



Facebook use and depressive symptomatology: Investigating the role of neuroticism and extraversion in youth[☆]



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ABSTRACT

The popularity of social networking sites, such as Facebook, has increased rapidly over the past decade, especially among youth. Consequently, the impact of Facebook use on mental health problems (e.g., depressive symptomatology) has become a recent area of concern. Yet, evidence for such a link has been mixed and factors that contribute to heterogeneity of findings have not been identified. In this study, we examined whether the association between Facebook use and depressive symptoms is moderated by individual factors (i.e., personality and sex). To this end, we measured Facebook use, depressive symptoms, and personality domains (i.e., extroversion and neuroticism) among 237 young adults. No direct association was found between Facebook use and depressive symptoms. However, for females with high neuroticism, more frequent Facebook use was associated with lower depressive symptoms. Our findings suggest a complex relationship between Facebook use and depressive symptomatology that appears to vary by sex and personality. Facebook use may be protective against depressive symptoms for female users with high levels of neuroticism, while Facebook use may be unrelated to depressive symptoms among males.

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1. Introduction

The use of social networking sites has grown exponentially during the last decade. For example, Facebook, the largest social networking site, increased its membership from 1 million in 2004 to 1 billion in 2012 (Smith, Segall, & Cowley, 2012), with over forty percent of its users under the age of twenty-five (Smith, 2010). The popularity of these sites has raised concerns about their potential role in mental health (O'Keeffe & Clarke-Pearson, 2011), given that risk for mental health problems during this developmental phase is high (¾ of all lifetime psychiatric illnesses begin before age 24; Kessler et al., 2005). However, evidence linking Facebook and mental health disorders, such as depression is sparse and mixed (Datu, Valdez, & Datu, 2012; Jelenchick, Eickhoff, & Moreno, 2013; Kross et al., 2013; Rosen, Whaling, Rab, Carrier, & Cheever, 2013). In addition, there is growing evidence suggesting the association between Facebook use and depressive symptomatology may vary as a function of other factors, such as, personality

(Ryan & Xenos, 2011) and type of use (Rosen et al., 2013). Yet, it is unclear if these factors explain prior inconsistencies in previous examinations of the Facebook-depression link. Therefore, we aim to clarify previous inconsistencies by examining whether the association between Facebook use and depressive symptoms in youth is moderated by personality factors and sex.

In 2011 the American Academy of Pediatrics (AAP) popularized the term “Facebook depression” to describe the potential phenomenon in which teens spend a significant amount of time on social networking sites and could subsequently exhibit symptoms of depression (O'Keeffe & Clarke-Pearson, 2011). The AAP was concerned that excessive exposure to negative peer interactions (e.g., online bullying, premature sexual experimentation) combined with youth's limited regulatory skills, would place youth at higher risk for mental health problems (O'Keeffe & Clarke-Pearson, 2011). Although at the time there was no empirical evidence of this effect, the studies that followed suggest a much more complex relationship. For example, while Facebook use has been linked with lower subjective well-being and life satisfaction among young adults (Kross et al., 2013), only a sub-category of Facebook behaviors, Facebook impression management, has been positively associated with greater depressive symptoms (Rosen et al., 2013). In contrast, other studies have failed to link Facebook use and depression in both older adolescents and young adults (Datu et al., 2012; Jelenchick et al., 2013; Kross et al., 2013). In fact, having more

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Facebook friends has been linked to lower symptoms of dysthymia (Rosen et al., 2013). It is possible however, that Facebook has a putative effect on depression only among vulnerable individuals, which could explain previously conflicting findings. Among factors associated with increased risk for depression we focused on personality and sex given that both are associated with social networking site usage (Kiser, 2011; Lynn & Martin, 1997) and risk for mental health problems (Goodwin & Gotlib, 2004; Hankin & Abramson, 1999).

Extraversion, characterized by positive emotionality, sociability, and energetic behavior (McCrae & John, 1992), is often associated with increased feelings of happiness and fewer depressive symptoms (Cheng & Furnham, 2003). Specifically, high extraversion may be protective against the development of depression (Farmer et al., 2002), as it may promote the use of social support (Pai & Carr, 2010). Extraversion also predicts greater *direct* social engagement compared to non-direct (e.g., online) social engagement (Muscanell & Guadagno, 2012). For example, when given the choice between Internet interaction and traditional (i.e., face-to-face) social interaction, highly extraverted people prefer traditional interaction (Amichai-Hamburger, Wainapel, & Fox, 2002). Therefore, it is possible that extraversion serves as a protective factor to the potential negative impact of excessive Facebook use by facilitating potentially less harmful use patterns.

In contrast, neuroticism, a personality construct characterized by emotional reactivity, anxiety, and negative emotionality (Lahey, 2009), has been extensively linked to higher risk for depression (Jylhä, Melartin, Ryttsälä, & Isometsä, 2009; Klein, Kotov, & Bufferd, 2011), especially among adolescents (Kercher, Rapee, & Schniering, 2009), and young adults (Cheng & Furnham, 2003). Individuals high in neuroticism are more likely to engage in social media (Correa, Hinsley, & De Zuniga, 2010; Guadagno, Okdie, & Eno, 2008), and prefer online interactions to face-to-face interactions (Amichai-Hamburger et al., 2002) than their low neuroticism peers. This is a significant concern given that neuroticism is linked to poor use of traditional social support systems when distressed (Wang & Gan, 2011), which may further increase risk for developing depressive symptoms if individuals high in neuroticism forgo face-to-face interactions for online exchanges. For example, greater online social networking use by women high in neuroticism has been associated with greater loneliness, a common correlate of depression (Amichai-Hamburger & Ben-Artzi, 2003).

In addition, there are robust sex differences in social networking behavior, personality profiles, and prevalence of depression. Traditionally, females have higher rates and more chronic cases of depression (Essau, Lewinsohn, Seeley, & Sasagawa, 2010). Females also compose around 60% of all Facebook users (Kiser, 2011), and are more likely than their male counterparts to update their Facebook profiles, post pictures, and comment on material shared by others ("College Students' Social Networking", 2008). Furthermore, females typically report higher neuroticism than males (Lynn & Martin, 1997). Sex differences in neuroticism may play a role in the type of social support females and males receive (i.e., online vs. traditional social interactions), and thus differentially contribute to risk for depression.

Therefore, the objective of this study was to examine whether the association between Facebook use and depressive symptoms was moderated by personality traits and sex. We hypothesized that Facebook use was associated with higher reported depressive symptoms but only among participants low in extraversion or high in neuroticism. Finally, given previous evidence that males and females differ in their Internet behavior (Muscanell & Guadagno, 2012), and depressive symptoms (Essau et al., 2010), we examined whether these associations were stronger among, or even unique to, females. If these hypotheses are confirmed, these findings

would contribute to our understanding of how dimensions of personality influence social behavior in a highly influential, novel, and growing social environment while potentially conferring mental health risk.

2. Methods

2.1. Participants

Participants included 237 young adults (112 females) ages 18–23 ($M_{age} = 18.81$ years; $SD_{age} = 0.98$). Participants were students at a large research university in the United States and were recruited from a research participant pool. Ethnic distribution of our sample was consistent with that of the larger undergraduate population at the university, and included: African American (5%), Asian American (11%), Caucasian (77%), and Other (7%).

2.2. Procedure

All questionnaires were administered online using web-based Qualtrics software. Participants were able to complete the survey on any computer with Internet access, 24 h per day, during the fall 2011 and winter 2012 terms. Before beginning the survey, participants read and indicated their consent to participate. The survey took an average of 29 min to complete and participants did not have the option of returning to the survey once finished. This study was approved by the University's Institutional Review Board and was conducted in concordance with the guidelines for ethical research with human subjects.

2.3. Measures

2.3.1. Depressive symptoms

Depressive symptoms were assessed via the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). The CES-D is a 20-question, self-report instrument with excellent reliability and validity (Radloff, 1977). This measure also demonstrated good internal consistency in the current sample ($\alpha = .87$).

2.3.2. Personality

Ninety-six items of the Revised NEO Personality Inventory (NEO PI-R; Costa & McCrae, 2008) that measure extraversion and neuroticism were used in this study. Raw totals for both Extraversion and Neuroticism were converted to *t*-scores before being centered for regression analyses. The NEO PI-R is a commonly used measure for assessing personality factors in the general population. The measure has been shown to have high reliability and validity (Young & Schinka, 2001). In our sample, this measure demonstrated good reliability for both extraversion ($\alpha = .88$) and neuroticism ($\alpha = .91$).

2.3.3. Facebook use

The Facebook Questionnaire (Ross et al., 2009) is a 35-item self-report questionnaire that was used to assess Facebook activity and daily Facebook use. Facebook activity consisted of the average score on 6-items that assessed how frequently (e.g., "more than once daily", "once weekly", "twice monthly") users commented on photos, posted on Walls, checked their own Wall, sent messages, "poked" others, and changed their status. Facebook activity is a measure of active behaviors, as compared with scrolling through pages passively. In our sample, the Facebook activity sub-scale demonstrated good reliability, $\alpha = .83$. We focused on the association between Facebook activity, or *active* Facebook use, and depressive symptoms as this construct has not been previously tested independently. Previous research has typically

examined total Facebook use, which fails to differentiate active (e.g., posting on walls) and passive (e.g., scrolling through news-feed) use. In order to control for the effect of passive Facebook use, we also assessed total daily Facebook use, which accounts for both active and passive use. Daily Facebook use was assessed by asking participants to indicate approximately how much time per day they spent on Facebook (e.g., 10 or less minutes, 10–30 min, 31–60 min, 1–2 h, 2–3 h, or 3+ h).

2.4. Data analysis

We examined whether the association between Facebook activity and depressive symptoms was moderated by sex and personality factors using a series of hierarchical regression models. Sex was coded as a dichotomous variable in our analyses where male = 0 and female = 1. In each of these models, we included the main effect of daily Facebook use as a covariate in order to account for any variance not specific to active Facebook use. All predictors were centered, and unstandardized beta estimates are presented. First, we tested the main effects and two-way interactions of sex, Facebook activity, neuroticism, and extraversion as predictors of depression. Finally, we examined whether the observed relationships between personality, Facebook activity, and depression were moderated by sex. To this end, we tested the three-way interactions of personality factors, Facebook activity, and sex as predictors of depressive symptoms. We used an alpha level of .05 for all statistical tests.

3. Results

3.1. Descriptive statistics

Table 1 includes the means, standard deviations, and correlations between all study variables. In general, participants endorsed a relatively wide range of depressive symptoms (51% = minimal, 37% = mild, 12% = severe). Furthermore, there was no significant difference in depressive symptoms between males and females, $F(1,235) = .620, p = .432$. The results also indicated a wide distribution in average daily Facebook use (9% = “10 or less min”, 17% = “10–30 min”, 25% = “31–60 min”, 28% = “1–2 h”, 15% = “2–3 h”, 7% = “3+ h”). Female participants reported more frequent Facebook activity, $F(1,235) = 7.97, p = .005$, and daily Facebook use, $F(1,235) = 11.76, p < .001$, compared to male participants. The average levels of extroversion in our sample ($M = 117$; $SD = 17.66$) is comparable to national norms ($M = 125$; $SD = 20.1$) (Lord, 2007) but the average levels of neuroticism ($M = 86.34$; $SD = 21.25$) are approximately one standard deviation above national norms ($M = 64.75$; $SD = 20.15$), suggesting high levels of neuroticism in our sample. In addition, there were some significant

sex differences on personality characteristics such that female participants reported higher extraversion, $F(1,235) = 4.17, p = .042$, compared to males, yet only a marginal difference in neuroticism, $F(1,235) = 3.07, p = .081$.

3.2. Personality and sex as moderators between Facebook activity and depression

Prior to testing our hypotheses, we conducted a covariate only model to examine the effect of daily Facebook use on depression. Daily Facebook use was not associated with depressive symptoms, $b = .014, t(241) = 1.78, p = .08$. We also examined whether sex moderated the effect of daily Facebook use on depression in a separate model. The interaction between sex and daily Facebook use was not significant, Sex \times Daily FB Use $b = -.001, t(239) = -.02, p > .20$. Therefore, we did not control for daily Facebook use in subsequent models but the overall results presented below did not change with or without the inclusion of daily Facebook use as a covariate.

3.2.1. Neuroticism

To examine the role of neuroticism in the relationship between Facebook activity and depressive symptoms we conducted a series of hierarchical regressions. The main effects model was significant and accounted for approximately 40% of the variance in CES-D scores, $R^2 = .41, F(3,239) = 54.83, p < .001$. Specifically, higher reported neuroticism was significantly associated with greater symptoms of depression, $b = .23, t(239) = 12.76, p < .001$. However, sex, $b = -.22, t(239) = -.029, p > .20$, and Facebook activity, $b = -.19, t(239) = -.078, p > .20$ were unrelated to depressive symptoms. The two way interaction model did not improve the model fit, R^2 change = .001, $F(6,236) = 0.67, p > .20$, and none of the two-way interactions were significant (see Table 2). However, our final three-way interaction improved the model fit, R^2 change = .012, $F(6,236) = 5.03, p < .01$. Specifically, sex significantly moderated the interaction between Facebook activity and neuroticism, Sex (females) \times FB Activity \times Neuroticism $F(1,235) = 4.83, p = .023$. Post-hoc analyses of simple slopes at various levels of neuroticism revealed that among females only, greater Facebook activity was associated with lower depressive symptoms among those with high levels of neuroticism (i.e., 1.5 SD above the mean), $b = -1.32, t(235) = -2.13, p = .03$ but not among those with average (or below average) levels of neuroticism, effect for average neuroticism levels $b = -.01879, t(235) = -.44, p > .20$.

3.2.2. Extraversion

Next, we examined the role of extraversion in the relationship between Facebook activity and depressive symptoms. The main effects model was significant and accounted for approximately

Table 1

Means, standard deviations by sex and correlations (Pearson's r) for total scores on the CES-D, NEO PI-R, and Facebook Questionnaire.

	Female ($n = 112$) M (SD)	Male ($n = 125$) M (SD)	1	2	3	4	5	6	7
1. Sex	–	–	1.00	–.23**	0.05	0.13*	0.11	0.18**	0.21**
2. Age	18.58 (0.81)	19.03 (1.09)		1.00	0.01	–0.15*	0.04	–0.19*	–0.16*
3. CES-D ^a	16.98 (7.85)	16.21 (7.28)			1.00	–0.34**	0.63**	0.04	0.10
4. Extraversion ^b	120.2 (15.96)	115.2 (18.84)				1.00	–0.32**	0.28**	0.07
5. Neuroticism ^b	88.92 (21.38)	84.10 (21.04)					1.00	0.15**	0.20**
6. Facebook Activity	4.17 (1.35)	4.80 (1.68)						1.00	0.49**
7. Daily Facebook use ^c	88.84 (60.64)	62.50 (1.32)							1.00

^a CES-D: Center for Epidemiologic Studies Depression Scale.

^b NEO PI-R: Revised NEO Personality Inventory-scores converted to T-scores for analyses.

^c Daily Facebook use represents average use per day (in minutes).

* $p < .05$.

** $p < .01$.

Table 2
Sex, Facebook (FB) activity and neuroticism as predictors of depressive symptoms among young adults. All independent variables are mean-centered and unstandardized coefficients are presented.

Predictor	<i>b</i>	<i>t</i>	<i>R</i> ² change
Main effects model			
Sex (females)	−.172	−.218	
FB Activity	−.270	−.903	
Neuroticism	.227	12.31**	
Two-way interaction model			
Sex (females)	−.181	−.23	.001
FB Activity	−.097	.81	
Neuroticism	.229	9.15**	
Sex * FB Activity	−.263	−.49	
Sex * Neuroticism	.001	.02	
FB Activity * Neuroticism	−.006	−.51	
Three-way interaction model			
Sex (females)	−.007	−.01	.012*
FB Activity	−.034	−.11	
Neuroticism	.237	9.45**	
Sex * FB Activity	−.153	−.29	
Sex * Neuroticism	.001	.001	
FB Activity * Neuroticism	.014	.98	
Sex * FB Activity * Neuroticism	−.061	−2.392*	

* *p* < .05.
** *p* < .01.

15% of the variance in CES-D scores, $R^2 = .15$, $F(4,232) = 10.08$, $p < .001$. Specifically, lower reported extraversion was significantly associated with more depressive symptoms, $b = -.17$, $t(239) = -6.44$, $p < .001$. However, sex, $b = .99$, $t(239) = 1.23$, $p > .20$, and Facebook activity, $b = .63$, $t(239) = 1.76$, $p = .08$ were unrelated to depressive symptoms. The two-way interaction model did not improve the model fit, R^2 change = .004, $F(6,236) = 1.13$, $p > .20$, and none of the two-way interactions were significant (see Table 3). The three-way interaction model also did not improve the model fit, R^2 change = .001, $F(7,235) = .28$, $p > .20$ and the interaction between extraversion and Facebook activity was not moderated by sex., Sex (females) \times FB Activity \times Extraversion $F(1,235) = .05$, $p > .20$.

4. Discussion

The purpose of this study was to explore the associations between Facebook use, personality, sex and depressive symptoms

Table 3
Facebook (FB) activity and extraversion as predictors of depressive symptoms among young adults. All independent variables are mean-centered and unstandardized coefficients are presented.

Predictor	<i>b</i>	<i>t</i>	<i>R</i> ² change
Main effects model			
Sex (females)	.99	1.23	
FB Activity	.63	1.76	
Extraversion	−.17	−6.44**	
Two-way interaction model			
Sex (females)	1.11	1.21	.004
FB Activity	0.55	1.43	
Extraversion	−.173	−5.00**	
Sex * FB Activity	.540	.840	
Sex * Extraversion	−.002	−.05	
FB Activity * Extraversion	−.008	−.57	
Three-way interaction model			
Sex (females)	1.06	1.10	.001
FB Activity	.548	1.41	
Extraversion	−.174	−4.99**	
Sex * FB Activity	.570	.86	
Sex * Extraversion	−.003	−.06	
FB Activity * Extraversion	−.010	−.61	
Sex * FB Activity * Extraversion	.007	.23	

** *p* < .01.

in young adults. We found no independent association between Facebook use and depressive symptoms. Additionally, specific personality traits (i.e., neuroticism and extraversion) did not independently moderate the association between Facebook use and depressive symptoms across the entire sample. However, contrary to our hypotheses, among females with high neuroticism, increased Facebook activity was associated with lower depressive symptoms, while there was no such relationship among males. Therefore, our findings do not provide support for the purported link between Facebook use and negative mental health outcomes. On the contrary, our findings identify at least one context in which Facebook is associated with reduced depression symptoms in youth.

We did not find a direct link between Facebook and depressive symptoms in this sample. This is consistent with previous investigations of Facebook use and depressive symptoms among adolescents and young adults (Datu et al., 2012; Jelenchick et al., 2013; Kross et al., 2013). In contrast, we found that certain personality traits may influence the association between Facebook use and depressive symptoms differently for males and females. Contrary to expectation, more frequent Facebook use was associated with fewer reported depressive symptoms among females high in neuroticism. This was surprising given that neuroticism is associated with greater risk for depression (Klein et al., 2011) and specific cognitions (e.g., hostile attributions; Martin, 1985) that were hypothesized to place individuals more vulnerable to the detrimental effects of Facebook. However, higher neuroticism can impair social functioning through more conflicted and unstable relationships with peers (Lahey, 2009). Therefore, females high in neuroticism may be using Facebook to maintain relationships and promote their positive qualities in a more regulated social environment. For example, neuroticism is associated with a preference for asynchronous forms of communication on Facebook, such as the use of the main timeline wall instead of instant messages (Ross et al., 2009). This form of communication can facilitate the careful crafting of messages and may reduce the sharing of potentially negative information (Ross et al., 2009; Ryan & Xenos, 2011). Thus, Facebook may actually facilitate adaptive social interaction patterns among those with high neuroticism, consequently mitigating the impact of neuroticism on their social lives.

In contrast, among males, variability in depressive symptoms was unrelated to Facebook use or specific personality traits, such as neuroticism or extraversion. This is not entirely surprising given that previous research suggest that correlates and risk factors for depression differ between males and females (Hankin & Abramson, 1999; Nolen-Hoeksema, 2001). For example, greater neuroticism may partially explain the higher depression rates seen among females (Goodwin & Gotlib, 2004) relative to males. Therefore, the current study further highlights the increased need for a better understanding of the differential role certain factors (e.g., personality traits and social networking site usage) have on depression among males and females in order to better inform prevention efforts among young adult populations.

Our findings should be considered in light of some important limitations. This study was conducted at a large, public university in the Midwest, and our sample consisted of predominantly Caucasian undergraduate students. Consequently, our findings may not reflect undergraduate students in other geographic regions or of other ethnic groups. Furthermore, these findings are likely specific to undergraduate students, and may not necessarily reflect the relationship between Facebook use and depressive symptoms among other populations of the same age who are not in college, or of other age groups. Furthermore, the current study examined self-reported Facebook use, which may be limited by reporter bias (e.g., memory bias or social desirability). Thus, future studies may benefit from more objective assessments of Facebook use. Finally,

our study only focused on the association between Facebook use and depressive symptoms, and thus our results may not generalize to other areas of functioning or mental health.

4.1. Conclusions

In sum, in the past two decades there have been major technological advances that have dramatically changed and increased outlets for online social behavior, which have also elicited fears about the potential harmful, unintended consequences of these innovations. Our goal was to empirically test the impact of these new technologies in order to understand conditions in which they serve a harmful (or beneficial) role in mental health. Our study suggests a complex relationship between Facebook use and depressive symptoms. We found no evidence of “Facebook depression” and instead found that in some cases Facebook usage is associated with lower depressive symptoms. This finding has significant implications for research and practice. Neuroticism is one of the strongest risk factors for depression in youth (Kercher et al., 2009). Thus, the association between active Facebook use and lower levels of depression among females with high levels of neuroticism raises questions about potential protective mechanisms. If in future experimental or longitudinal studies Facebook use is found to be protective in these individuals, then identifying the mechanism of this effect can pinpoint to novel forms of interventions (e.g., facilitating structured social communication via online systems). On the other hand, if there is no causal relation and females with high levels of neuroticism and low depressive symptoms simply tend to use Facebook more often, then future studies should identify the factors among this unique group that make them resilient to the putative effect of neuroticism. All in all, our study provides evidence of a relationship between Facebook and positive mental health factors in some contexts highlighting the need to examine how some types of online interactions can have a positive effect on mental health outcomes.

Conflict of interest

The authors declare no conflict of interests.

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