Facebook Depression Revisited: The Absence of an Association between Facebook Use and Depressive Symptoms

by

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Abstract

The negative impact of Facebook use on everyday life has been widely publicized, despite limited empirical examinations of this relationship. The purpose of this study was to investigate the association between Facebook use, depression, and the personality factors of extroversion and neuroticism. The study included 245 undergraduate university students who completed an online survey composed of a Facebook questionnaire, the Center for Epidemiologic Studies Depression Scale, and the extroversion and neuroticism components of the Revised NEO Personality Inventory. Generally, even when controlling for sex effects, no direct association was found between depression and Facebook activity, or between depression and attachment to Facebook. However, for females with high levels of neuroticism, high levels of Facebook activity were associated with lower levels of depression. The results suggest the existence of a protective function of Facebook for female users with high levels of neuroticism.

Keywords: depression, Facebook, extroversion, neuroticism, gender

Facebook Depression Revisited: The Absence of an Association between Facebook Use and Depressive Symptoms

Depression is a major public health concern, with approximately 17% of American adults receiving a diagnosis of depression during their lifetime (Kessler et al., 2005). In addition, depression on college campuses has become a widespread phenomenon in recent years (Bayram & Bilgel, 2008; The American College Health Association, 2009). For example, approximately 15% of college students have been labeled with depression at some point during their education (Zivin, Eisenberg, Gollust, & Golberstein, 2009) and one in every four to five students who visits a university health center for a routine cold or sore throat reports symptoms of depression (Mackenzie et al., 2011). Therefore, it is important to identify elements contributing to the development and maintenance of mental health problems, including depression, in this population. In this study we specifically examined the use of the social networking site Facebook, which has become a part of college students everyday routine (Pempek, Yermolayeva, & Calvert, 2009), and has been hypothesized to increase depression levels among its users (O'Keeffe, Clarke-Pearson, & Council on Communications and Media, 2011). In addition, personality factors, especially high levels of extroversion and low levels of neuroticism, have been associated with depressive symptoms (Bienvenu et al., 2004), and these personality factors have been shown to be related to different uses of the Internet and social networking sites (Amichai-Hamburger, 2002; Correa, Hinsley, & de Zúñiga, 2010). Therefore, this study examined the association between Facebook use and depressive symptoms, and considered extroversion and neuroticism as potential moderators of this association.

The Impact of Depression on College Students

Depression and its consequences can be especially detrimental in college students. It is

estimated that around 50% of college undergraduates experience some form of mental illness during their university years, with depression being the most widely reported illness (Burnsed, 2010). The prevalence of depressive symptoms in the college population has increased within the past several years, in tandem with the frequency of students seeking treatment for those symptoms (Voelker, 2003). Depression in college students contributes to difficulties during this stage of life, and has been associated with negative factors such as increased risk for developing illness (Adams, Wharton, Quilter, & Hirsch, 2008), substance abuse (Cranford, Eisenberg, & Serras, 2009) and decreased probability of academic success (Eisenberg, Golberstein, & Hunt, 2009).

Gender plays a part in the presence of depression in undergraduate students. Specifically, mild-to-severe depression symptoms have been found in up to 30% of college women (Beeber, 1998; Peden, Hall, Rayens, & Beebe, 2000). Gender differences in depression first become apparent in puberty, with girls and women being twice as likely as men to receive a diagnosis of depression (Petersen et al., 1993). Investigation into this discrepancy suggests that females possess more risk factors for depression than males even before the gender differences in depression appear, but these risk factors contribute to depression only when challenges associated with puberty and subsequent life stages become apparent (Nolen-Hoeksema & Girgus, 1994). Research suggests that the gender discrepancy perhaps stems from the idea that females typically desire closer emotional connections and intimacy within interpersonal relationships than males, and difficult transitions during adolescence may increase this desire, creating anxious feelings and doubt in personal ability to cope (Cyranowski, Frank, Young, & Shear, 2000). Therefore, gender discrepancies in depressive symptoms should be taken into account when analyzing post-pubescent populations.

Social Networking Sites: An Overview

Over the past several years, the number of social networking site (SNS) users has escalated significantly, rising from 8% of adult Internet users in 2005 to 37% in 2008 (Lenhart, Purcell, Smith, & Zickhur, 2010). These SNSs allow users to create profiles showcasing demographic information, personal thoughts, and a wide range of interests (Boyd & Ellison, 2007). Additionally, these sites offer users the opportunity to maintain online connections with online friends, as well as to share photographs, videos, and stories. SixDegrees.com, launched in 1997, was the first SNS, and allowed users to create personalized profiles, maintain lists of friends, and browse these friend lists. Interest in this type of Internet interaction led to the creation of various sites such as LiveJournal, LinkedIn, MySpace, and Facebook (Boyd & Ellison, 2007). In 2010, 72% of online 18-29 year olds used SNSs, and the rate of use among teens was similar (Lenhart et al., 2010). Motivations for SNS use differ between individuals and are related to factors such as frequency of site visitation (Hargittai & Hsieh, 2010). For example, those who engage in more frequent site visitation report being more social in their online communication, as opposed to those users who visit SNS sites infrequently (Hargittai & Hsieh, 2010). Additionally, SNS preference is associated with the user's level of attachment to that particular site (Lynn, 2009).

In 2004, a Harvard undergraduate named Mark Zuckerberg founded a SNS he called "The facebook" as a way for his Harvard University classmates to communicate on the web (Phillips, 2007). In the past seven years, Facebook has evolved into a globally-utilized site with over 800,000,000 users that post photographs, share feelings, and update relationship statuses (Fletcher, 2010). The average user of the SNS creates and shares 90 pieces of personal information each month ("Statistics," 2011). Features of Facebook commonly used are Friend

Requests (the ability to add a connection with another Facebook user), the Wall (a public posting site for each individual user where friends may share public messages and exchange comments), and Photos (publicly sharing a single photo or a complete online album with the option to "tag" users as a means of identification). Individual users differ in regards to the manner in which they use Facebook (Haskins, 2005; Joinson, 2008). For instance, there is still ambiguity over what type of conduct and communication is appropriate with this new form of social media, in regards to the degree to which a person chooses to share personal details on a public forum (Lewis, Kaufman, & Christakis, 2008).

Almost all college undergraduate students are Facebook users, with over 90% participation being reported in some studies (Ellison, Steinfield, & Lampe, 2007). Since the conception of this social networking tool, college undergraduates have been using Facebook with increasing frequency, now spending around 40 minutes per day actively using its features (Muise, Christofides, & Desmarais, 2009). There are potentially positive effects associated with the widespread use of Facebook in college students. The college undergraduate population typically uses Facebook as a method of keeping in touch with old and current friends, and to post and look at pictures, as opposed to simply follow a current trend or to occupy free time (Raacke & Bonds-Raacke, 2008). In addition to this positive and meaningful use of Facebook, spending time on the site has been associated with increased life satisfaction, social trust, and political participation in college students (Valenzuela, Park, & Kee, 2009). It is evident that Facebook has become integrated into the daily lives of undergraduates, although some may not consider this form of social interaction to be beneficial to the learning environment colleges strive to promote (Bugeja, 2006).

Gender differences have been identified in overall SNS use as well as in Facebook-

specific use. When considering SNS practices, women are more likely than men to engage in "stronger-tie activities" like interacting with existing friends, and are less likely than men to engage in "weaker-tie activities" like forming new relationships via the Internet (Hargittai & Hsieh, 2010). Additionally, gender differences have been associated with Facebook use. More females than males are active users of Facebook, with females composing around 60% of all Facebook users (Kiser, 2011). College women 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). Additionally, females are more concerned about their online privacy being invaded and are more proactive about protecting their privacy by un-tagging photos that suggest questionable character and seeking out help from network administrators to remove unsavory posts from other users about themselves (Hoy & Milne, 2010). Finally, females are more likely than males to attempt to deflect compliments given via public Facebook features such as the Wall (Lesmana, 2009).

The Relationship between Personality Factors, the Internet and Depression

The five-factor model of personality explains that Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism are all components of personality that vary from person to person (McCrae, 2002). Varying levels of extroversion have been associated with different mental disorders and behaviors. For example, low levels of extraversion have been linked to Major Depressive Disorder (Bienvenu et al., 2004; Jylhä & Isometsä, 2006; Jylhä, Melartin, Rytsälä, & Isometsä, 2009). Additionally, depression has been shown to have negative impacts on extroversion scores during depressive episodes (Jylhä et al., 2009). Furthermore, in college students, high levels of extroversion are correlated with increased feelings of happiness and lower levels of depressive symptoms (Cheng & Furnham, 2003). Extroversion scores have

also been related to differences in Internet use. When given the choice between Internet interaction and traditional social interaction, introverts prefer to express their true selves via the Internet, while extroverts prefer traditional social interaction as a means to share their inner thoughts (Amichai-Hamburger, Wainapel, & Fox, 2002). Accordingly, extroverts prefer the Internet for goal-oriented and instrumental tasks, as opposed to using the Internet to feel like a member of a community (Amiel & Sargent, 2004; Ross et al., 2009). These findings have been further supported when analyzing the Facebook user population, and it has been shown that online and offline popularity is associated with the ways in which users utilize Facebook features. Specifically, introverted users of Facebook are less popular in offline communities, and thus strive to make their online image exciting and interesting by oversharing personal information (Zywica & Danowski, 2008).

Neuroticism is a personality factor that has also been linked to Major Depressive Disorder, with neuroticism being positively correlated to depressive symptoms (Bienvenu et al., 2004; Jylhä & Isometsä, 2006). Additionally, neuroticism has been suggested to exist as a distal vulnerability for the future development of depression in an adolescent depression (Kercher, Rapee, & Schniering, 2009). In an undergraduate population, high levels of neuroticism are associated with decreased feelings of happiness and increased levels of depressive symptoms (Cheng & Furnham, 2003). In regards to choosing between interactions via the Internet and traditional social interactions, individuals with higher neuroticism scores use the Internet as a mode of self-expression, and individuals with lower neuroticism scores express a preference for traditional social interactions (Amichai-Hamburger, Wainapel, et al., 2002). Additionally, users with high levels of neuroticism are more likely to engage in social media use than counterparts with lower levels of neuroticism (Correa et al., 2010; Guadagno, Okdie, & Eno, 2008). Finally,

individuals reporting high levels of neuroticism are more likely to engage in social media use than their counterparts reporting lower levels of neuroticism (Correa et al., 2010; Guadagno et al., 2008).

Exploring the Relationship between Facebook and Depression

A widely sensationalized and promulgated claim included in a publication by the American Academy of Pediatrics introduced the term "Facebook depression, defined as when preteens and teens spend a great deal of time on social media sites, such as Facebook, and then begin to exhibit classic symptoms of depression" (O'Keeffe, Clarke-Pearson, & Council on Communications and Media, 2011). Unfortunately, the sources used to cite evidence of this claim consist of studies not addressing a relationship between Facebook use and depression (i.e., Selfhout, Branje, Delsing, ter Bogt, & Meeus, 2009). Instead, the evidence presented in the article consists of citations to news articles incorrectly interpreting results of other studies (i.e., Davila et al., 2009), a blog post (Melville, 2011), an article from TrendHunter.com, and a source that has an invalid hyperlink and cannot be found on search engines (O'Keeffe, Clarke-Pearson, & Council on Communications and Media, 2011).

In contrast to the shortcomings of the previously mentioned article, research has been conducted on the relationship between Internet and mental health that utilizes empirical evidence to make its claims. Some concerns exist regarding the widespread prevalence of the Internet, as some of the uses of the Internet have been associated with negative impacts on psychological well-being. For example, "Internet addiction," a self-explanatory condition associated with excessive use, withdrawal, tolerance, and negative repercussions of the Internet, has been suggested as a disorder that should be included in the DSM-V (Block, 2008). Additionally, in adult users, web browsing has been positively correlated with loneliness and negatively

correlated with overall life satisfaction (Stepanikova, Nie, & He, 2010). Finally, misrepresentation of the self, a common practice on SNSs, has been linked to decreased social skills, decreased self-esteem, increased social anxiety, and increased aggression in a young population (Harman, Hansen, Cochran, & Lindsey, 2005). While there are several positive uses that have been identified with Internet use and Facebook participation, it is apparent that downsides also exist.

A small amount of research exists that examines the relationship between styles of Facebook use and depressive symptoms. Approximately one quarter of college students disclose symptoms of depression on Facebook via status updates and Wall posts. It is suggested that students that are highly involved in SNS communities of friends are more likely to share personal information than students who are low-frequency SNS users (Moreno et al., 2011b). Statements posted on Facebook that may suggest the presence of depressive symptoms in the user have been shown to be associated with at least mild forms of depression (Moreno et al., 2011a). Thus, while there have been some studies conducted on the relationship between Facebook and depression, there is still a large gap in reliable literature detailing the specific components, if any, of this association. Research needs to be done that examines the direct relationship between Facebook use and depression. Additionally, studies need to be conducted to investigate the factors that moderate this relationship.

Our Study: Examining the Interaction between Facebook Use and Personality to Predict Depression

There is a deficit of research on the interactions existing between personality types, Facebook use, and depression. However, a select few studies have been conducted that show potential for associations between these variables. For example, an increased use of social

Internet services by highly neurotic women has been associated with their loneliness and depressive symptoms experienced, and an attempt to reduce that loneliness (Amichai-Hamburger & Ben-Artzi, 2003). Additionally, the new phenomenon identified earlier in this introduction termed "Facebook depression" has been identified as a correlation between young adults spending excessive amounts of time on Facebook and other SNSs and developing the classic symptoms of depression (O'Keeffe, Clarke-Pearson, & Council on Communications and Media, 2011). More information about the interaction between personality, Facebook use, and depression, especially in the college population, must be discovered in order to fill this gap in psychological literature.

Yet, no study has directly examined the use of Facebook in an undergraduate population that displays depressive symptoms. The primary aim of this study is to explore differences in Facebook usage along a spectrum of self-reported depressive symptoms. The second aim is to examine whether personality factors moderate the association between elements of Facebook use and depressive symptoms. We hypothesize that:

1. There will be a positive linear relationship between Facebook activity and depressive symptoms.
2. There will be a positive linear relationship between attachment to Facebook and depressive symptoms.
3. The association between Facebook activity/attachment and depression will be stronger among those with low levels of extroversion.
4. The association between Facebook activity/attachment and depression will be stronger among those with high levels of neuroticism.

Method

Participants

Participants for this study were 245 (115 females) undergraduate students at the University of Michigan ranging from 18 to 23 years of age (*Mean age* = 18.81 years; *SD* = 0.98). Racial/ethnic groups for the study sample included: African American (5.31%), Asian American (10.61%), White (76.73%), and 7.35% of participants marked "Other" as their racial/ethnic background. All participants were given the option of participating in various studies within the Introductory Subject Pool to fulfill a requirement for an Introductory Psychology course, and chose this study in conjunction with others to meet the minimum number of hours for this assignment. Although the students were enrolled in an introductory psychology course, a diverse array of majors was reported, including Economics, Nursing, and Mechanical Engineering in addition to Psychology.

Measures

Depression. The Center for Epidemiologic Studies Depression Scale (CES-D) was used to assess depressive symptoms. CES-D is a 20-question, multiple-choice, self-report survey. Participants are asked to select one statement for each question that best describes the way they have been feeling during the past week. Each answer is scored on a scale value of 0 to 3. The standard cut-offs are as follows: zero-15: minimal depression; 16-26: mild depression; 27-60: major depression. The possible range of scores is zero to 60, with higher scores indicating the presence of more depressive symptoms. CES-D is a widely used and freely available instrument used in measuring the level of depressive symptomatology in a general population. The measure has been shown to have high reliability and validity (Radloff, 1977).

Personality factors. Sections of the Revised NEO Personality Inventory (NEO PI-R)

were used to assess participants' personality factors. The original scale includes 240 items that measure participants on the Five Factor Model of personality (Costa & McCrae, 1992). The items that measure Extroversion and Neuroticism were used in this survey, creating a revised 96-item measure. Participants are asked to select one statement for each question that most accurately describes them. Each answer is scored on a scale of zero (*strongly disagree*) to 4 (*strongly agree*), with higher scores indicating a stronger personality factor. NEO PI-R is a commonly used measure for assessing personality factors in a general population. The measure has been shown to have high reliability and validity (Young & Schinka, 2001).

Facebook use. The Facebook Questionnaire (Ross et al., 2009) was used to assess types and levels of Facebook use. The Facebook Questionnaire includes 35 questions that deal with attachment to Facebook (attitudes toward Facebook, length of membership), uses of Facebook (writing on the Wall, using private messages, posting photos, participating in events, etc.), privacy settings on Facebook (posting of personally identifying information), and time (minutes used per day) on Facebook. Response alternatives range from nine-item multiple choice to yes/no response based on the nature of the item. The main variables used in this study were Activity and Attachment. Facebook Activity was measured by a six-part question that assessed how frequently users commented on other people's photos, posted on other people's walls, checked their own walls, sent private Facebook messages, "poked" others on Facebook, and changed their Facebook statuses. Attachment to Facebook was measured via a six-part question that asked users to agree or disagree with statements such as, "Facebook is a part of my daily activity," "I am proud to tell people I'm on Facebook," and "I would be sad if Facebook shut down.

Procedure

The study was completed using Qualtrics Survey Software. Participants who chose to participate in this study were directed to the Qualtrics survey through a link provided on the Sona-System Research Participation Management System. Participants were able to complete the survey on any computer with access to the Internet. The survey was open to students during the Fall 2011 term and Winter 2012 term (October 2011-March 2012) 24 hours per day. Before beginning the survey, participants were instructed to read and consent to participate in the survey by checking a box. The survey took approximately one hour to complete and participants did not have the option of returning to the survey once it had been completed. Upon completion of all survey questions, participants were taken to a debriefing screen where they were informed of the purpose of the study, and given contact information of the primary investigator and her mentor if they had questions about the study.

Results

Descriptive Statistics

Depression. The CES-D scores revealed mild levels of depressive symptoms in the overall sample (M = 16.58, SD = 7.55, score range: 6 - 47). 51% of the population reported minimal depressive symptoms, 37% of the population reported mild depressive symptoms, and 12% of the population reported major depressive symptoms. We found no significant difference in depression scores between males and females, $t(241) = -0.78$, $p > .40$, with males reporting mild levels of depression (M = 16.23, SD = 7.33, score range: 6 - 38) and females also disclosing similarly mild levels of depression (M = 16.99, SD = 7.81, score range: 7 – 47).

Facebook use. The variables Facebook Activity and Attachment to Facebook were measured for the sample of students (N = 243) that participated in the study. Those participants

who did not have a Facebook when they took the study were not considered in the analysis. Facebook Activity scores (M = 4.51, SD = 1.57, Activity range 1 - 9) revealed that the average study participant used various features of Facebook about once per week. When comparing males to females, a significant difference in scores was discovered, $t(241) = -3.16$, $p < .01$, whereby females reported engaging in more Facebook activity than males. Facebook Attachment scores (M = 3.22, SD = 0.92, Attachment range 1-5) showed that on average, our study population did not confirm or deny attachment to Facebook, but instead took a neutral stance. In a gender comparison of males to females, significant differences were revealed, $t(241) = -3.39$, $p < .01$, and females disclosed greater amounts of Facebook attachment.

Personality factors. The scores from the NEO PI-R showed a mean neuroticism score of 86.35 in the overall undergraduate sample (SD = 21.26, score range: 20 - 136). There was no significant difference in neuroticism scores between males and females $t(241) = -1.77$, $p > .05$, with males reporting a mean neuroticism score of 84.10 (SD = 21.05, score range: 20 - 133) and females reporting a similar mean neuroticism score of 88.93 (SD = 21.39, score range: 38 - 136). The scores from the NEO PI-R revealed a mean extroversion score of 117.49 in the overall sample (SD = 17.69, score range: 63 - 164). A significant difference in extroversion scores between genders was found, $t(241) = -2.20$, $p < .05$, with males displaying slightly decreased levels of extroversion (M = 115.2, SD = 18.85, score range: 63 - 157) and females displaying slightly higher levels of extroversion (M = 120.2, SD = 15.96, score range: 84 - 164).
See Table 1 for correlations between all variables examined.

Multivariate Analyses

The direct association between Facebook use and depression.

***Facebook activity and gender as predictors of depression*.** A series of hierarchical GLM

regressions were used to examine the direct and two-way interaction between Facebook activity and gender as predictors of depression. The main effects model was not significant, $R^2 = 0.00$, $F(2, 240) = 0.48$, $p > .10$. Facebook activity was not associated with depression, $t(241) = 0.59$, $p > .10$. The interaction model was also not significant, $R^2 = 0.00$, $F(3, 239) = 0.45$, $p > .10$.

Facebook attachment and gender as predictors of depression. A series of hierarchical GLM regressions were used to examine the direct and two-way interaction between Facebook attachment and gender as predictors of depression. The main effects model was not significant, $R^2 = 0.01$, $F(2, 240) = 1.70$, $p > .10$. Facebook attachment was not associated with depression $t(241) = 1.67$, $p = .09$. However, a trend indicated that greater Facebook attachment may be associated with greater depression (r = .11). The two-way interaction model was also not significant, $R^2 = 0.00$, $F(3, 239) = 1.13$, $p > .10$.

Extroversion as moderator of the association between Facebook activity and depression.

A series of hierarchical GLM regressions were used to examine the direct, two-way, and three-way interactions between Facebook activity, extroversion, and gender as predictors of depression. The main effects model was significant, $R^2 = 0.15$, $F(3, 239) = 14.18$, $p < .001$. On this model, extroversion was negatively related to depression, $t(239) = -6.44$, $p < .001$. In addition, Facebook activity was positively associated with depression, $t(239) = 2.54$, $p < .01$, suggesting that extroversion exerts a positive suppression effect on the association between Facebook activity and depression. The two-way interactions model was also significant, $R^2 = 0.15$, $F(6, 236) = 7.21$, $p < .001$. However, none of the 2-way interactions were significant. Finally, the model with the three-way interactions model was significant, $R^2 = 0.16$, $F(7, 235) = 6.16$, $p < .001$. However, the three-way interaction between sex, extroversion, and Facebook

activity was not significant, $F(7, 235) = 0.05$, $p > .10$.

Extroversion as moderator of the association between Facebook attachment and depression.

A series of hierarchical GLM regressions were used to examine the direct, two-way, and three-way interactions between Facebook attachment, extroversion, and gender as predictors of depression. The main effects model was significant, $R^2 = 0.16$, $F(3,239) = 14.80$, $p < .001$. On this model, extroversion was negatively related to depression, $t(239) = -6.36$, $p < .001$. In addition, Facebook attachment was positively associated with depression, $t(239) = 2.84$, $p < .001$, suggesting that extroversion exerts a positive suppression effect on the association between Facebook attachment and depression. The two-way interactions model was also significant, $R^2 = 0.15$, $F(6, 236) = 7.36$, $p < .001$. However, none of the two-way interactions were significant. Finally, the model with the three-way interactions model was significant, $R^2 = 0.16$, $F(7, 235) = 6.38$, $p < .001$. However, the three-way interaction between sex, extroversion, and Facebook attachment was not significant, $F(7, 235) = 0.57$, $p > .10$.

Neuroticism as moderator of the association between Facebook activity and depression.

A series of hierarchical GLM regressions were used to examine the direct, two-way, and three-way interactions between Facebook activity, neuroticism, and gender as predictors of depression. The main effects model was significant, $R^2 = 0.41$, $F(3, 239) = 54.\ 83$, $p < .001$. On this model, only neuroticism was related to depression, $t(239) = 12.76$, $p < .001$. The 2-way interactions model was also significant, $R^2 = 0.41$, $F(6, 236) = 27.26$, $p < .001$. However, none of the 2-way interactions were significant. Finally, the model with the three-way interactions model was significant, $R^2 = 0.42$, $F(7, 235) = 24.43$, $p < .001$. The interaction between Facebook

activity, sex, and neuroticism was significant, $F(7, 235) = 4.83$, $p = .02$. Given the 3-way interaction we proceeded to conduct a series of post-hoc analyses to identify the moderator effect. Specifically, we examined the potential moderation of extroversion separately in males and females.

Neuroticism as moderator of the association between Facebook activity and depression in males. A GLM analysis was conducted to examine whether neuroticism moderated the association between Facebook activity and depression in males. The model was statistically significant, $R^2 = 0.45$, $F(3, 126) = 33.39$, $p < .001$. However, the interaction between activity and neuroticism was not significant.

Neuroticism as moderator of the association between Facebook activity and depression in females. A GLM analysis was conducted to examine whether neuroticism moderated the association between Facebook activity and depression in females. The model was statistically significant, $R^2 = 0.39$, $F(3, 109) = 23.43$, $p < .001$. The interaction between activity and neuroticism was significant, $F(1,111) = 3.69$, $p = . 057$. Given this significant interaction, we conducted separated analysis by examining the impact of Facebook use on depression among individuals scoring 1 standard deviation below and above the neuroticism sample mean

The model with females with *low* levels of neuroticism was not significant, $R^2 = 0.00$, $F(1, 17) = 0.03$, $p > .10$, indicating that Facebook activity was not a significant predictor of depression in this population (see Figure 1). However, the model analyzing females with *high* levels of neuroticism was significant, $R^2 = 0.27$, $F(1, 17) = 6.41$, $p < .01$ (see Figure 2). Specifically, Facebook activity was negatively related with depression in this population, $t(17) = -2.53$, $p = .02$.

Neuroticism as moderator of the association between Facebook attachment and depression.

A series of hierarchical GLM regressions were used to examine the direct, two-way, and three-way interactions between Facebook attachment, neuroticism, and gender as predictors of depression. The main effects model was significant, $R^2 = 0.41$, $F(3, 239) = 54.51$, $p < .001$. On this model, only neuroticism was related to depression, $t(239) = 12.57$, $p < .001$. The two-way interactions model was also significant, $R^2 = 0.41$, $F(6, 236) = 27.42$, $p < .001$. However, none of the two-way interactions were significant. Finally, the model with the three-way interactions model was significant, $R^2 = 0.41$, $F(7, 235) = 23.71$, $p <.001$. However, the three-way interaction between sex, neuroticism, and Facebook attachment was not significant, $F(7, 235) = 1.27$, $p > .10$.

Discussion

The main purpose of this study was to explore the relationship between Facebook use, personality factors, and depression among university students. We hypothesized that Facebook activity and attachment would be positively correlated with depressive symptoms. In addition, we hypothesized that the association between Facebook activity/attachment and depression would be moderated by personality factors. Our results partially substantiated our hypotheses. Interestingly, we did not find a linear association between Facebook activity and depression, nor between Facebook attachment and depression. Additionally, we did not discover a general relationship between Facebook activity, extroversion and depression; Facebook attachment, extroversion and depression; or Facebook attachment, neuroticism and depression. However, when examining the association between neuroticism, Facebook activity and depression, we found that in females with high levels of neuroticism, high frequency of Facebook activity was

associated with decreased scores of depression. This is the first study to investigate the association between overall Facebook use and depressive symptoms in any population. Previous knowledge of this subject was unsubstantiated by empirical research. This is also the first study to explore the association between Facebook activity, neuroticism and depression among female college students.

Our examination of the relationship between Facebook use and depressive symptoms suggests the absence of a general correlation between these two variables, even when including gender as a possible influence. This lack of an overall association between Facebook use and depression contrasts the media's overall negative portrayal of the use of social networking sites. A quick web search for "Facebook depression" yields countless news articles from reputable sources that cite studies which, upon further exploration, are unrelated to Facebook use or do not have empirical evidence to support their claims, (i.e. "Could 'Facebook depression' affect you?," 2011; Jaffee, 2011). Several articles cite an article coining the term "Facebook depression" to describe a phenomenon of depressive symptoms resulting from high frequency of activity on SNS, such as Facebook (O'Keeffe, Clarke-Pearson, & Council on Communications and Media, 2011). The citations used by the authors to provide evidence for "Facebook depression" do not provide any empirical evidence for an association between Facebook and depression (O'Keeffe, Clarke-Pearson, & Council on Communications and Media, 2011). Our study is the first of its kind to empirically measure depressive symptoms and Facebook use in any population. The results of this study oppose the popular hypothesis that Facebook use increases depression.

In contrast, our results indicate that more frequent of Facebook activity in females exhibiting high levels of neuroticism seems to be protective against depressive symptoms. There are several other factors that have been shown to relate to the relationship between neuroticism

and depression, including some empathy-related traits (Lee, 2009), perceptions of stressful life events (Conway et al., 2011), and rumination (Roelofs, Huibers, Peeters, & Arntz, 2008). One study explored the idea of creating an ideal self on a popular Internet multiplayer game, and revealed that users of the game tended to create their characters to reflect their ideal selves, rather than their true attributes. This phenomenon was stronger in gamers with lower psychological well-being (Bessière, Seay, & Kiesler, 2007). Facebook is a medium in which users can enhance their presented image through exciting photographs, interesting status updates, and witty commentary. Perhaps individuals with high levels of neuroticism, and especially female individuals that meet this criteria, take comfort in having the control to create an ideal self for presentation through their online profiles.

The interaction between Facebook activity, gender and neuroticism was only significant when considering female participants. Gender differences in neuroticism have been discovered, with women generally having higher levels of neuroticism than men (Richard Lynn & Martin, 1997). Additionally, women use SNSs, including Facebook, in different ways than their male counterparts. In terms of SNS use, women are more likely than men to socialize with existing real-world connections on these sites, while males are more likely to reach out and form new connections via SNS use (Hargittai & Hsieh, 2010). When comparing gender differences on Facebook, women spend more time on Facebook overall (Muise et al., 2009). These differences in use patterns and motivations of SNSs and Facebook, as well as overall gender differences in neuroticism, could potentially explain why only females seem to be affected in the interaction of Facebook activity, neuroticism and depression.

One final finding of this study was the lack of significant gender differences in depression scores obtained through the CES-D. Historically, it has been a widely known fact that

post-pubescent females are more likely than post-pubescent males to develop depression (Kornstein, 1997; Nolen-Hoeksema & Girgus, 1994). However, one study assessed item bias by gender among adults reporting depressive symptoms through the CES-D, and discovered that two items on the scale were gender biased, with one item more likely to be endorsed by females, and another item more likely to be endorsed by males (Stommel et al., 1993). Additionally, more recent research has begun to explore a possible response bias in self-reported depressive symptoms between males and females. Gender-specific differences in opinions on society-imposed gender roles, mental health stigmas, and depression have been noted and show a need for further investigation into depression self-report measures, such as the CES-D (Sigmon et al., 2005). There are several initiatives to increase mental health awareness and provide services for depression on the college campus where this study took place. Perhaps the lack of a significant difference in depressive scores between males and females reflects some gender bias within the CES-D, as well as a changing society in which males feel more comfortable disclosing their feelings and experience less stigmatization in regards to mental health issues.

There were several limitations to our study. The University of Michigan was the only source of subjects for the study, and thus the sample is not reflective of all university students. Future studies should utilize college campuses across the nation, in order to replicate the results obtained in this study with greater validation. Our sample was composed solely of undergraduate students, and the results obtained may vary when considering a population of the same age that is not currently enrolled in college. A more accurate presentation of the interaction between Facebook use, personality factors and depression would result from the use of a population that varied in age and educational status. Additionally, our sample size was relatively small and did not have a great amount of racial-ethnic diversity. Future studies should consider populations

that are larger and more diverse. Self-report measures can be deceiving based on self-perception and reporting bias, so clinical evaluations and personal Facebook observations would lead to a clearer picture of the population being analyzed. Finally, our sample was of an essentially healthy population with generally mild to normative levels of depressive symptoms. Therefore, our understanding of the association between Facebook use, personality factors, and depressive symptoms centers on a population that reports low symptoms of depression.

In summation, our study suggests that there is no association between Facebook use and depression in college students. Additionally, for females exhibiting high levels of neuroticism, Facebook activity can actually have a protective function against protective symptoms. This is the first study to empirically examine the relationship between Facebook use and depression, and its results contradict popular perception of this relationship. We encourage other researchers to continue exploration into this controversial relationship in order to validate the results we obtained. We hope that through future research, the understanding that Facebook use is not associated with depression will become integrated into conversations regarding this relationship.

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Table 1

Summary of Intercorrelations, Means, and Standard Deviations for Scores on the CES-D, NEO PI-R, and Facebook Questionnaire for the Total Population Sample

Measure	1	2	3	4	5	6	*M*	*SD*
1. Age	1.00	0.01	-0.14*	0.04	-0.16*	-0.11	18.81	0.98
2. CES-D		1.00	-0.34**	0.64**	0.05	0.12	16.58	7.55
3. Extroversion			1.00	-0.33**	0.32**	0.19**	117.49	17.69
4. Neuroticism				1.00	0.14*	0.20**	86.35	21.26
5. Facebook Activity					1.00	0.59**	4.51	1.57
6. Facebook Attachment						1.00	3.22	0.92

Note. CES-D: Center for Epidemiologic Studies Depression Scale; NEO PI-R: Revised NEO Personality Inventory.

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

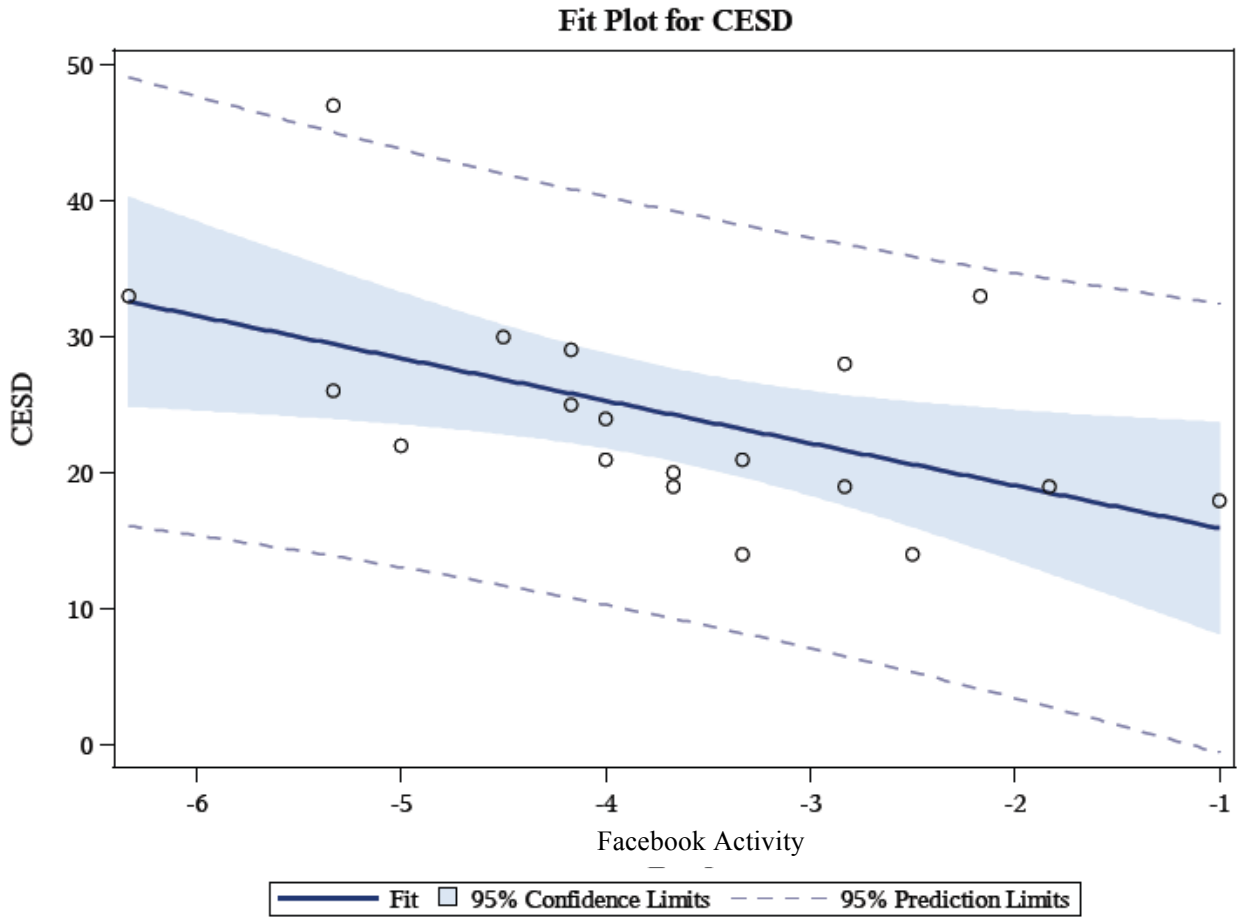

Figure 1. Fit plot for CES-D scores versus Facebook Activity in females with high neuroticism scores.

Note. CESD: Center for Epidemiologic Studies Depression Scale.

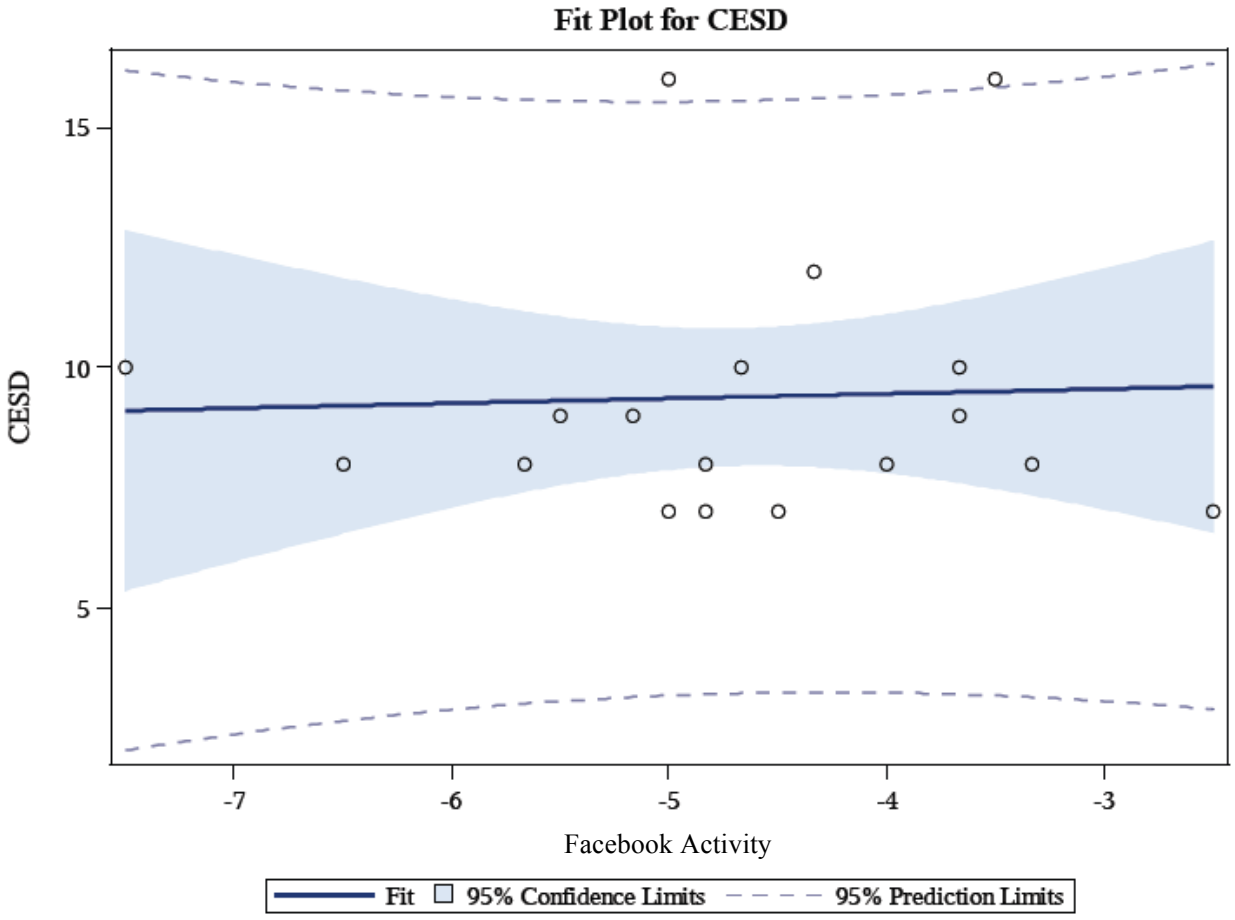

Figure 2. Fit plot for CES-D scores versus Facebook Activity in females with low neuroticism scores.

Note. CESD: Center for Epidemiologic Studies Depression Scale.