Final Report

A Study on How Personality Drives Social Media Use and Its Subsequent Effects on Loneliness

Members

Chen Ken
Chia Yu Ying
Daniel Tan Jun Hao
Justin Peng Zheng Wei
Kong Yik Khuen
Ryan Chua Jie Jian

Introduction

Social media has been growing in the past few decades and has become an indispensable part of our lives. Studies have found that roughly 84.8% of the total population of Singapore are social media users, which is a relatively high penetration rate compared to the rest of ASEAN countries (Ng, 2021). According to the proposed definition by Kent, social media is interpreted as 'any interactive communication channel that allows for two-way interaction and feedback.' (Kent, 2010). It has provided an alternative way for us to interact with other parties without having to meet up face-to-face. Some research claims that social media serves as an added avenue that aids in daily social interactions, with identified benefits of improving communications and increasing availability of resources to be shared (Moorhead et al, 2013).

With the exploding popularity of social media, the effects of the use of social media have become an increasing concern for many. A study by Savcu and Aysan in 2016 found that there was a positive correlation between social media usage and loneliness (Savci & Aysan, 2016), suggesting that the more a person uses social media, the more lonely the person tends to feel. A recent review by Schønning compiles a total of 79 studies conducted on social media and its effects on people's mental wellbeing (Schønning, 2020). Even though these studies have relatively large coverage on different aspects, this review paper has identified a lack of research done on how personality can be an additional factor when it comes to the use of social media. There is a lot of potential to be discovered by looking at personality in the study of the effects of social media usage.

With the studies mentioned above as our theoretical foundation, we intend to explore how personality drives social media use and its subsequent effects on loneliness. Taking into account both of the studies, we propose that extroverts who seek interactions through social media would be more likely to experience higher levels of loneliness due to them having a high social media usage. Similarly, we expect that introverted social media users who do not seek interactions as much as their extroverted counterparts have lower levels of social media usage and thus leading them to have lower levels of loneliness (Harbaugh, 2010). This study will in turn provide greater insights on whether the level of loneliness social media users experience is mediated by their personalities. This information would allow us to further propose solutions to the loneliness issues associated with social media usage based on the users' personalities.

Literature Reviews, Concept Explication, and Hypothesis

Personality Difference on Social Media Usage

By Holzman's definition, personality is a characteristic way of thinking, feeling, and behaving (Holzman, 2020). Based on the fundamental idea that people can be distinguished by their individual behaviour characteristics, we seek to understand how people's personalities play a role when it comes to the usage of social media. Among the five dimensions of personalities, the measure of Extraversion is most strongly related to interpersonal information seeking, which reflects the tendency and intensity in which someone seeks interaction, particularly with their social environment (Lim, 2020). Hence, we decided to look at personality in terms of the level of extraversion and observe how this is related to a person's social media usage.

A study by Dhar and Jha argues that extroverted people are more adventurous in nature and that they crave to connect with people around the globe instantly (Dhar & Jha, 2014). Hence, many of them turn to social media when seeking to connect with other individuals due to the convenience and far reach of social media. However, others argue that introverts also benefit from social media as they can express themselves more comfortably unlike in face-to-face interactions (Voorn & Kommers, 2013). A study conducted by Elon University found that users who were more extroverted tend to spend more time on Facebook (Harbaugh, 2010), but there are not many studies of this type.

In recent years, other popular social media platforms such as Tiktok have risen in popularity and have acquired a large user base (Auxier & Anderson, 2021), which has caused significant changes to the current distributions of social media usage amongst the various platforms. Therefore, instead of focusing on one particular social media platform, we decided to study a broader range of platforms. As the overall study is centered around the frequency of social media usage and the user's loneliness, it is beneficial to know whether the personality variable is forming distinctions in social media usage and thus leading to disparate levels of loneliness in later findings. Hence, we postulate that:

- H1: Extroverts will report higher levels of social media usage compared to Introverts

Effect of Social Media Usage on Loneliness

As social media becomes an integrated part of a significant number of people's lives (Dean, 2021), many have been concerned with the potential effects that high SMU has on people, which

results in numerous studies trying to understand the detrimental effects social media have on people psychologically. Social media usage can be said to have taken the time away from other life commitments. A study conducted between 2011 - 2012 on undergraduate students in 3 countries (LaRose et al, 2014) observed the effects of connection overload and how connection demands eventually result in negative effects on the students. Connection overload is described in this study as when the demands of maintaining and updating social media have detrimental effects on a person's life. The conclusion of this study suggests that while social media usage can have positive effects on the mental wellbeing of its users when connection overload occurs, the effects of social media then turn detrimental. The study also observed that the commitment to social media has taken up time that could have been spent on other activities, which relates to what is known as the displacement hypothesis. The displacement hypothesis brought up in the study predicts that the use of social media reduces the well-being of people due to the time that could have been used to interact with friends being taken up by browsing social media content instead, which results in a drop in the quality of personal relationships (Valkenburg & Peter, 2007). Several studies (Bernd & Keefe, 1995; Lodder et al., 2015; Pinquart & Sörensen, 2001; Youssef et al, 2020) have shown a strong negative correlation between the quality of friendship and loneliness (Lodder et al., 2015). The same hypothesis also holds among the elderly. (Pinquart & Sörensen, 2001) That being said, the quality of relationships is evidently an important factor affecting the level of loneliness. From all the above studies, we can then relate the drop in the quality of relationships with an increase in loneliness felt by social media users.

Another research conducted by Aysan and Savci using the UCLA loneliness scale supports that SMU has a positive correlation to loneliness. Their hypothesis, impulsivity leads to more social

media usage and this increase in usage leads to an increase in loneliness was statistically supported by their findings (Savci & Aysan, 2016). A positive correlation between Problem Social Media Usage (PSMU) and loneliness is also found in research conducted by Marttila, Koivula, and Räsänen. The research asks straightforward questions, such as 'Are you lonely?', instead of utilizing the UCLA loneliness scale, (Victor & Yang, 2012). Although different tools of measurement for loneliness were used, their findings agree that an increase in loneliness as the usage time of social media increases. Based on the above analyses, it is reasonable to hypothesize that:

- H2: Frequency of social media use is positively associated with loneliness

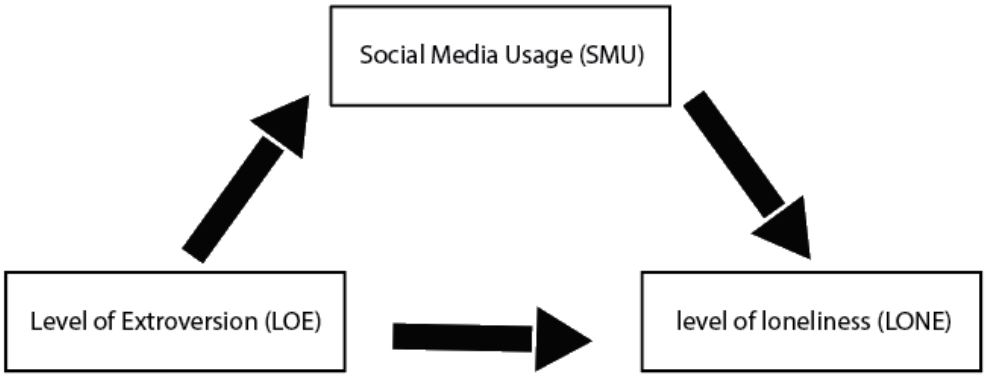
Effects Personality has on Loneliness through Social Media Usage

A study on loneliness and the big five personality traits (extraversion, agreeableness, conscientiousness, neuroticism, and openness) has reported that out of the 5 personality traits, extraversion and neuroticism were shown to have the strongest relationship with loneliness. (Buecker et al., 2020) That is to say, an average lonely person is more introverted and neurotic than an average non–lonely person. That being said, this study suggests that lower extraversion predicts higher loneliness. From all the above studies reviewed, we found that extroverted social media users tend to have more social media usage as compared to introverts as extroverts more often seek interaction with other people, which results in them utilizing social media as a way of reaching out to others. On top of this, a study conducted in 2016 suggests a positive correlation between social media usage and loneliness (Savci & Aysan, 2016). Furthermore, a Scoping Review (Schønning, 2020) which has assembled a total of 79 studies relating to social media use

and mental health among adolescents has identified that there is a lack of research in this field regarding how factors such as the personality of an individual affect their social media usage. Hence, this explains our interest in exploring this research area on how different personalities affect the mental well-being of people.

We would like to propose that personality alone is not the sole reason that affects the level of loneliness of a person. Instead, we would like to investigate how personality, specifically level of extraversion, affects the loneliness of a person through the difference in the frequency of their social media usage: [P (personality) → S (social media usage) → L (loneliness)]

No existing studies have looked at this relationship between these 3 variables and we think that doing this study will allow us to better understand the relationship the users have with social media. This brings us to our research question:



- RQ: The effect of level of extraversion on loneliness is mediated through the frequency of social media usage

Hypothesis:

- H1: Extroverts report higher levels of social media usage compared to Introverts
- H2: Frequency of social media use is positively associated with loneliness
- RQ: The effect of level of extraversion on loneliness is mediated through frequency of social media usage

Methods

As this study looks at the relationships of time spent on social media, the loneliness associated with social media usage, and the personality of the users, we believe that a survey is the most appropriate method to use for this research. This survey's format and content are largely based on multiple research papers that look at social media and loneliness (Ahn & Shin, 2013; *UCLA Loneliness Scale (version 3)*; BFI questionnaire). Our survey was in the form of multiple questions to assess these 3 main variables: time spent on social media, levels of loneliness the participants are experiencing, and whether they are extroverted or introverted. Details of the questionnaire are listed in Annex.

Samples

For this study, we used convenience sampling by conducting an online survey using Microsoft form sent via emails. The consent was taken at the start of the Microsoft form when the participant indicates that they have fully understood and agreed to the consent form by clicking an ' agree' option before they were allowed to access the survey questions. A debrief is done at

the end of the form to explain the purpose of the questions used in the survey as well as the contact details of the investigators. The data obtained were from individuals from Singapore University of Technology and Design (SUTD), where the pool of participants consisted of mostly undergraduate students, some graduate students and faculty members. This sample pool is likely to contain a higher percentage of students who are considered digitally savvy as they were born in an era with internet access and have high accessibility to current technologies such as social media.

Variables

Social Media Usage

We took reference from the study (Ahn & Shin, 2013) regarding social media usage, and measured the time spent on social media using a Likert-type scale. The Likert-type scale is detailed in the following format: The participants' responses are measured in the range from 0 - 4.5 where the intervals are listed as - (0) "Never", (0.5) "less than one hour", (1.5) "about one to two hours", (2.5) "about two to three hours", (3.5) "about three to four hours", (4.5) "more than four hours" in the context of daily basis. However, the individuals taking the survey were not provided with the numerical value of these choices.

As the Ahn & Shin study was conducted in 2013, and since then there have been changes to the way social media interacts with its users. We decided to make some slight changes to the categorized media use in the study to take into account the recent changes to social media. The following are the amended categories to classify the new social media features:

1. Communication use: Posting comments on social networking sites such as Facebook, Twitter, Instagram, Tiktok, and Youtube
2. Communication use: Synchronous text-based messaging such as instant messaging found in platforms like Facebook Messenger, Instagram, and Tiktok Direct Message
3. Communication use: Synchronous voice-based messaging such as Facebook/Instagram direct video chatting and Facebook/Instagram/TikTok/Youtube live and sharing short clips (stories) on Facebook/Instagram/TikTok/Youtube
4. Video use: Watching shared videos on Facebook/Instagram/TikTok/Youtube
5. Reading use: Reading post/news on Facebook/Instagram/Twitter

Loneliness

To collect data on loneliness, we will be taking references from the newer version of the UCLA Loneliness Scale (Russell, 1996). This iteration of the loneliness scale contains a test with 20 items that can measure how often a person feels disconnected from other individuals. The UCLA Loneliness Scale uses a scale that ranges from 1 - 4 as details: 1: “Never”, 2: “Rarely”, 3: “Sometimes”, and 4: “Always”, and the users are required to answer accordingly for all the 20 items. The higher a person scores on the UCLA Loneliness Scale, the more likely a person has difficulty in their social interactions with others.

Level of Extraversion

In order to test if a person’s extraversion affects social media usage and in turn loneliness, we have taken questions for measuring Extraversion from the Big Five Inventory (BFI) to assess

whether the extraversion level of the participants. In a BFI test, the participants are expected to rate themselves on a scale of 1 to 5, 1 being 'disagree strongly' to 5 being 'agree strongly'. The questions ask about certain traits or behaviour that the participants might see about themselves. The scores of questions from the same categories are then added up and divided by the number of questions in the category to give the mean, which is then used to represent the extraversion level of the participants. In this case, a higher score indicates a higher level of extraversion.

Other Variables

One control variable that we keep for this study is that users must use some form of social media. It would not be fair to use a data sample of a person that does not even use social media as social media usage is one of the independent variables that we are looking at, thus, if the user does not use social media they would be an invalid sample.

Another variable that we collected is gender as we do not want to have a population sample that is skewed to any gender since that could be a factor influencing the results of our studies. We also collected the ages of participants in our survey as people from different age groups may utilize social media in different ways and thus may potentially influence the results of our study.

Result and Analysis

Reliability of measures used

We have used Cronbach's alpha test to assess the reliability of our measures. We have calculated Cronbach's alpha of 0.93, 0.67, and 0.85 for the level of loneliness, social media usage, and level of extraversion measure respectively.

Descriptive statistics

Demographic characteristics of participants:

Social Media User

Is a social media user: 113 (99.1%)

Not a social media user: 1 (0.9%)

Gender

Male: 57 (50.4%)

Female: 53 (46.9%)

Others 3 (2.7%)

Age Group

18 year old and below: 3 (2.7%)

19-24 year old: 68 (60.2%)

25-30 year old: 15 (13.3%)

31-40 year old: 14 (12.4%)

41 year old and above: 13 (11.5%)

Mean and SD of each measure:

Level of loneliness: mean = 2.22; sd = 0.52

Social Media usage: mean = 1; sd = 0.67

Level of Extraversion: mean = 2.81; sd = 0.83

Regression

** 114 responses in total, 113 used in analysis as 1 respondent does not use SM

** All reverse-score questions are taken into account in analysis

1. LOE1-8: Level of extraversion (out of a score of 5 per question, dependent variable)

   [Disagree strongly-1; Agree strongly-5]

2. SMU1-5: Time spent on SMU (out of a score of 4.5 per question, independent variable)

   [Never-0; More than four hours-4.5]

3. LONE1-20: Level of Loneliness (out of a score of 4 per question, mediator variable)

   [Never-1; Always-5]

Combined scores:

LOE: Mean of LOE1-8 (out of a score of 5)
SMU: Mean of SMU1-5 (out of a score of 4.5)
LONE: Mean of LONE1-20 (out of a score of 4)

- **H1: Extroverts report higher levels of social media usage compared to Introverts**

H1 predicted that individuals with higher levels of extroversion would report higher levels of social media usage as compared to individuals with lower levels of extroversion. Table 1 shows the hierarchical multiple regression analysis predicting social media usage. We controlled for the effects of age and gender, neither of which was a significant predictor for social media usage. Level of Extroversion accounted for a significant proportion of variance in an individual's social media use after controlling for demographic effects (R^2 change = 0.0507, F(7,105) = 2.159, p-value = 0.04372 < 0.05) and has a significant and positive effect on an individual's social media usage ($\beta = 0.228$), supporting H1.

Variables	Standardized Coefficient Beta	R^2
Model 1: Demographics		
GenderMale (male=1, not male=0)	-0.160	
GenderOthers (others=1,not others =0)	-0.058	
Age 25 to 30 (age 25 to 30 =1, 0 otherwise)	-0.064	
Age 31 to 40 (age 31 to 40 =1, 0 otherwise)	-0.173	
Age 41 and above (age above 40 =1, 0 otherwise)	-0.159	
Age below 18 (age below 18 = 1, 0 otherwise)	0.055	
Incremental R^2		7.512%
Model 2: Level of Extroversion		
GenderMale (male=1, not male=0)	-0.159	
GenderOthers (others=1,not others =0)	-0.0527	
Age 25 to 30 (age 25 to 30 =1, 0 otherwise)	-0.0420	
Age 31 to 40 (age 31 to 40 =1, 0 otherwise)	-0.162	
Age 41 and above (age above 40 =1, 0 otherwise)	-0.187	
Age below 18 (age below 18 = 1, 0 otherwise)	0.0567	
Level of Extroversion	0.228*	
Incremental R^2		5.07 %
Total R^2 (%)		12.58%
*p<0.05, **p<0.01, ***p<0.001		

Table1. Hierarchical multiple regression predicting an individual's social media usage

- **H2: Frequency of social media use is positively associated with loneliness**

H2 predicted that individuals with higher social media usage would report higher levels of loneliness as compared to individuals with lower social media usage. Table 2 shows the hierarchical multiple regression analysis predicting the level of loneliness. We controlled for the effects of age and gender, and the results showed that people belonging in the group category of age 41 and above (β = -0.232, p-value = 0.0144 < 0.05) reported lower levels of loneliness as compared to people belonging in the group category of 19 - 24 years old. Demographic variables significantly explained 12% of the variance in an individual's social media usage (R^2 = 0.12, F(6,106) = 2.409, p-value = 0.03193 < 0.05). Social media usage does not account for a significant proportion of variance in an individual's level of loneliness after controlling for demographic effects (R^2 change = 0.0019, F(7,105) = 2.083, p-value = 0.05167 > 0.05). Hence,

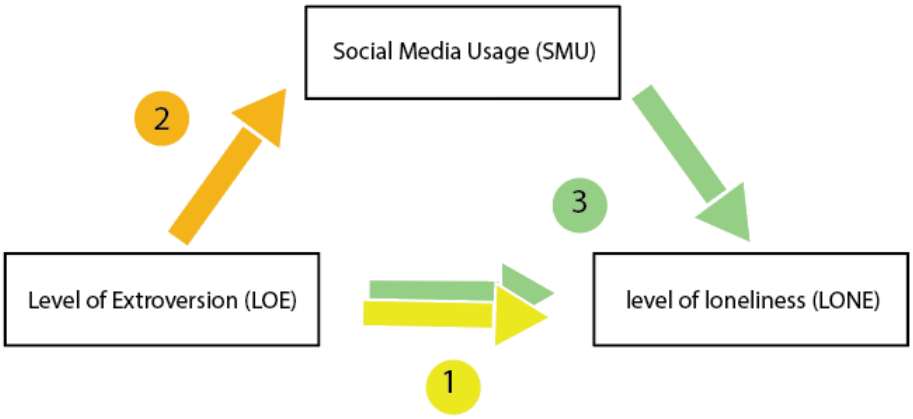
H2 is not supported and we cannot conclude that an individual's social media usage is correlated with how lonely they feel.

Variables	Standardized Coefficient Beta	R^2
Model 1: Demographics		
GenderMale (male=1, not male=0)	0.134	
GenderOthers (others=1,not others =0)	0.158	
Age 25 to 30 (age 25 to 30 =1, 0 otherwise)	0.0045	
Age 31 to 40 (age 31 to 40 =1, 0 otherwise)	-0.145	
Age 41 and above (age above 40 =1, 0 otherwise)	-0.232*	
Age below 18 (age below 18 = 1, 0 otherwise)	-0.096	
Incremental R^2		12 %
Model 2: Social Media Usage		
GenderMale (male=1, not male=0)	0.142	
GenderOthers (others=1,not others =0)	0.161	
Age 25 to 30 (age 25 to 30 =1, 0 otherwise)	0.0074	
Age 31 to 40 (age 31 to 40 =1, 0 otherwise)	-0.137	
Age 41 and above (age above 40 =1, 0 otherwise)	-0.226*	
Age below 18 (age below 18 = 1, 0 otherwise)	-0.099	
Social Media Usage	0.046	
Incremental R^2		0.19 %
Total R^2 (%)		12.19 %
*p<0.05, **p<0.01, ***p<0.001		

Table 2. Hierarchical multiple regression predicting an individual's level of loneliness.

- **RQ: The effect of level of extroversion on loneliness is mediated through the frequency of social media usage**

Mediation Analysis (Baron & Kenny, 1986)



Step 1(RQa): The effect of level of extroversion (IV) on loneliness (DV)

First, we find the total effect that level of Extroversion has on the level of loneliness. We set up hypothesis 3a to predict that the higher the level of Extroversion, the lower the level of loneliness. Table 3 shows the hierarchical multiple regression analysis predicting the level of loneliness. We controlled for the effects of age and gender, and the results showed that people belonging in the group category of 'age 41 and above' (β = -0.232, p-value = 0.0144 < 0.05) reported lower levels of loneliness as compared to people belonging in the group category of 19 - 24 years old. Demographic variables significantly explained 12% of the variance in an individual's social media usage (R^2 = 0.12, F(6,106) = 2.409, p-value = 0.03193 < 0.05). Level of Extroversion accounted for a significant proportion of variance in an individual's level of loneliness after controlling for demographic effects (R^2 change = 0.1167, F(7,105) = 4.651, p-value = 0.000144 < 0.05) and had a significant and negative effect on an individual's level of loneliness (β = -0.347), supporting RQa and conclude that there is a significant total effect.

Variables	Standardized Coefficient Beta	R^2
Model 1: Demographics		
GenderMale (male=1, not male=0)	0.134	
GenderOthers (others=1,not others =0)	0.158	
Age 25 to 30 (age 25 to 30 =1, 0 otherwise)	0.0045	
Age 31 to 40 (age 31 to 40 =1, 0 otherwise)	-0.145	
Age 41 and above (age above 40 =1, 0 otherwise)	-0.232*	
Age below 18 (age below 18 = 1, 0 otherwise)	-0.096	
Incremental R^2		12%
Model 2: Level of Extroversion		
GenderMale (male=1, not male=0)	0.134	
GenderOthers (others=1,not others =0)	0.150	
Age 25 to 30 (age 25 to 30 =1, 0 otherwise)	-0.028	
Age 31 to 40 (age 31 to 40 =1, 0 otherwise)	-0.161	
Age 41 and above (age above 40 =1, 0 otherwise)	-0.190*	
Age below 18 (age below 18 = 1, 0 otherwise)	-0.099	
Level of Extroversion	-0.347***	
Incremental R^2		11.67 %
Total R^2 (%)		23.67%
*p<0.05, **p<0.01, ***p<0.001		

Table3. Hierarchical multiple regression predicting an individual's level of loneliness

Step 2(RQb): The effect of level of extroversion (IV) on social media usage (mediator)

Next, to establish a mediation effect, the level of extroversion (IV) must affect social media usage (mediator). As reported above, our H1 is supported and hence we can conclude that the level of extroversion is positively correlated with an individual's social media usage.

Step 3(RQc): The effect of Social media usage (mediator) on the level of loneliness (DV)

To confirm whether there is a mediation effect, we need to run a regression to see the effect that social media usage (mediator) has on the level of loneliness (DV) while controlling for the level of extroversion (IV). Table 4 shows the hierarchical multiple regression analysis predicting the level of loneliness while controlling for the demographics and the level of extroversion (model 3, an extension to the model in step 1). Social media usage does not account for a significant proportion of variance in an individual's level of loneliness after controlling for both the level of extroversion and demographic effects. (R^2 change = 0.0162, F(8,104) = 4.401, p-value = 0.000131 < 0.05). The level of extroversion still completely predicts the level of loneliness of an individual (β=-0.378) and hence, we conclude that Social media usage (mediator) does not mediate between the level of extroversion and the level of loneliness.

Variables	Standardized Coefficient Beta	R^2
Model 1: Demographics		
GenderMale (male=1, not male=0)	0.134	
GenderOthers (others=1,not others =0)	0.158	
Age 25 to 30 (age 25 to 30 =1, 0 otherwise)	0.0045	
Age 31 to 40 (age 31 to 40 =1, 0 otherwise)	-0.145	
Age 41 and above (age above 40 =1, 0 otherwise)	-0.232*	
Age below 18 (age below 18 = 1, 0 otherwise)	-0.096	
Incremental R^2		12%
Model 2: Level of Extroversion		
GenderMale (male=1, not male=0)	0.134	
GenderOthers (others=1,not others =0)	0.150	
Age 25 to 30 (age 25 to 30 =1, 0 otherwise)	-0.028	
Age 31 to 40 (age 31 to 40 =1, 0 otherwise)	-0.161	
Age 41 and above (age above 40 =1, 0 otherwise)	-0.190*	
Age below 18 (age below 18 = 1, 0 otherwise)	-0.099	
Level of Extroversion	-0.347***	
Incremental R^2		11.67 %
Model 3: Social Media Usage		
GenderMale (male=1, not male=0)	0.155	
GenderOthers (others=1,not others =0)	0.157	
Age 25 to 30 (age 25 to 30 =1, 0 otherwise)	-0.022	
Age 31 to 40 (age 31 to 40 =1, 0 otherwise)	-0.139	
Age 41 and above (age above 40 =1, 0 otherwise)	-0.165	
Age below 18 (age below 18 = 1, 0 otherwise)	-0.107	
Level of Extroversion	-0.378***	
Social Media Usage	0.136	
Incremental R^2		1.62 %
Total R^2 (%)		25.29%
*p<0.05, **p<0.01, ***p<0.001		

Table 4. Hierarchical multiple regression predicting an individual's level of loneliness.

Discussion

From the assessment of internal validity of our scales that measured levels of loneliness, social media usage, and level of extroversion. We found that the Cronbach's alpha test for reliability of our measurement of social media usage has a score of 0.67 which is less than 0.70. A low score on Cronbach's alpha test means that some items in the group of questions in our social media

usage questions are not closely related or there are not enough questions that test social media usage (Lavrakas, 2008). This means that our scale for social media usage is not very reliable.

From our results, we can see that participants aged 41 and above reported lower levels of loneliness as compared to those belonging to 19 - 24 years old. Which could possibly indicate that the effects of social media are more effective on younger people as compared to older adults who may have already learned to cope with emotions as they are older and have more experience living. This could be something that can be further explored.

From the results we obtained, we can see that H1 is supported and thus extroverts report higher levels of social media usage as compared to introverts. The result agrees with one of the research done by Harbaugh in 2020, which was a study done solely on Facebook social media users (Harbaugh, 2010). This suggests that such a phenomenon is still applicable with the various forms of social media in today's context. We can infer that users who are more extroverted tend to have higher social media usage regardless of the platforms.

Looking at the results for H2 we can see that our hypothesis, frequency of social media is positively associated with loneliness is not supported and thus we cannot conclude that there is any correlation to an individual's social media usage with how lonely they feel. This could be due to there being many factors that contribute to how lonely a person feels, and hence we should not assume social media usage is the main contributing factor to a person's loneliness.

From the study conducted by Ahn and Shin, we can see that they had 300 samples of individuals aged 19 - 39, this included people who were not university students. In comparison, our study only managed to obtain 110 responses and focused only on university students and staff, this could be the reason why we failed to achieve similar results as the Ahn and Shin study as we did not have enough data on working adults.

This result also differs from another study done by Savci and Aysan in 2016, which collects data from only university students, observes that the level of loneliness increases when social media usage increases. This could potentially be because the above study used a different measure of social media usage, Social Media Usage Scale (SMUS), which consists of a two-dimensional structure and 10 items. This measure was tested for its reliability and validity across different age groups and social media platforms and could be more reliable than the one we adopted in our data collection.

Since in our RQ, we hypothesized that the effect of level of extroversion on loneliness is mediated through the frequency of social media usage. From the results, as we could not conclude a relationship between social media usage and loneliness, we cannot connect with our previous findings from H1. Thus, we are unable to conclude that an extrovert would feel more lonely due to the increased usage of social media, and hence the mediation analysis is not supported by our data. One possible reason could be that the level of extraversion does not have a mediation effect on loneliness due to social media usage. Another reason could be that our sample population is not a good representative of the general population.

Limitations

As the data we collected was from students and faculty members of SUTD which is a university that mainly focuses on engineering. Since the students studying in an engineering-focused university might have very different mindsets and backgrounds as compared to traditional universities which would host a myriad of courses that caters to more students of different backgrounds such as students who are more inclined towards humanities subjects or the sciences. Results from our study may not be able to be generalized to the population of people in Singapore as our subjects may not have a diverse enough background.

Another reason is that since the data obtained from the survey relied on self-rating, participants might have failed to answer the questions accurately or honestly, which may have affected the accuracy of the results. Loneliness is also a subjective feeling that is affected by many factors, not only social media, therefore, the reported level of loneliness from the participants may not be solely due to their usage of social media but from other sources.

One other thing that we did not take into account in our study is the different types of social media. In our study, we looked at social media as a whole and did not examine how each type of social media might differ from the other. There are many types of social media such as social networks which would include platforms like Facebook, Twitter, or Media sharing networks like Instagram, Snapchat, and Youtube. While these are all forms of social media they differ greatly in terms of the purpose they serve and how people are using these platforms to interact with each other. For example, users using Facebook versus Youtube would have varying effects on the loneliness a user would feel from the usage of such social media since a platform like Facebook

would usually have users follow their acquaintances and friends, and thus they would get updates on their lives whereas a platform like Youtube shows content from people whom the user finds entertaining and usually the user would not be related in any way to the content creators. This could make a difference in terms of the level of loneliness experienced by the users.

Another thing that we did not take into account was whether a user was more of an active social media user or more of a passive user. An active user would use social media to post and comment on things whereas a more passive user would just spend time viewing content on social media. By analysing the type of social media user they are instead of just looking at only the duration spent on social media we may be able to gain more insights on whether there are any varying effects between the two types of users.

Proposed Solutions

With a low Cronbach's alpha test score of 0.67 for Social Media Usage (SMU), we might require further refinement of the questions that measure social media usage or consider using multi-dimensional measures instead of solely looking at the users' time spent on social media.

To enhance this study when it is duplicated in the future, we must examine the approach for collecting data on social media usage. Instead of focusing on the participants' perspectives on social media usage, we could examine additional variables such as the sort of social media they use. Currently, there are more emerging social media platforms that have a range of features such

as video production in TikTok and news feeds on Twitter. With this variety in social media, there may be some variance in the amount of influence social media has on an individual's loneliness.

A future study might also look at the participant's real usage by analysing their social media usage patterns. Instead of asking how long they use it, we then ask about how they use it. This would allow us to see how individuals utilize social media and this might possibly give us a greater insight into the relationship between a person's personality and the actions that they take on social media which could lead to the amount of loneliness they experience.

Due to the limited amount of time provided to conduct this research paper, a cross-sectional survey was chosen as the method for data collection within the educational institution. The sample population of the data collected is unable to effectively represent a bigger community. As such, in the future, we propose to gather data on a wider variety of populations across the nation and expand the age limit to include the younger population who were born in the age of social media and working adults who only experienced social media at a late stage in their lives. This would provide a more comprehensive study on the effects of social media on the population and would be more useful as the results we obtained would be for the general population of Singapore.

We would also choose to use a diary study, which is a research method used to collect qualitative data over time, and data is self-reported by participants throughout the study (Salazar , 2016). With daily records of the amount of social media usage and their loneliness levels, we can analyse how social media usage and loneliness vary throughout the study which is more accurate

as we are getting more readings instead of the general feeling when we conducted it as a cross-sectional study. This would allow us to track the changes more closely and also provide us with more data to work with.

Another way is to propose a quasi-experiment where we conduct interviews with students from different backgrounds and assign them accordingly based on their usage of social media for experimental observations. A quasi-experimental design is more effective at determining cause and effect relationships between independent and dependent variables. In the experiment, we would be able to control some variables like their social media usage time and split them into introverts and extroverts. This would allow us to clearly test out our hypothesis.

Contributions

Name	Contributions
Chen Ken	Helped with the discussion and planning for the study. Proof reading the documents and rephrasing the document to have lesser grammatical errors and making the document more concise and understandable. Rewrote parts of the document that were not clear or were unnecessary. Worked on the slides that were used for the presentation and made it pretty. Rewrote the document based on the comments made by prof after our first submission.
Yik Khuen	Helped to formulate the overall study and decide on the hypothesis and research questions. Consulted with prof about the initial ideas and refined the overall idea. Wrote most of the method section. Helped create the survey and added the questions. Searched and added the questions required for the study. Contributed to literature review

Yu Ying	Wrote part of the literature review, did the data analysis and wrote the result and analysis section. Worked on the presentation slides and presented parts of the slides.
Daniel	Wrote the limitations section for the final report, part of the literature review, found research gaps in the social media research papers and part of the presentation slides on future works
Ryan	Wrote part of the literature review on connection overload and displacement hypothesis, found the initial topic of study through the Ahn and Shin paper, and did the method section on BFI. Worked on presentation slides and presented part of the slides.
Justin	Wrote parts of the Introduction, Discussion and added on to the limitation section based on the comments given in the presentation. Wrote variables - other variables and contributed to the research on the methodology and crafting the survey questions. Helped refine the document for submission. Presented part of the slides

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Annex

1. Survey Questions

1.1 Loneliness related questions:

1. How often do you feel that you are “in tune” with the people around you?
2. How often do you feel that you lack companionship?
3. How often do you feel that there is no one you can turn to?
4. How often do you feel alone?
5. How often do you feel part of a group of friends?
6. How often do you feel that you have a lot in common with the people around you?
7. How often do you feel that you are no longer close to anyone?
8. How often do you feel that your interests and ideas are not shared by those around you?
9. How often do you feel outgoing and friendly?
10. How often do you feel close to people?
11. How often do you feel left out?
12. How often do you feel that your relationships with others are not meaningful?
13. How often do you feel that no one really knows you well?
14. How often do you feel isolated from others?
15. How often do you feel that you can find companionship when you want it?
16. How often do you feel that there are people who really understand you?
17. How often do you feel shy?
18. How often do you feel that people are around you but not with you?

19. How often do you feel that there are people you can talk to?
20. How often do you feel that there are people you can turn to?

1.2 Personality related questions (BFI questions on E/I)

(https://fetzer.org/sites/default/files/images/stories/pdf/selfmeasures/Personality-BigFiveInventory.pdf):

Based on the questions in the Big Five Inventory on Extraversion by John & Srivastava (1999), we will be taking the questions used to measure for extraversion on a scale of 1 to 5 (1 being disagree strongly to 5 being agree strongly). We will then take the mean of the 8 questions to determine the extraversion value of the participant.

I see myself as someone who…

1. Is talkative
2. Is reserved
3. Is full of energy
4. Generates a lot of enthusiasm
5. Tends to be quiet
6. Has an assertive personality
7. Is sometimes shy, inhibited
8. Is outgoing, sociable

Questions 2, 5 and 7 are reverse scored.

1.3 Time spent on social media

Based on the different social media categories, we will be asking “On an average day, how much time do you spend on using [category i]?” where the users have to respond to each category from 4 options. 1: “Never”, 2: “Rarely”, 3: “Sometimes”, and 4: “Always”

The questions will be as follows:

1. On an average day, how much time do you spend on posting/commenting on social networking sites such as Facebook, Twitter, Instagram, TikTok?
2. On an average day, how much time do you spend on using the instant messaging function found on social media platforms like Facebook Messenger, Instagram Direct Message, or TikTok Direct Message?
3. On an average day, how much time do you spend using Facebook/Instagram video chat, Facebook/Instagram live, or sharing short clips (stories) with others on social media platforms like Facebook/Instagram/TikTok?
4. On an average day, how much time do you spend viewing videos shared on social media platforms like Facebook/Instagram/TikTok Feed/Youtube?
5. On an average day, how much time do you spend on reading posts/news on social media platforms like Facebook/Instagram/TikTok?

Screenshots of analysis

H1

Demographics

```
Call:
lm(formula = SMU ~ gender + age, data = data)

Residuals:
    Min      1Q  Median      3Q     Max
-1.2092 -0.4952 -0.1874  0.4048  1.6908

Coefficients:
                           Estimate Std. Error t value Pr(>|t|)
(Intercept)                  1.2092     0.1075  11.246   <2e-16 ***
genderMale                  -0.2140     0.1278  -1.674   0.0970 .
genderOthers                -0.2425     0.3982  -0.609   0.5437
age25 - 30 years old        -0.1218     0.1853  -0.657   0.5124
age31 - 40 years old        -0.3512     0.1951  -1.800   0.0747 .
age41 years old and above   -0.3736     0.2259  -1.654   0.1012
agebelow 18 years old        0.2288     0.3929   0.582   0.5616
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.664 on 106 degrees of freedom
Multiple R-squared:  0.07512,   Adjusted R-squared:  0.02277
F-statistic: 1.435 on 6 and 106 DF,  p-value: 0.2082
```

Step 1

```
Call:
lm(formula = SMU ~ gender + age + LOE, data = data)

Residuals:
     Min       1Q   Median       3Q      Max
-1.10634 -0.48066 -0.05795  0.50544  1.65963

Coefficients:
                           Estimate Std. Error t value Pr(>|t|)
(Intercept)                 0.68206    0.23801   2.866  0.00503 **
genderMale                 -0.21318    0.12483  -1.708  0.09063 .
genderOthers               -0.21942    0.38905  -0.564  0.57396
age25 - 30 years old       -0.08065    0.18182  -0.444  0.65825
age31 - 40 years old       -0.32966    0.19082  -1.728  0.08700 .
age41 years old and above -0.43999    0.22234  -1.979  0.05045 .
agebelow 18 years old       0.23613    0.38376   0.615  0.53969
LOE                         0.18610    0.07540   2.468  0.01520 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.6486 on 105 degrees of freedom
Multiple R-squared:  0.1258,    Adjusted R-squared:  0.06756
F-statistic: 2.159 on 7 and 105 DF,  p-value: 0.04372
```

Standardized beta coefficient

```
> lm.beta(model1A)

Call:
lm(formula = SMU ~ gender + age, data = data)

Standardized Coefficients::
              (Intercept)                genderMale              genderOthers
               0.00000000               -0.15997817               -0.05830601
     age25 - 30 years old      age31 - 40 years old age41 years old and above
              -0.06352204               -0.17303492               -0.15867781
    agebelow 18 years old
               0.05499786
```

```
> lm.beta(model1B)

Call:
lm(formula = SMU ~ gender + age + LOE, data = data)

Standardized Coefficients::
              (Intercept)               genderMale             genderOthers
               0.00000000              -0.15938625              -0.05274774
     age25 - 30 years old      age31 - 40 years old age41 years old and above
              -0.04204761              -0.16241249              -0.18686530
    agebelow 18 years old                      LOE
               0.05676450               0.22860823
```

H2

Demographics

```
Call:
lm(formula = LONE ~ gender + age, data = data)

Residuals:
     Min       1Q   Median       3Q      Max
-1.21106 -0.32785 -0.04914  0.35086  1.05086

Coefficients:
                           Estimate Std. Error t value Pr(>|t|)
(Intercept)                2.211058   0.080547  27.451   <2e-16 ***
genderMale                 0.138084   0.095730   1.442   0.1521
genderOthers               0.505608   0.298270   1.695   0.0930 .
age25 - 30 years old       0.006655   0.138846   0.048   0.9619
age31 - 40 years old      -0.225678   0.146185  -1.544   0.1256
age41 years old and above -0.421292   0.169259  -2.489   0.0144 *
agebelow 18 years old     -0.307086   0.294295  -1.043   0.2991
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.4974 on 106 degrees of freedom
Multiple R-squared:   0.12,     Adjusted R-squared:  0.07019
F-statistic: 2.409 on 6 and 106 DF,  p-value: 0.03193
```

W pred var

```
Call:
lm(formula = LONE ~ gender + age + SMU, data = data)

Residuals:
     Min       1Q   Median       3Q      Max
-1.25635 -0.33411 -0.04229  0.37174  1.02613

Coefficients:
                          Estimate Std. Error t value Pr(>|t|)
(Intercept)                2.16863    0.11972  18.114   <2e-16 ***
genderMale                 0.14559    0.09734   1.496   0.1377
genderOthers               0.51412    0.29988   1.714   0.0894 .
age25 - 30 years old       0.01093    0.13964   0.078   0.9378
age31 - 40 years old      -0.21335    0.14894  -1.432   0.1550
age41 years old and above -0.40818    0.17205  -2.372   0.0195 *
agebelow 18 years old     -0.31511    0.29584  -1.065   0.2893
SMU                        0.03509    0.07303   0.480   0.6319
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.4992 on 105 degrees of freedom
Multiple R-squared:  0.1219,    Adjusted R-squared:  0.06339
F-statistic: 2.083 on 7 and 105 DF,  p-value: 0.05167
```

```
Call:
lm(formula = LONE ~ gender + age, data = data)

Standardized Coefficients::
              (Intercept)                genderMale              genderOthers
              0.000000000               0.134429352               0.158267563
     age25 - 30 years old      age31 - 40 years old age41 years old and above
              0.004517745              -0.144774017              -0.232981965
    agebelow 18 years old
             -0.096125361


Call:
lm(formula = LONE ~ gender + age + SMU, data = data)

Standardized Coefficients::
              (Intercept)                genderMale              genderOthers
               0.00000000               0.14173869                0.16093154
     age25 - 30 years old      age31 - 40 years old age41 years old and above
               0.00742004              -0.13686813               -0.22573204
    agebelow 18 years old                      SMU
              -0.09863819               0.04568957
```

RQ

```
Call:
lm(formula = LONE ~ gender + age + LOE, data = data)

Residuals:
     Min       1Q   Median       3Q      Max
-0.95579 -0.33315 -0.01054  0.29114  1.17355

Coefficients:
                           Estimate Std. Error t value Pr(>|t|)
(Intercept)                 2.82507    0.17081  16.540  < 2e-16 ***
genderMale                  0.13716    0.08958   1.531 0.128748
genderOthers                0.47868    0.27920   1.714 0.089392 .
age25 - 30 years old       -0.04132    0.13048  -0.317 0.752095
age31 - 40 years old       -0.25079    0.13694  -1.831 0.069879 .
age41 years old and above -0.34399    0.15956  -2.156 0.033381 *
agebelow 18 years old      -0.31565    0.27540  -1.146 0.254352
LOE                        -0.21677    0.05411  -4.006 0.000116 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.4655 on 105 degrees of freedom
Multiple R-squared:  0.2367,    Adjusted R-squared:  0.1858
F-statistic: 4.651 on 7 and 105 DF,  p-value: 0.000144


Call:
lm(formula = LONE ~ gender + age + LOE, data = data)

Standardized Coefficients::
              (Intercept)                genderMale              genderOthers
               0.00000000                0.13353159                0.14983738
     age25 - 30 years old      age31 - 40 years old age41 years old and above
               -0.02805235               -0.16088497               -0.19023022
    agebelow 18 years old                       LOE
               -0.09880482               -0.34672834
```

```
Call:
lm(formula = LONE ~ gender + age + LOE + SMU, data = data)

Residuals:
     Min       1Q   Median       3Q      Max
-0.95227 -0.35065  0.00907  0.30608  1.10623

Coefficients:
                           Estimate Std. Error t value Pr(>|t|)
(Intercept)                 2.75366    0.17630  15.619  < 2e-16 ***
genderMale                  0.15948    0.09028   1.767   0.0802 .
genderOthers                0.50165    0.27795   1.805   0.0740 .
age25 - 30 years old       -0.03288    0.12982  -0.253   0.8006
age31 - 40 years old       -0.21628    0.13805  -1.567   0.1202
age41 years old and above -0.29792    0.16154  -1.844   0.0680 .
agebelow 18 years old      -0.34037    0.27426  -1.241   0.2174
LOE                        -0.23625    0.05533  -4.270 4.33e-05 ***
SMU                         0.10470    0.06962   1.504   0.1356
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.4627 on 104 degrees of freedom
Multiple R-squared:  0.2529,    Adjusted R-squared:  0.1954
F-statistic: 4.401 on 8 and 104 DF,  p-value: 0.000131
```

```
Call:
lm(formula = LONE ~ gender + age + LOE + SMU, data = data)

Standardized Coefficients::
              (Intercept)                genderMale              genderOthers
               0.00000000                0.15526096                0.15702856
     age25 - 30 years old      age31 - 40 years old age41 years old and above
              -0.02231994               -0.13874303               -0.16475460
    agebelow 18 years old                       LOE                       SMU
              -0.10654361               -0.37789485                0.13633151
```