessary to investigate the relation between adolescent SNS addiction and depression.

It has been suggested that Internet addiction is a form of passive coping, and the addicted users rely on the Internet to escape from their real-life problems and troubling feelings (Caplan, 2002; Tao, 2005). According to the coping style theory, if people cope with their problems negatively, it can lead to decreased well-being (Lazarus & Folkman, 1984). Therefore, it is theoretically reasonable that the SNS addiction (a subtype of Internet addiction) could lead to depression. Numerous empirical studies support the notion. For example, a series of cross-sectional studies find that SNS use is positively related to depression (Feinstein et al., 2013; Nesi & Prinstein, 2015). Diary and experience sampling studies have further confirmed that SNS use could predict depression (Steers, Wickham, & Acitelli, 2014; Verduyn et al., 2015). Although there are a few inconsistent results about the relationship between these SNS use and depression (Jelenchick, Eickhoff, & Moreno, 2013; Kim & Lee, 2011), available evidence is largely in line with the notion that SNS use could lead to depression (Appel, Gerlach, & Crusius, 2016). Given that SNS addiction can cause more severe damage than general SNS use (Griffiths, Kuss, & Demetrovics, 2014), it is reasonable to deduce that SNS addiction could lead to depression.

Given the penetration of the SNS and the severe consequences of

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depression, it is of both academic and practical importance to explore the underlying mechanisms in the association with SNS addiction and depression. Prior studies have mainly focused on the mediating effects of envy and social comparison between SNS use and depression (Appel et al., 2016). There is little empirical research about the relation between SNS addiction and depression, less is known about whether certain variables would moderate or mediate the relationship between SNS addiction and depression. Besides, most of the studies related to SNS use and depression are focused on college samples (Appel et al., 2016), yet adolescents should attract more academic attention given their development tasks (Robins & Trzesniewski, 2005) and heavy SNS use (Correa, Hinsley, & De Zuniga, 2010). To fill these gaps, our study constructed a moderated mediation model to test the mediating role of rumination and the moderating role of self-esteem in the relationship between SNS addiction and depression in the Chinese adolescents.

1.1. The mediating role of rumination

Rumination is defined as repetitive thoughts and behaviors on symptoms, causes, and consequence of past personal distress (Nolen-Hoeksema, 1991; Nolen-Hoeksema, 2000). According to the response style theory (Nolen-Hoeksema, 1991), rumination is a maladaptive response style that may exacerbate and prolong negative mood by increasing negative thoughts, hindering problem-solving skills and social interactions (Nolen-Hoeksema, 2000; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Numerous studies have confirmed that rumination could lead to depression. For example, a meta-analysis (Olatunji, Naragongainey, & Wolitzkytaylor, 2013) finds that higher levels of rumination could predict higher levels of depression. A longitudinal research has also confirmed that rumination predicts the onset and maintenance of depression (Wilkinson, Croudace, & Goodyer, 2013).

There are several reasons supporting that SNS addiction could lead to rumination. Firstly, certain built-in features of SNS could facilitate rumination (Feinstein et al., 2013; Locatelli, Kluge, & Bryant, 2012). For example, it is convenient for the users to share their thoughts on the SNS, and rumination could be reinforced if these shared thoughts gain feedbacks from other users. Secondly, some studies find that certain ways of SNS use could cause the users to ruminate, such as updating negative status (Locatelli et al., 2012) and passive SNS use (Shaw, Timpano, Tran, & Joormann, 2015). Thirdly, in a recent study, Liu et al. (2017) found that mobile phone addiction can cause rumination, and given that mobile phone addiction often coexists with SNS addiction (Salehan & Negahban, 2013), this also supports that SNS addiction can lead to rumination. At last, according to the stress-reactive model of rumination and previous empirical studies, rumination takes place after a stressful event (Nolen-Hoeksema, 1991; Nolen-Hoeksema, 2000). Some studies find that SNS addiction could undermine individuals' offline activities, such as damaging academic performance and interpersonal relationships, these adverse influences would unavoidably lead to adolescent stress (Kuss & Griffiths, 2011), which in turn may lead to rumination. To sum up, it is reasonable to assume that SNS addiction can trigger rumination, and rumination would lead to depression. That is, rumination can mediate the relation between SNS addiction and depression. To date, no prior research has examined the mediating role of rumination in the relation between SNS addiction and depression. Based on the theoretical and empirical grounds, we come up with the following hypothesis:

Hypothesis 1. Rumination would mediate the relation between SNS addiction and depression.

1.2. The moderating role of self-esteem

Although SNS addiction is generally regarded as a risk factor for adolescent depression, adolescents may not be identically susceptible to SNS addiction. Some individual characteristics may moderate the

impact of SNS addiction on adolescent depression, for example, self-esteem.

Self-esteem refers to the affective, or evaluative, component of the self-concept, it signifies how individuals feel about themselves (Leary & Baumeister, 2000). Individuals with high levels of self-esteem show better psychological adjustment such as low negative affect and high positive affect (Orth, Robins, & Widaman, 2012), happiness (Diener & Diener, 1995), and lower levels of depression as well (Sowislo & Orth, 2013). According to the risk-buffering hypothesis, favorable individual characteristics, such as self-esteem, can attenuate the relation between some risk factors and psychological status (Luthar, Crossman, & Small, 2015). Empirical research has supported this hypothesis. For example, it is found that self-esteem moderates the relation between cell-phone addiction and depression (HyunSill & Hyon-jin, 2017), and the relation between smartphone addiction and emotional problems as well (Eunseel, 2017). Besides, it is found that self-esteem moderates the relation between Internet addiction and some negative psychological traits (Zhang et al., 2015). Little research has examined self-esteem as a moderator of the indirect relations between SNS addiction and adolescent depression. Based on the risk-buffering hypothesis and empirical grounds, we propose the following hypothesis:

Hypothesis 2. Self-esteem would buffer the indirect relations between SNS addiction and depression.

1.3. The present study

The current study tested the mechanisms underlying the association between SNS addiction and depression in the Chinese adolescents. Particularly, we established a moderated mediation model to answer the following questions: (a) whether rumination plays a mediating role in the relation between SNS addiction and depression, (b) whether self-esteem buffers the mediating effect of rumination in the association between SNS addiction and depression. The integrated model can address questions about both mediation (i.e., how does SNS addiction associate with depression) and moderation (i.e., for whom is the relation most or least strong). Fig. 1 illustrates the proposed model.

2. Method

2.1. Participants

A total of 365 senior high school students in China (52% of the participants were female adolescents) completed our survey, the survey was designed to collect information including demographic variables, SNS addiction, rumination, depression, and self-esteem. The average age of the participants was 15.96 ($SD_{age} = 0.69$ years, range = 14–18 years).

2.2. Measures

2.2.1. Social networking sites addiction

The Facebook Intrusion Questionnaire (FIQ, Elphinstone & Noller, 2011) was adapted in the present study, which consists of 8 items (e.g., "I often think about social networking sites when I am not using it"). Each item is rated on a 7-point scale (1 = *never*, 7 = *always*). Higher scores indicate greater social networking sites addiction. The FIQ has been used in the Chinese sample and shows good reliability and validity (Błachnio et al., 2016a, 2016b). In the present study, Cronbach's α for the FIQ was 0.86.

2.2.2. Rumination

Rumination was measured by the Chinese version (Yang, Ling, Xiao, & Yao, 2009) of Ruminative Response Scale (RRS, Nolen-Hoeksema & Morrow, 1991), which consists of 22 items. Participants rated each item on a 4-point scale (1 = *never*, 4 = *always*), with higher scores indicate

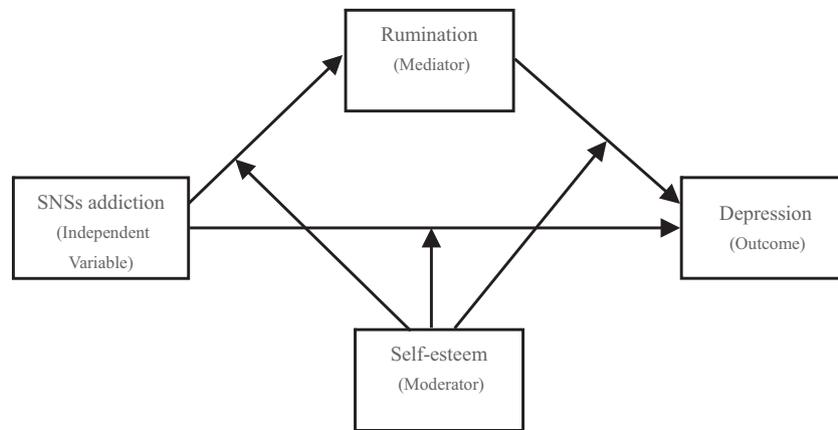


Fig. 1. The proposed moderated mediation model.

Table 1
Descriptive statistics and correlations between variables.

	M	SD	1	2	3	4
1. SNS addiction	3.62	1.27	1			
2. Rumination	2.37	0.51	0.31***	1		
3. Depression	1.99	0.50	0.18***	0.70***	1	
4. Self-esteem	2.58	0.43	-0.07	-0.38***	-0.56***	1

Note: N = 365.
*** p < 0.001.

higher tendency to ruminate. Cronbach's α for the RRS was 0.91 in this study.

2.2.3. Depression

Depression was measured by the Center for Epidemiological Studies Depression Scale (CES-D, Radloff, 1977), which consists of 20 items. Each item was rated on a 4-point scale (1 = never, 4 = always), with higher scores representing worse conditions on depression. The CES-D has been used in Chinese sample with good reliability and validity (Dwyer et al., 2014). In the present study, Cronbach's α for the CES-D was 0.91.

2.2.4. Self-esteem

Self-esteem was measured by the Rosenberg Self-Esteem Scale (SES, Rosenberg, 1965), which consists of 10 items. The participants rated each item on a four-point scale ranging from 1 = not very true of me to 4 = very true of me, with higher scores indicating higher levels of self-esteem. Cronbach's α for the CES-D was 0.82.

2.3. Procedure

All materials and procedures were approved by the Ethics in Human Research Committee of the first author's university. The data were collected in middle school classrooms in March 2017. Informed consent was obtained from the teachers and participants. Students in the target classes were invited to participate in the survey anonymously in classrooms. Well-trained psychology postgraduate students administered the survey. Students were informed that their participation was voluntary and they could terminate the participation anytime they want. Participants received a gift as incentives.

2.4. Statistical analyses

We first conducted the analyses of variance, descriptive statistics, and correlation with SPSS 20.0. Then, we followed the four-step procedure to execute the mediation effect (Baron & Kenny, 1986). At last,

we further examined whether the mediation process was moderated by self-esteem. It is normative to use the moderated mediation to examine whether the magnitude of a mediation effect depends on the value of a moderator (Hayes, 2013). The moderated mediation model was analyzed by Hayes's PROCESS macro (Model 59). We used the bootstrapping method to test the significance of the effects in order to obtain robust standard errors for parameter estimation (Hayes, 2013). The bootstrapping method produced 95% bias-corrected confidence intervals of these effects from 1000 resamples of the data. Confidence intervals that do not include zero means effects that are significant at $\alpha = 0.05$.

3. Results

3.1. Preliminary analyses

Means, standard deviations, and correlations for all the study variables are presented in Table 1. The results showed that SNS addiction was positively associated with rumination and depression, $r = 0.31$, $p < 0.001$ and $r = 0.18$, $p < 0.001$, respectively. Rumination was positively correlated with depression, $r = 0.70$, $p < 0.001$, as well. Besides, self-esteem was negatively associated with rumination and depression, $r = -0.38$, $p < 0.001$ and $r = -0.56$, $p < 0.001$, respectively.

3.2. Testing for the mediation effect

We expected that rumination would mediate the relationship between SNS addiction and depression in Hypothesis 1. To examine this hypothesis, we followed the four-step procedure to set up mediation effect (Baron & Kenny, 1986), which demands (a) a significant association between SNS addiction and depression; (b) a significant association between SNS addiction and rumination; (c) a significant association between rumination and depression after controlling for SNS addiction; (d) a significant coefficient for the indirect path between SNS addiction and depression through rumination. The bias-corrected percentile bootstrap approach determines whether the last condition is satisfied.

Regression analysis revealed that, in the first step, SNS addiction positively predicted adolescent depression, $\beta = 0.18$, $p < 0.001$ (see Model 1 of Table 2). In the second step, SNS addiction positively predicted rumination, $\beta = 0.34$, $p < 0.001$ (see Model 2 of Table 2). In the third step, after controlled for SNS addiction, rumination positively predicted adolescent depression, $\beta = 0.63$, $p < 0.001$ (see Model 3 of Table 2). At last, the bias-corrected percentile bootstrap method showed that the indirect effect of SNS addiction on adolescent depression via rumination was significant, $ab = 0.22$, $SE = 0.04$, 95%

Table 2
Testing the mediation effect of SNS addiction on depression.

Predictors	Model 1 (Depression)		Model 2 (Rumination)		Model 3 (Depression)	
	β	t	β	t	β	t
SNS addiction	0.18	3.46***	0.34	6.22***	-0.04	-1.03
Rumination					0.63	17.81***
R ²	0.03		0.10		0.48	
F	12.00***		38.67***		169.74***	

Note: N = 365. Each column is a regression model that predicts the criterion at the top of the column.

*** p < 0.001.

CI = [0.14, 0.30]. On the whole, the above four criteria for establishing a mediation effect were totally satisfied, which indicates that Hypothesis 1 was supported.

3.3. Testing for the moderated mediation

In Hypothesis 2, the present study assumed that self-esteem would buffer the indirect relation between SNS addiction and depression. To examine the moderated mediation hypothesis, the current study estimated parameters for three regression models with PROCESS macro (Model 59) by Hayes (2013). This study estimated the moderating effect of self-esteem on: the relation between SNS addiction and depression (Model 1); the relation between SNS addiction and rumination (Model 2); the relation between rumination and depression (Model 3). The specifications of the three models were summarized in Table 3.

Moderated mediation was established if either or both of two patterns existed (Hayes, 2013): the path between SNS addiction and rumination was moderated by self-esteem, and/or the path between rumination and depression was moderated by self-esteem.

As shown in Table 3, in Model 1 there was a significant main effect of SNS addiction on depression, $b = 0.14, p < 0.01$, and this effect was not moderated by self-esteem, $p > 0.05$. Model 2 showed that the effect of SNS addiction on rumination was significant, $b = 0.29, p < 0.001$, and this effect was not moderated by self-esteem, $p > 0.05$. Finally, as Model 3 indicated that there was a main effect of rumination on depression, $b = 0.56, p < 0.001$, and more importantly, this effect was moderated by self-esteem, $b = -0.10, p < 0.01$. For descriptive purposes, this study plotted predicted depression against rumination, separately for low and high levels of self-esteem (1 SD below the mean and 1 SD above the mean respectively) (Fig. 2). Simple slope tests showed that the association between rumination and depression was stronger for low self-esteem participants ($b_{simple} = 0.65, p < 0.001$) than for high self-esteem participants ($b_{simple} = 0.46,$

Table 3
Testing the moderated mediation effect of SNS addiction on depression.

Predictors	Model 1 (Dep)		Model 2 (Rum)		Model 3 (Dep)	
	b	t	b	t	b	t
S.A.	0.14	3.31**	0.29	6.19***	-0.01	-1.4
SE	-0.54	-12.40***	-0.36	-7.60***	-0.32	-8.73***
S.A. × SE	0.04	1.11	0.04	1.00	0.04	1.25
Rum					0.56	14.49***
Rum × SE					-0.10	-3.18**
R ²	0.33		0.23		0.59	
F	60.53***		36.11***		105.45***	

Note: N = 365. S.A. = SNS addiction, SE = self-esteem, Rum = rumination, Dep = depression. The beta values are standardized coefficients, thus they can be compared to determine the relative strength of different variables in the model.

** p < 0.01.

*** p < 0.001.

p < 0.001).

4. Discussion

This study explored the underlying mechanisms between SNS addiction and adolescent depression by establishing a moderated mediation model. The results showed that rumination played a mediating role between SNS addiction and adolescent depression, and self-esteem moderated the mediating effect.

4.1. The mediating role of rumination

First, the present study indicated that SNS addiction was a risk factor for adolescent depression, which is in line with the previous research showing SNS use could lead to depression (Kuss & Griffiths, 2011). Numerous studies indicate that SNS use can predict depression, but most of the previous studies measured SNS intensity instead of SNS addiction as the independent variable. To our knowledge, this is the first study to directly explore the relation between SNS addiction and adolescent depression.

Second, this study indicated that rumination mediated the association between SNS addiction and adolescent depression. Many studies support that rumination could predict depression (Nolen-Hoeksema, 2012), yet, little research explored the relationship between SNS addiction and rumination, the mediating effect of rumination between SNS addiction and depression was also unknown. As predicted, SNS addiction could predict rumination, and rumination mediated the influence of SNS addiction on depression. SNS addiction often coexists with mobile phone addiction, and the middle school teachers often hold negative attitudes toward students' mobile phone usage because it violates the school rules and impacts students' academic performance. SNS addiction can be a stressful event for the middle school students in this context, and according to the stress-reactive model of rumination, rumination takes place after undergoing a stressful event like this. Besides, as we mentioned above, the built-in features of SNS, certain ways that adolescents use SNS, and the adverse impacts of SNS addiction on interpersonal relationships could all lead to rumination.

4.2. The buffering role of self-esteem

The second aim of this study was to examine the buffering effect of self-esteem on the indirect relations between SNS addiction and adolescent depression through rumination. The results showed that self-esteem only buffered the path between rumination and depression. The relation between rumination and depression was much stronger among adolescents with a low level of self-esteem. Adolescents with a high level of self-esteem view themselves as competent people (Leary & Baumeister, 2000), they have more confidence to solve their problems. Therefore, they are less likely to be depressed compared with adolescents with a low level of self-esteem, even if they are facing the same level of rumination. Overall, this finding supports the importance of testing the risk-buffering hypothesis (Luthar et al., 2015) in understanding the influence of rumination on adolescent depression.

Contrary to our hypothesis, the relation between SNS addiction and rumination was not buffered by self-esteem. One possible reason is that the influence of SNS addiction on adolescent is fierce, so it would lead to adolescent rumination regardless of their level of self-esteem.

Overall, by integrating self-esteem as a moderator into the model, the current detected effects that would have been omitted without the moderation analysis. This study found that for adolescents with a low level of self-esteem, SNS addiction had an adverse impact on depression through rumination. However, this indirect effect was significantly weaker for adolescents high in self-esteem. Therefore, researchers interested in the influence of SNS addiction on adolescent well-being, such as depression, should pay attention to boosting adolescents' self-esteem. The moderated mediation model in the current study is

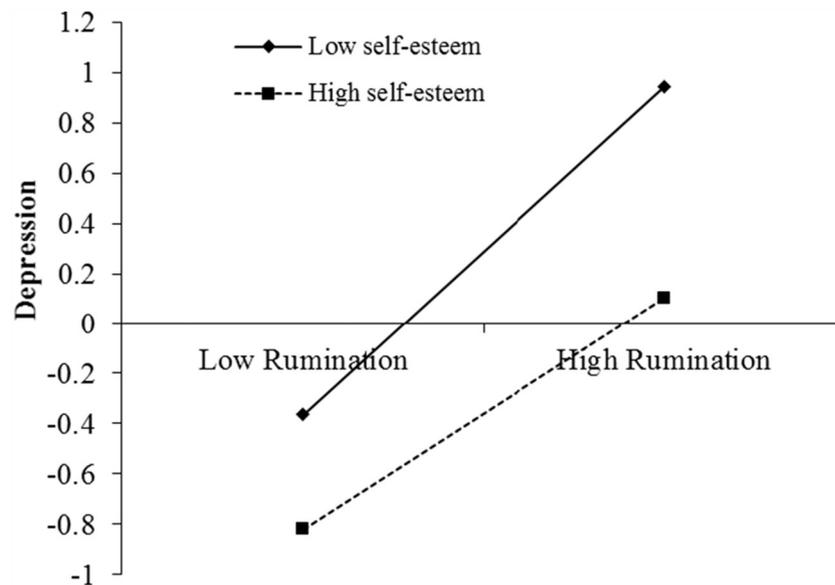


Fig. 2. Depression as a function of rumination and self-esteem. Functions are graphed for two levels of self-esteem: 1 standard deviation above the mean and 1 standard deviation below the mean. Note that the graph is for descriptive purpose only. All inferential analyses maintained the continuous values of rumination and self-esteem.

conceptually more nuanced and offers greater predictive power than the mediation model alone.

4.3. Limitations and implications

Several limitations should be noted when interpreting the results of the current study. First, we cannot make any causal inferences about the associations due to the cross-sectional nature of the study design. Longitudinal design (Hayes, 2013; MacKinnon, 2008) or experimental studies are in need to further confirm the causal relationships of the variables. Second, the self-report method limits the validity of the data because of social desirability and other biases, future studies should use data from diverse samples (e.g., adolescent, peer, parent, teacher) to provide more solid evidence from different informants. Third, since we used a convenience sample, all participants were recruited from the same middle school, the representativeness of the sample is limited. So, it is important to be careful about the generalization of these findings. For example, it is more suitable to generalize the findings to the middle school students than to the clinical samples.

Despite these limitations, our study found that rumination mediated the relation between SNS addiction and adolescent depression, and self-esteem played a moderating role in the relation between rumination and depression. These findings could deepen our understanding of how SNS use can lead to depression, and for whom the impact is more serious. In addition, our study has important practical limitations. First, it is necessary for the teachers and parents to take action to reduce adolescents' dependence on SNS and help adolescents realize that overuse of SNS can have negative influences on their mental health such as depression. It is found that SNS are mainly used for social purpose (Kuss & Griffiths, 2011) and those who are not good at communicating with other people in the offline world could get addicted to SNS more easily (Xu & Tan, 2012). So, it is necessary for the parents and educators to help adolescents develop their social skill. Nevertheless, SNS usage does have some positive impacts on adolescents' development (e.g., bridging social capitals, obtaining social support, knowing about the world) (Ellison, Steinfield, & Lampe, 2007), banning the adolescents from using SNS blindly may not be the best choice, it is of great importance to guide them to use the SNS in a proper way. Second, as rumination plays a mediating role in the association between SNS addiction and depression, it would be of great benefit if the adolescents could reduce their tendency to ruminate. Studies related to rumination find that

changing emotional response style and negative cognitive style (Cohen, Mor, & Henik, 2015; Querstret & Cropley, 2013) could alleviate rumination. It is beneficial for the school administrators to take actions to establish policies to promote these methods. Third, our study found that the relation between rumination and depression is stronger for adolescents with a lower level of self-esteem. That is, self-esteem is an important buffer of the adverse influence rumination on depression. Therefore, boosting self-esteem can be a complementing component of intervention programs that target at reducing adolescents' depression.

5. Conclusion

In summary, the present study indicates that SNS addiction can be a risk factor for adolescent depression. Further, the mediation analysis reveals that rumination can be one possible mechanism underlying this relation. Besides, moderated mediation analysis reveals that self-esteem buffers the relation between rumination and adolescent depression, with the effect between rumination and depression being stronger for adolescents with a low level of self-esteem.

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