



# The effects of personality traits, self-esteem, loneliness, and narcissism on Facebook use among university students

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## ABSTRACT

This study examined the relationship between three of the “Big Five” traits (neuroticism, extraversion, and openness), self-esteem, loneliness and narcissism, and Facebook use. Participants were 393 first year undergraduate psychology students from a medium-sized Australian university who completed an online questionnaire. Negative binomial regression models showed that students with higher openness levels reported spending more time on Facebook and having more friends on Facebook. Interestingly, students with higher levels of loneliness reported having more Facebook friends. Extraversion, neuroticism, self-esteem and narcissism did not have significant associations with Facebook use. It was concluded that students who are high in openness use Facebook to connect with others in order to discuss a wide range of interests, whereas students who are high in loneliness use the site to compensate for their lack of offline relationships.

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## 1. Introduction

As well as providing access to information, the Internet has enabled people to establish and build relationships with others. Social networking sites, such as Facebook, are one method people use to connect with others socially on the internet (Bonds-Raacke & Raacke, 2010). Facebook is the predominant social networking site with more than 500 million active users (Facebook website, 2011). Typical users will spend anything from less than 10 min to more than 2 h per day on Facebook (Christofides, Muise, & Desmarais, 2009; Orr et al., 2009; Pempek, Yermolaveya, & Calvert, 2009; Raacke & Bonds-Raacke, 2008; Ross et al., 2009). One group that uses social networking sites extensively, particularly Facebook, is university students. Recent studies have found that over 90% of university students have Facebook accounts (Cheung, Chiu, & Lee, 2010; Pempek et al., 2009), and while it can be used to facilitate study students mainly use it to communicate with friends, look at photos and user profiles of other persons, and to pass the time, avoid boredom and procrastinate (Pempek et al., 2009).

### 1.1. Personality and social networking

Over the past 3 years there has been a substantial increase in the number of peer-reviewed articles on social networking sites appearing in the literature. Several of these studies have investi-

gated how psychological factors such as personality traits influence the use of social networking sites (Amichai-Hamburger & Vinitzky, 2010; Correa, Willard Hinsley, & Gil se Zuniga, 2010; Ross et al., 2009; Ryan & Xenos, 2011; Wilson, Fornasier, & White, 2010). This research has typically involved the Five Factor Model or “Big Five” model of personality (FFM; Costa & McCrae, 1992) which posits that most of the variability in personality can be captured by five overarching dimensions: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. In general, researchers have used cut-off scores to divide participants into low and high trait groups and compared their mean time spent using social networking sites. However, this practice of dichotomising continuous variables is not recommended since it can hide meaningful relationships by reducing effect size and wasting statistical power (MacCallum, Zhang, Preacher, & Rucker, 2002).

Two of the most cited studies examining the relationship between the “Big Five” personality traits and Facebook are those of Ross et al. (2009) and Amichai-Hamburger and Vinitzky (2010). Ross et al. examined the effects of the “Big Five” on Facebook usage among 92 undergraduate students and found that participants who reported higher levels of extraversion were members of more groups on Facebook than those with lower extraversion levels, but no significant differences were found in the mean number of friends, time spent using Facebook, or the use of communicative features (e.g., messages) on Facebook. It was suggested that extraverts engage in more social activities on and off Facebook and use Facebook to maintain and enhance ties, but do not use Facebook as an *alternative* to social activities. Amichai-Hamburger and Vinitzky partially replicated the Ross et al. study using a larger sample of

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237 undergraduate students and found that participants high in extraversion reported having more friends compared to those low in extraversion. Consistent with Ross et al., Amichai-Hamburger and Vinitzky concluded that individuals transfer their offline behaviour online, which would explain the smaller social networks for introverts and the larger friends count for extraverts.

Neuroticism has been found to affect how individuals use Facebook but not the number of friends or groups memberships. For instance, Ross et al. (2009) reported that individuals with higher neuroticism levels were less willing to share personal information on Facebook, but preferred posting on the wall compared to uploading photos. This was attributed to autonomous and asynchronous nature of the wall, which allows individuals to control what is posted, when it is posted and for how long. Amichai-Hamburger and Vinitzky (2010) revealed that participants in the high neuroticism group were more inclined to upload photos than the low neuroticism group. In fact, participants with low and high levels of neuroticism were more inclined than the middle cohort to share personal information, though probably for different reasons.

The results from the remaining three traits indicated that individuals who score high on the openness use more features on Facebook compared to those individuals with low openness (Amichai-Hamburger & Vinitzky, 2010). It has been suggested that individuals with high openness would have wider interests and are more willing to pursue those interests, which Facebook permits. However, contrary to expectations, high agreeableness was not associated with having more friends on Facebook. Moreover, evidence for differences in Facebook use between low and high conscientiousness groups has been mixed.

Despite these findings, there is an emerging consensus that broad approaches to personality such as the FFM may not be the best predictors of online behaviour and that more specific individual difference constructs such as narcissism and loneliness may be preferable (Amichai-Hamburger & Vinitzky, 2010).

### 1.2. Other psychological factors predicting Facebook use

Researchers are increasingly investigating the relationship of psychological constructs other than the “Big Five” personality traits on social networking use. These include self-esteem (Ellison, Stenfield, & Lampe, 2007; Kalpidou, Costin, & Morris, 2011; Mehdizadeh, 2010; Wilson et al., 2010), loneliness (Amichai-Hamburger & Ben-Artzi, 2003; Kraut et al., 1998) and narcissism (Buffardi & Campbell, 2008; Mehdizadeh, 2010). There are mixed findings regarding the association between self-esteem and the use of social networking sites. For instance, in a sample of 100 university students, users with low self-esteem were found to check Facebook more often and spend more time on Facebook (Mehdizadeh, 2010). This finding is consistent with Ellison et al. (2007) who suggested that Facebook may help to compensate for low self-esteem, allowing these students to build social capital. In contrast, Gonzales and Hancock (2011) used analysis of variance (ANOVA) to analyse data from 63 students and reported that Facebook has a positive impact on self-esteem. Gonzales and Hancock put forward the argument that creating and updating one's profile enhances self-esteem because users can select what information they present about themselves, and presenting only positive characteristics will enhance self-esteem. However, other studies have reported no significant association between self-esteem and Facebook variables (Kalpidou et al., 2011).

There has also been debate regarding the direction of causality in the relationship between loneliness and Internet use. Kraut and colleagues put forward the concept of the *internet paradox*, in which increased internet use was associated with greater feelings of loneliness (Kraut et al., 1998). On the one hand, high internet usage can isolate an individual physically, leading them to

experience increased loneliness (Kim, LaRose, & Peng, 2009). Conversely, individuals predisposed to loneliness have been found to engage in greater internet usage (Amichai-Hamburger & Ben-Artzi, 2003). This is likely to be because the internet provides individuals who are lonely with an opportunity to gain access to and interact with others online via social networking sites.

Given that users are encouraged to self-disclose when developing their user profiles or engaging with others on social networking sites, naturally researchers have investigated the role of narcissism in the use of such sites. For instance, Buffardi and Campbell (2008) found that higher levels of narcissism predicted more social interaction online and more information posted up about the self. Narcissists also tend to check their profiles more often and spend more time on Facebook (Mehdizadeh, 2010). It is likely that narcissists are drawn to the high levels of control available on social networking sites such as Facebook, because this allows them to present selected information to others and withhold other information. This is consistent with the notion that users in name identified environments such as Facebook have a preference for implicitly showing others who they are through uploading photos and joining certain groups rather than explicitly having to tell them via the About Me function (Zhao, Grasmuck, & Martin, 2008).

Although researchers are currently investigating associations between psychological factors and the use of social networking sites, it is important to note that one limitation in the literature has been the narrow focus of studies which have only examined the effects of one or two psychological variables on social networking site use, and not the simultaneous effects (i.e., the effect of extraversion in the presence of neuroticism) of multiple variables. Only a small number of studies have included measures of the “Big Five” personality traits alongside other psychological factors such as self-esteem, narcissism and loneliness. In one of the few studies to address this gap in the literature and investigate the relationships between multiple psychological variables and Facebook use, Ryan and Xenos (2011) investigated the “Big Five” personality traits, shyness, narcissism, loneliness and Facebook usage in a sample of 1635 self-selected Australian Internet users. The results from their online questionnaire showed that Facebook users are more extraverted and less conscientiousness than non-Facebook users. Facebook users also reported higher mean levels of narcissism compared to non-Facebook users. Yet it should be noted that a closer inspection of the results revealed only very weak relationships between Facebook use measures and the “Big Five” traits, shyness, loneliness and narcissism. There is a clear need for more research examining the simultaneous effects of multiple psychological factors on the use of social networking sites such as Facebook, particularly because it is likely that the behaviours do not have simple causes, but are multiply determined by a large number of interacting individual differences and contextual variables.

### 1.3. Use of appropriate statistical models and sample size issues

Another significant weakness of many Facebook studies is reliance on small samples (i.e.,  $N < 100$ ) and use of mean comparison designs instead of data models. Some researchers have used multiple regression, thus avoiding the compromise of dichotomising continuous variables. This also has the advantage of testing for the simultaneous effects of multiple predictors (e.g., the effects of extraversion in the presence of the effects of neuroticism). However, the studies that have used such techniques have used ordinary least squares regression which is a standard analysis of most statistical packages. Yet, many of the outcome variables for Internet use (such as time spent online or number of friends on Facebook) are count variables for which such methods are not suitable. Count variables take on only positive integer values or zero. Their distributions arise from different processes and are

typically positively skewed and overdispersed (having greater variance than would be expected form a normal distribution with otherwise similar parameters) (0, 1, 2; Coxe, West, & Aiken, 2009). Such variables should not be used in standard regression techniques as they violate the assumptions of normality and homoscedasticity, and require slightly different methods to estimate the model parameters. Although it is sometimes possible to transform data to meet the assumptions of ordinary linear regression, Gardner, Mulvey, and Shaw (1995) suggest that researchers consider regression models that capture the natural features of the data. One such model for count data is Poisson regression. However, unless certain assumptions such as equidispersion (i.e., conditional mean and variance are equal) are met, this method can produce misleading results. Therefore, the current study will use an alternative to the Poisson regression called Negative Binomial regression, which accounts for overdispersion by allowing unexplained variability among individuals (see Coxe et al., 2009).

#### 1.4. The purpose of this study

The purpose of this study was to address the gaps in the literature and examine the simultaneous effects of three of the “Big Five” traits (i.e., neuroticism, extraversion and openness), self-esteem, loneliness and narcissism on Facebook. To illustrate a statistical method better suited to modelling the outcome measures associated with Internet use we utilised a Negative Binomial regression technique.

## 2. Method

### 2.1. Participants

The participants were first year undergraduate psychology students from a Melbourne metropolitan university. Five hundred and forty-eight students participated in the study. Of these, 94% had Facebook accounts. Participants' data were not included in the analyses if they had more than 10% missing data. The final sample comprised 300 women and 93 men with an average age of 20.59 years ( $SD = 5.17$ ). The entire final sample had Facebook accounts.

### 2.2. Measures

The scales administered in the current study included measures of Facebook use and the “Big Five” personality traits described below. These were delivered online using *Opinio* online survey software package (Opinio, 2011).

#### 2.2.1. The Facebook Questionnaire (FQ; Ross et al., 2009)

The FQ is a 28-item questionnaire developed by Ross et al. (2009) and was designed to measure basic Facebook use, attitudes towards Facebook and information relating to the posting of personal information. Basic use items were designed to collect information about the use of common functions on Facebook, such as time spent using Facebook, number of Facebook friends, preferred functions (e.g., wall, messages) and reasons for using Facebook (e.g., to communicate with friends). Multiple items were used to assess the different attitudes towards Facebook (e.g., ‘I feel out of touch when I haven't logged onto Facebook for a while’ and ‘I would be sad if Facebook shut down’). Participants were also asked to indicate whether they had posted personal information on their profiles, including their phone number and mailing address. Response formats on this tool ranged from dichotomous item to five-point rating scales with a number of items requiring a numeric response.

#### 2.2.2. Australian Personality Inventory (API; Murray et al., 2009)

The API comprises 50 items drawn from the International Personality Item Pool (IPIP) with ten items associated with each of the “Big Five” traits, namely neuroticism (e.g., ‘Panic easily’), extraversion (e.g., ‘Make friends easily’), openness (e.g., ‘Have a vivid imagination’), agreeableness (e.g., ‘Respect others’) and conscientiousness (e.g., ‘Am always prepared’). Participants were asked to indicate their responses on a five-point scale with responses ranging from 1 (very inaccurate) to 5 (very accurate). Scores were summed for the positively worded items and averaged for each trait, with higher scores indicating higher levels of that particular trait.

#### 2.2.3. Rosenberg's self-esteem scale (Rosenberg, 1965)

The Rosenberg self-esteem scale is a 10-item scale measuring how one feels about oneself. Five of the items were positively worded, while the other five items were negatively worded. Participants were asked to indicate their responses on a four-point scale with responses ranging from 1 (Strongly Disagree) to 4 (Strongly Agree). The scores were averaged for the positively worded items, where higher scores on this measure corresponded to higher levels of self-esteem.

#### 2.2.4. Narcissism Personality Inventory – 16 item version (NPI; Ames, Rose, & Anderson, 2006)

The NPI is a short version of the NPI-40, which is a 40-item measure. The 16-item version is a reliable and valid measure of narcissism which asks participants to select the most appropriate response from a pair of items and respond on a dichotomous response format either ‘0’ for narcissism-inconsistent responses or ‘1’ for narcissism consistent responses. These scores were summed, with higher scores on the NPI-16 indicating higher levels of narcissism.

#### 2.2.5. The UCLA Loneliness Scale Version 3 (Russell, 1996)

The UCLA Loneliness Scale Version 3 is a 20-item measure of loneliness that has been found to be both reliable and valid among undergraduates. Participants were asked to indicate their responses on a four-point scale ranging from 1 (Never) to 4 (Always). The scores were averaged for the positively worded items with higher scores on this measure corresponding to higher levels of loneliness.

### 2.3. Procedure

Ethical approval for the current research was obtained from the university's Human Research Ethics Committee. Participants were invited to take part in the research during the first week of tutorials via an information sheet distributed in class by their tutor. The sheet emphasised that (a) students' participation in the survey was voluntary, (b) all processed data would be anonymous, (c) their decision to participate (or not) would not affect their academic evaluation/relationship with the university, (d) they were free to discontinue participation at any time, and (e) they were free to omit any questions they did not wish to answer. Participants who agreed to be involved in the study were able to access the online questionnaire through their portal on the university learning management system, where they were directed to the URL for the questionnaire. Return of a completed online questionnaire was taken as consent to participate in the research. Participants completed the survey during the first week of semester at a location and time of their choosing. Data were downloaded at the end of the first week.

### 3. Results

Data were analysed using SPSS Version 19.0 and Mplus Version 6.0. Prior to analysis, data were screened for missing values, outliers and out of range values. Frequencies and descriptive statistics were generated for each of the variables and a random sample of 10% of participants checked for data entry errors. Missing data was replaced with the Full Information Maximum Likelihood (FIML) estimation method.

The mean time spent using Facebook per day was 66.15 min ( $SD = 62.18$ ). The typical time spent of Facebook ranged from 20 to 90 min per day with half of the sample falling within this range. There was one exceptionally high user who spent 500 min using Facebook per day. The average number of Facebook friends and Facebook groups was 349.97 ( $SD = 226.38$ ), and 66.10 ( $SD = 211.62$ ) respectively. The wall (35.1%) was the most preferred function, followed by message (18.3%), photos (17.0%) and events (15.0%). In response to the question, ‘Why do you like Facebook?’, over half reported that ‘It is how I communicate with my friends’ (56.1%), with 17.3% suggesting that it is allow he/she to communicate with people from their past. Only 4.9% suggested it provides them with information. The means, standard deviations and inter-correlations for the psychological variables and Facebook measures can be seen in Table 1.

One-factor congeneric models were conducted in order to ensure unidimensionality of predictor variables prior to the testing the two regression models. The first negative binomial regression was performed between time spent on Facebook per day as the outcome variable, and neuroticism, extraversion, openness, self-esteem, loneliness and narcissism as the predictors. As can be seen in Table 2, the results showed that openness was the only significant predictor of time spent on Facebook per day. Participants who scored high on the openness trait tended to report spending more time on Facebook per day. More specifically, for a one unit increase in openness, time spent using Facebook per day is multiplied by 1.20. Although none of the other predictors were significant, it should be noted that self-esteem and narcissism were approaching significance.

A second negative binomial regression with number of friends as the outcome variable revealed that openness and loneliness were significant predictors. Participants who scored high on the openness trait and loneliness reported having more friends on Facebook respectively. For a one unit increase in openness and loneliness, number of friends will be multiplied by 1.25 and 1.14 times respectively. However, no significant relationships were found for Neuroticism, Extraversion, Self-esteem or Narcissism (see Table 2).

**Table 2**

Unstandardised regression coefficients and standard errors for the different psychological predictors and outcome variables.

Predictors	B	SE	p
<i>Time spent on Facebook per day</i>			
Neuroticism	-.09	-.06	.14
Extraversion	.07	.12	.55
Openness	<b>.18</b>	<b>.09</b>	<b>.05</b>
Self-esteem	-.18	.10	.06
Loneliness	.13	.10	.16
Narcissism	.20	.11	.08
<i>Number of friends</i>			
Neuroticism	.06	.04	.16
Extraversion	.11	.09	.19
Openness	<b>.22</b>	<b>.07</b>	<b>.00</b>
Self-esteem	-.01	.07	.90
Loneliness	<b>.13</b>	<b>.07</b>	<b>.05</b>
Narcissism	-.05	.07	.46

Note:  $N = 393$ . Bold values are significant at the  $p < .05$  level.

### 4. Discussion

The purpose of this study was to examine the simultaneous effects of three of the ‘‘Big Five’’ personality traits (i.e., neuroticism, extraversion and openness), self-esteem, narcissism and loneliness on Facebook use using a Negative Binomial regression model. The results showed that higher levels of openness were associated with spending more time and having more friends on Facebook. Moreover, higher loneliness levels were associated with having more friends on Facebook. However, extraversion, neuroticism, self-esteem and narcissism were not found to be associated with Facebook use, though self-esteem and narcissism had correlations with time spent per day using Facebook approaching significance.

The finding that individuals with high openness spend more time and have more friends is consistent with previous research (Amichai-Hamburger & Vinitzky, 2010). According to Amichai-Hamburger and Vinitzky, individuals high in openness have a wider range of interests and are more prepared to pursue those interests. The openness measure used in this study contained items about a vivid imagination, higher level conversations and desire to discuss new ideas. One plausible explanation for the significant association between openness and Facebook use is that Facebook provides high openness individuals access to similar people, interest groups and networks in a medium well suited to explore and discuss their wide range of interests.

Given that students who felt lonely reported having more friends, it may be that these same individuals are attempting to access and interact with others online to compensate for their lack of

**Table 1**

Means, standard deviations and intercorrelations between psychological predictors and Facebook use measures.

	M	SD	1	2	3	4	5	6	7	8	9	10
1. Time spent per day	66.15	62.18	1	.19***	.25***	.09	.13*	.00	-.05	-.10	.10*	-.09
2. Number of logins	4.81	5.97	.19***	1	.12*	.14**	.09	-.00	.11*	-.07	.07	-.05
3. Number of friends	349.97	226.38	.25***	.12*	1	.19***	-.01	-.24***	.02	.04	-.17***	-.21***
4. Number of groups	66.10	211.62	.09	.14**	.19***	1	.14**	-.10	.07	-.07	.08	-.07
5. Neuroticism	2.48	.86	.13*	.09	-.01	.14**	1	.25***	-.08	-.61***	.51***	.05
6. Extraversion	2.62	.81	.00	-.00	-.24***	-.10	.25***	1	-.33***	-.41***	.50***	.44***
7. Openness	3.69	.59	-.05	.11*	.02	.07	-.08	-.33***	1	.25***	-.07	.32***
8. Self-esteem	3.07	.60	-.10	-.07	.04	-.07	-.61***	-.41***	.25***	1	-.51***	-.29***
9. Loneliness	2.41	.61	.10*	.07	-.17**	.08	.51***	.50***	-.07	-.51***	1	.11
10. Narcissism	1.71	.21	-.09	-.05	-.21**	-.07	.05	.44***	-.32***	-.29***	.11	1

Note:  $N = 393$ .

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .



offline relationships. The finding of a significant effect of loneliness is consistent with Ellison and colleagues' (2007) theory that individuals with low social capital use Facebook to build social capital. In this case, social capital refers to bridging capital, or individuals outside of one's immediate circle of family or friends who provide access to useful information or new perspectives. It could be that having more friends on Facebook also allows individuals to have access, indirectly, to the friends of their friends via status updates, comments and photos, making them feel more connected to others and reducing their sense of isolation.

It was surprising to find that self-esteem and narcissism were not significantly related to time spent and number of friends on Facebook, though they were approaching significance. These two variables appear to be closely associated with the notion of *impression management*, or attempts to control information in order to affect other people's opinion of oneself (Goffman, 1959). Impression management on Facebook tends to be done implicitly by having certain friends, belonging to certain groups, uploading selected pictures and removing tags from others, and "checking in" at certain places or locations. Given the *p* values of .06 and .08 for self-esteem and narcissism respectively, further work should consider the use of confidence intervals or combining the evidence across multiple studies involving Facebook as an approach to determine the extent to which these variables have an effect of Facebook use (see Cumming, 2011).

In addition to the surprising (lack of) results for self-esteem and narcissism, the lack of a significant association between extraversion and Facebook use was consistent with the findings of Ross et al. (2009). One explanation for the absence of an association between extraversion and number of friends may be that extraverts use Facebook to voice their opinions and share information with others, but not to establish new relationships online. Furthermore, the non-significant association between neuroticism and Facebook use may be explained by the view that individuals with high and low neuroticism levels spend the same amount of time on Facebook, but have different motives for using Facebook and use different features. Individuals with high neuroticism levels may post photos to receive some assurance from others, while those with low neuroticism are less concerned about negative feedback (cf. Amichai-Hamburger & Vinitzky, 2010).

This paper has shown that it is relatively straightforward to conduct and interpret analyses which are more appropriate for typical Facebook data than the more commonly used linear regression. The general problems with applying ordinary least squares regression to count data are well documented, although much more detailed studies would need to be done to determine whether Facebook studies that use these less optimal techniques are producing misleading conclusions or are "near enough."

The results from this study raise some interesting questions for educational researchers. The data were collected from a university cohort in the context of a class project. There were questions asking students to describe their use of Facebook, yet there was little or no indication that Facebook was being used to directly support any academic activities. Furthermore, respondents indicated that Facebook was often used as a means of taking a break or as a distraction from study. Since collecting our data, correlational studies have indicated a negative impact of Facebook use on grades (Junco, 2012). It is clear that Facebook is a tool that allows students to connect with others who share similar interests, and much of a speculative nature has been written about using social media to support educational aims. Given the interest in using new media and social networking to informally support learning (Fewkes & McCabe, 2012) or even manage learning (Wang, Lit Woo, Lang Quek, Yang, & Liu, 2012) future research should consider whether Facebook promotes social engagement in a manner that might increase academic engagement, or whether it operates as a distracting influ-

ence in which students turn to Facebook to avoid academic tasks as the modal responses in our survey indicates.

#### 4.1. Limitations

One of the main limitations of this study, and social networking research more generally, is the lack of good theory and data concerning the optimal method for operationalising Facebook use. For instance, time spent using Facebook per day is often employed as an indicator of usage, but this does not exactly capture the extent to which one actively uses Facebook. For example, individuals may log into Facebook once per day and sporadically check their account throughout the day, while others may log in multiple times per day and spend several minutes each time checking the news feed, wall posts, friends' profiles and personal messages. Yet it is not clear which of these use Facebook more, nor whether volume, frequency, duration and pattern of usage correlate uniquely with psychological constructs. Indeed, Kalpidou et al. (2011) argues that we should be looking at friends and not measures of Facebook such as time spent online. Accordingly, it may be that we need to create a formative index comprising several indicators such as time spent online, number of friends, number of groups, etc. However, it can be difficult at times to draw meaning from these aggregate indexes. That is, in the absence of a theory we start data-mining for an indicator that generates high correlations without knowing why it generates those correlations.

Another limitation of the current research was that we exclusively tested direct effects, though it is likely that these variables interact with each other to have a combined effect on Facebook use. There is some evidence in the literature on combinations of personality traits and how different combinations are related to different coping behaviours (Vollrath & Torgesen, 2000). A third limitation refers to the use of cross-sectional data, which means that we cannot be certain of the causal directions of the significant relationships. Future research should collect multiple waves of data in order to test longitudinal models with autoregressive and cross-lagged effects, which would provide an indication of the causal direction of the relationships between psychological variables and measures of Facebook.

#### 4.2. Conclusion

After examining the simultaneous effects of several psychological variables using a regression model especially suited to Facebook usage data – the negative binomial regression model, it appears that other psychological factors in addition to personality traits captured by the "Big Five" are associated with Facebook use. This study has revealed that students with open personalities use Facebook to connect with others in order to discuss their wide range of interests, whereas lonely students use the site to compensate for their lack of offline relationships. Future research should consider collecting multiple waves of data to test the causal direction of the relationships between psychological variables and Facebook measures.

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