

The Role of Connectedness in the Relationship Between Social Network Sites and Mental Health

Paula Janina Bornemann

Department of Psychology, University of Twente

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Dr. Mirjam Radstaak

PhD Candidate Deniz Ergun

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Abstract

The use of social network sites (SNS) has increased over the last decade and is now an important part of today's society. However, SNS have been shown to have highly controversial effects on the mental health of their users, as they can both improve and worsen it. To explain these controversial effects, the current study investigated the role of connectedness in the relationship between SNS use and mental health. It was hypothesized that SNS use would lead to a decrease in mental health, however high levels of connectedness were assumed to moderate this relationship and lead to SNS use improving mental health. An online survey was distributed in which participants indicated the frequency of their SNS use and the time they spent on SNS. Additionally, their mental health and feelings of connectedness were assessed. The collected data was analyzed using a correlation and bootstrapping analysis in RStudio. The results showed that while feeling connected had an impact on participants' mental health, it did not have an impact on the relationship between SNS use and mental health. In addition, no influence of time spent using SNS on mental health was found. However, this could be due to the scale used to assess SNS, and its presentation in the online survey. Therefore, future research is needed to evaluate different ways of measuring SNS and other possible moderating variables to explain the complex relationship between SNS and mental health.

The Role of Connectedness in the Relationship Between Social Network Sites and Mental Health

The frequent use of social network sites (SNS) such as Facebook or Instagram is firmly anchored in today's society. They are used by children as young as five years old (Swist et al., 2015) and continue to be used in adolescence (O'Reilly et al., 2018) and adulthood (Perrin, 2015). Furthermore, the average time spent on SNS has increased from 95 minutes a day in 2013 to 151 minutes a day in 2023 (Dixon, 2024) with people aged between 16 and 24 spending an average of 3 hours and 38 minutes (Larson, 2024). This indicates the ever-increasing relevance of SNS.

Over the years, many different definitions of SNS have been used (Aichner et al., 2021), pointing to difficulties and inconsistencies in defining SNS. This could be due to challenges such as the constant and rapid development of SNS and uncertainty about which technologies to include in the definition (Obar & Wildman, 2015). In this study, SNS are defined as a web-based platform through which individuals can establish connections by creating a public or semi-public profile, creating a list of other users they want to connect with, and accessing the list of connections of other SNS users (boyd & Ellison, 2007). This definition is used as it describes some of the most commonly used SNS in January 2024 such as Facebook, Instagram or, TikTok (Larson, 2024).

SNS and Mental Health

Previous research has found that SNS use has controversial effects on mental health. Mental health can be defined as a general state of mental well-being that helps an individual to function well in society (World Health Organization., 2022). On the one hand, it can be linked to a sense of greater connectedness and communication (Allen et al., 2017; O'Reilly et al., 2018) through means such as online chatting, which has led to a reduction in loneliness and an increase in happiness and self-esteem, particularly in times such as COVID 19 (Feng & Tong, 2023). In addition, some young people report that they can turn to SNS to escape the external pressures placed on them outside of the online environment (O'Reilly et al., 2018). On the other hand, it has been shown that the use of SNS is associated with a lower sense of mental health. Young people have described SNS use as a form of addiction (O'Reilly et al., 2018) which promotes feelings of loneliness and social isolation (Allen et al., 2017) and leads to more depression, anxiety, cyberbullying (O'Reilly et al., 2018) and less face-to-face contact (James et al., 2017).

The extent of SNS use was related to negative views of SNS, with participants who reported spending almost all day on SNS describing the negative rather than the positive effects of SNS use (Allen et al., 2017; O'Reilly et al., 2018). This suggests that spending an excessive amount of time on SNS leads to negative effects on mental health which could be caused by for example spending less time socializing offline (Allen et al., 2017).

Connectedness

A possible explanation for the controversial findings could be the feeling of connectedness. Connectedness “occurs when a person is actively involved with another person, object, group or environment, and that involvement promotes a sense of comfort, well-being, and anxiety-reduction.” (Hagerty et al., 1993, p. 293). It consists of three dimensions. Firstly, connectedness to the self, which includes a felt emotional and embodied connection to the self. Secondly, connectedness to others, which deals with the social network of an individual. And lastly, connectedness to the world, which refers to a feeling of connectedness to nature, a greater purpose in life and spirituality (Bellingham et al., 1989; Watts et al., 2022).

Connectedness has been associated with both mental and physical health benefits. It is associated with less psychological distress (Luo et al., 2023; Nguyen et al., 2019) and an increase in happiness (Zelenski & Nisbet, 2014) and life satisfaction (Blau et al., 2016). Moreover, previous research has found that smaller social networks can be associated with increased mortality in the older population (Bennett et al., 2002; Schutter et al., 2022) suggesting that connectedness also influences the physical health of humans. Consequently, the feeling of connectedness can be linked to a happier and longer life.

Furthermore, in the context of SNS use, connectedness may be associated with less social comparison. Previous research has shown that the relationship between SNS use, and mental health is influenced by unfavorable social comparisons as it leads to negative effects of SNS on mental health (Braghieri et al., 2022). Depressed people and people with low self-esteem have been shown to make more social comparisons than non-depressed people and people with higher self-esteem (Appel et al., 2015; Jang et al., 2016). Interestingly, feeling socially connected acts as a buffer against depression (Nguyen et al., 2019) and increases people's self-esteem (Luo et al., 2023). In addition, connectedness to nature increases people's sense of happiness (Zelenski & Nisbet, 2014) and it has been shown that an increase in happiness reduces the number of upward social comparisons one makes when using SNS (Lyubomirsky et al., 2001). Therefore, it can be

assumed that connectedness reduces social comparisons and, in this way, influences the relationship between SNS use and mental health by causing SNS to improve users' mental health.

Moreover, connectedness may reduce passive SNS use. Passive SNS use, thus merely consuming content rather than actively producing content, has been shown to influence the relationship between SNS use and mental health as it is associated with negative consequences of SNS use on mental health such as a reduction in well-being (Wang et al., 2018). People who feel lonely and socially anxious are the people who are more likely to use SNS passively and problematically (O'Day & Heimberg, 2021). Noteworthy, connectedness is negatively associated with loneliness, therefore low levels of connectedness are associated with an increase in loneliness (Townsend & McWhirter, 2005) and high levels are associated with a decrease in loneliness (Jose & Lim., 2014). Consequently, it can be assumed that connectedness influences the relationship between SNS use and mental health by reducing the risk of passive SNS use, leading to SNS use improving people's mental health.

Furthermore, connectedness can lead to a more authentic representation of oneself. Through SNS, people have greater control over how they portray themselves and what they put out into the world, which provides an opportunity to influence how one is perceived by others (Strimbu & O'Connell, 2019). For example, people with a less stable self-concept have been associated with a more ideal self-presentation (Fullwood et al., 2016) and a greater discrepancy between their online and offline presentations (Strimbu & O'Connell, 2019). However, a more authentic representation of oneself online has been associated with positive effects of SNS on mental health such as increased life satisfaction and well-being (Bailey et al., 2020; Bij de Vaate et al., 2020). Since self-concepts are a sense of who we are (Strimbu & O'Connell, 2019), it could be assumed that a feeling of connectedness to the self leads to more stable self-concepts. Therefore, people with a stronger connection to themselves have no problem presenting themselves sincerely and authentically online, which affects the relationship between SNS use and mental health, as SNS use improves mental health.

Current Study

In light of the research conducted to date, this study examines the relationship between SNS use and mental health and whether connectedness can be used to explain the controversial effects of SNS use by playing a moderating role. This could represent a potential protective factor on which to build future interventions. The hypotheses are as follows:

1. More time spent using SNS leads to a reduction in mental health.
2. High levels of connectedness lead to a positive relationship between mental health and SNS use.

Method

Participants

To obtain the value of the ideal sample size, the G*Power software was used to perform a statistical power analysis (Faul et al., 2009). In reality, the effect size of a moderation is usually quite small, therefore it was set to 0.02 (Cohen, 1988). The α -Level was set to 0.05 and the statistical power was set to 0.8. The number of predictors was set to two, as there were two predictor variables included in this analysis. Ultimately, the G*Power analysis determined a required sample size of a minimum of 311 people.

The participants in this study were recruited in various ways. A snowball system was used, where participants were sent an invitation to the survey and asked to pass it on. In addition, the survey was published on Survey Circle, where researchers exchange study participation, and on SONA system, a subject pool consisting of education students from the Faculty of Behavioral, Management and Social Studies (BMS) at the University of Twente. Participants who were younger than 18 and did not have sufficient English language skills were excluded from the study.

The final sample consisted of 103 participants. Sixty-nine percent ($n = 71$) were women and 26% ($n = 27$) were men. In addition, 2 participants identified as being diverse, 1 other, and 2 did not wish to provide any information. The average age of the sample was 24.37 years with a standard deviation of 8.11 years. Twenty-four percent ($n = 25$) of the sample were Dutch, 60% ($n = 62$) were German, and 16% ($n = 16$) had a different nationality. In addition, 32% ($n = 33$) of the participants had a bachelor's degree, followed by 37% ($n = 38$) high school degrees and 18% ($n = 19$) college education. Eleven percent ($n = 11$) had a master's degree, and 1 participant did not want to state their level of education.

Materials

The current study was part of a bigger study, which investigated the construct connectedness in different contexts. All materials used for the study, including the introduction, questionnaires, and demographic data assessment questions, can be found in Appendix A. The materials used for the current study are described in greater detail.

Questionnaires

Social Network Use. The 29-item Social Networking Time Use Scale (SONTUS) (Olufadi, 2016) was used to assess the frequency of SNS use and the amount of time spent on SNS. In front of each item, the participants were instructed to imagine the introduction sentence “*Kindly use the scale below to indicate how often you always use the social networking sites like Facebook, Instagram, WhatsApp, Twitter, Myspace, Pinterest etc., during the past week in the following situations and places:*”. The items assessed whether SNS was used during relaxation and free periods (nine items e.g., “*When you are at home sitting idly*”), during academic-related periods (six items e.g., “*When you are doing school or job-related assignment at home*”), when being in public places (five items e.g., “*When you go to the stadium to watch football, basketball etc.*”), and during stress-related periods (five items e.g., “*When you need to reduce your mental stress*”). The last items considered the motive for using SNS (four items e.g., “*when you need to find people you haven't seen for a while*”). The participants were then asked to indicate on a scale of 1 (Not applicable to me during the past week) to 11 (I used it more than 3 times during the past week but spent more than 30min each time) how well the item suited them. A sum score was calculated. A higher score pointed towards more frequent SNS use and longer durations spent on SNS. Previously executed exploratory and confirmatory analyses indicated excellent psychometric properties, including reliability and construct, convergent, discriminant, predictive, and incremental validity (Olufadi, 2016). The current study found a good internal consistency of the scale with a Cronbach's alpha of 0.89.

Mental Health. The 14-item Mental Health Continuum Short Form (MHC-SF) (Keyes et al., 2008) was used to assess the mental health of the participants. The items assess emotional well-being (three items, e.g., “*How often in the past month did you feel happy?*”), social well-being (five items, e.g., “*How often during the past month did you feel that you belong to a community?*”), and psychological well-being (Six items, e.g., “*How often during the past month did you feel that your life has a sense of direction or meaning to it?*”). Participants needed to indicate their answer on a 6-point Likert scale ranging from 0 (never) to 5 (every day). A sum score was calculated. A higher score indicated a higher level of mental health in the sample. Previous research has found support for good psychometric properties of the scale including good internal reliability as well as convergent and discriminant validity (Lamers et al., 2011).

Furthermore, in the current study, the internal consistency of the scale was found to be good with a Cronbach's alpha of 0.89.

Connectedness. The 19-item Watts Connectedness Scale (WCS) (Watts et al., 2022) was used to measure the felt connectedness of the participants. The items assess connectedness to the self (six items e.g., "*I have felt connected to my heart/emotions*"), connectedness to others (six items e.g., "*I have felt connected to a community*"), and connectedness to the world (seven items e.g., "*I have felt connected to nature*"). Participants were asked to indicate their agreement on a sliding bar ranging from 0 (not at all) to 100 (entirely). When scoring the WCS, a sum score was obtained. For answers with reverse scores, the score of the participant was deducted from 100 before adding this value to the others. A higher score indicated a higher level of connectedness. Previous research performed psychometric validation analysis which pointed towards good internal consistency as well as good construct, convergent, and divergent validity of the scale (Watts et al., 2022). Moreover, in the current study, the internal consistency of the scale was good with a Cronbach's alpha of 0.87.

Procedure

Prior to the start of this study, ethical approval was granted by the BMS (Department for Behavioral, Management and Social Sciences) ethics committee of the University of Twente (#240354). Participants could access the survey via a link that was sent to them and published on Survey Circle and SONA system. This link was active from March 19 to April 22, 2024.

When participants accessed the survey, they were redirected to the introduction. This contained a general overview of the study as well as the eligibility criteria, information about data handling, and the contact details of the research team in case participants had any concerns or questions. In addition, to ensure ethical treatment, participants were made aware that their mental health would be assessed and were provided with hyperlinks leading them to counseling services. Participants then had to indicate whether they wanted to take part in the study. If they gave their consent, they were directed to the first questionnaire assessing both the frequency of their SNS use and time spent on SNS. After that, participants had to answer questions to assess their level of compassion. Next, they answered questions about authenticity and their mental health, and lastly, they had to indicate their political orientation.

Finally, participants were asked to provide their demographic data such as age, gender, nationality, and level of education. However, they were free not to provide this information in

case of identification concerns. When participants had finished, they were thanked and told that their responses had been recorded. Participants who took part via SONA system were credited with 0.25 points. On average, participants took 26 minutes to complete the survey.

Data Analysis

Data analysis in this study consisted of quantitative analyses performed using the statistical software RStudio (Dege & Brüggemann, 2023) and the packages tidyverse, boot, Kendall, ppcor, modelr, ggplot2, car, broom, and psych. The dedicated R script can be found in Appendix B. Firstly the data was screened for outliers by applying Cook's distance. The results indicated some significant influential outliers with a Cook's distance value higher than n divided by 4, where n is the sample size (Hardin et al., 2007). This equation determines the threshold value for whether the influence of the outliers is significant or not (Hardin et al., 2007). However, when looking into the data, only one outlier seemed to answer in an unreliable way, as they always only chose the lowest possible answer. The responses of this participant were therefore excluded. After that, an analysis of the descriptive data such as sum score values and standard deviation values was carried out.

Furthermore, the statistical assumptions of linearity, independence, homogeneity, normality, and multicollinearity were assessed. To assess linearity and independence the residuals were plotted against the predictor variables and for homoscedasticity the residuals were plotted against fitted values. For normality, a Q-Q plot was used and to assess the multicollinearity of the independent variables, the Variance Inflation Factors (VIF) was calculated. Results indicated that not all assumptions were able to be met. The data was normally distributed, homogeneity was met and there was no multicollinearity between the independent variables. However, the residuals did not seem to be independently distributed and there did not seem to be linearity. Because of those violations, alternative analyses which are not based on the statistical assumptions were used.

First, the nonparametric test Kendall's tau was used to assess the correlations between the variables. Second, the resampling bootstrapping method was applied to assess the hypothesized moderating effect of connectedness on mental health and SNS use. For this analysis, the seed was set to 1,2,3,4,5 to ensure the same starting point and sequence of random numbers to obtain the same resampled data set and reproducibility of results. In addition, a bootstrap of 5000 was chosen and a 95% confidence interval was calculated to assess whether the hypothesis could be

accepted. The predictor variable for the analysis was SNS use, the outcome variable was mental health, and the moderating variable was connectedness. To show that the moderating effect of connectedness is significant, the value zero must lie outside the confidence interval associated with the interaction effect of SNS and connectedness.

Results

Descriptive Statistics

The descriptive statistics of the study variables mental health, SNS use, and connectedness, as well as the correlations between the variables based on Kendall's tau, can be found in Table 1.

Table 1

Descriptive Statistics and Correlations of the Variables

	<i>Sum</i>	<i>SD</i>	Mental Health	Connectedness
SNS	137.50	41.83	-.07	.07
Mental Health	40.36	11.40		.63***
Connectedness	1061.00	306.58		

*** = $p < .001$

Inferential Statistics

The values associated with the Bootstrapping analysis can be found in Table 2. Results indicated a significant effect of connectedness on mental health 95% CI [.02, .05]. However, no significant effects of SNS on mental health 95% CI [-.06, .13], as well as no significant interaction effect of SNS and connectedness 95% CI [$<-.001$, $<.001$] was found. Therefore, both hypotheses were rejected, meaning that higher scores of SNS use did not lead to lower scores of mental health, and that connectedness did not moderate the relationship between SNS and mental health.

Table 2*Bootstrapping Analysis*

Mental Health				
Effects	Estimate	SE	95% CI	
			LL	UL
Intercept	4.03	7.20	-10.37	18.10
SNS	.03	.05	-.06	.13
Connectedness	.04	.01	.02***	.05***
SNS:Con	<.001	<.001	<-.001	<.001

Note. SNS:Con = the interaction effect. CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

*** = $p < .001$.

Discussion

This study investigated the relationship between SNS use and mental health and the possible moderating effect of connectedness on this relationship. It was assumed that more time spent using SNS would lead to a reduction in mental health and that high levels of connectedness would lead to a positive relationship between mental health and SNS use. The results revealed no relationship between SNS use and mental health, as well as no moderating effect of connectedness on this proposed relationship. Noteworthy, connectedness was associated with increases in mental health.

SNS and Mental Health

One explanation as to why SNS use had no effect on mental health, could be the way SNS use was assessed. The frequency of SNS use and the time spent on SNS were evaluated. This was done as previous research had illustrated that the amount of screen time influences the mental

health of SNS users. For example, the study of Twenge et al., (2018) highlighted that more time spent online leads to more mental health issues and may even be associated with an increase in depression and suicide. Similarly, Boers et al., (2019) reported that more screen time was found to be associated with an increase in depressive symptoms. However, Coyne et al., (2020) criticized such research and investigated the effects of time spent using SNS on mental health in a longitudinal study. And even though they also found that participants spending more time on SNS were lower in mental health, they did not find that more time spent online over the years for one and the same individual, leads to a decrease in mental health. Moreover, Coyne et al., (2020) highlighted that also other studies have found mixed results or small effect sizes. Therefore, the research about the effects of time spent using SNS on mental health is controversial, suggesting that measuring SNS differently could be a task for future investigations.

Another explanation could be that high SNS users could not be identified. The sample had a mean age of 24.37 and people in this age category, on average spend 3 hours and 38 minutes on SNS daily (Larson., 2024). However, the highest amount of time spent on SNS participants could indicate was for 30 minutes, three times a week. This made it hard to distinguish between participants, meaning that a participant who uses SNS three hours every day, would be ranked the same as a participant using SNS 30 minutes for three days a week. This is problematic as previous research has found participants spending more than three hours a day on SNS had a heightened risk for mental health problems through internalizing problems, but this was not the case for participants who spent less time than this on SNS (Rhiem et al., 2019). Therefore, this study was not able to distinguish those high SNS users from the other SNS users and could therefore not investigate the effects of excessive SNS use on mental health.

Connectedness

The finding that connectedness does not influence the relationship between SNS use and mental health could indicate that other factors may be more useful in explaining this complex relationship. For example, previous research has assessed extraversion in the context of SNS use and has found that more extraverted individuals are more likely to continue using SNS because they enjoy using SNS more, as they use SNS for entertainment purposes, and are more likely to be connected with similar SNS users (Deng et al., 2013). Therefore, one could assume that because people high on extraversion have more positive feelings towards SNS, for them the relationship between SNS and mental health is positive. More research is needed to investigate

this and how other personality traits may influence the relationship between SNS and mental health. In conclusion, other moderating variables need to be proposed to explain the relationship between SNS use and mental health.

Connectedness nevertheless is an important construct as higher scores of connectedness were associated with higher levels of mental health. This can be explained by the positive effects connectedness in general has. It reduces depression, anxiety, and loneliness (Luo et al., 2023; Nguyen et al., 2019; Townsend & McWhirter, 2005) and increases happiness and life satisfaction (Blau et al., 2016; Zelenski & Nisbet, 2014). It heightens self-esteem and well-being (Jose et al., 2012; Luo et al., 2023; Townsend & McWhirter, 2005) and increases the life expectancy of the individual (Bennett et al., 2002; Schutter et al., 2022). Therefore, even though connectedness does not seem to moderate the relationship between SNS and mental health in this study, it nevertheless is an important construct, which can influence the mental health of the population and should therefore be part of future investigations.

Strengths and Limitations

The evaluation of this study revealed the following key strengths. First, this study assessed connectedness in a holistic way. Most research on connectedness focuses on only one dimension at a time, such as research examining the effects of connectedness to nature (Zelenski & Nisbet, 2014), or research examining the effects of social connectedness (Luo et al., 2023; Nguyen et al., 2019). However, this study followed the approach of Watts et al. (2022) and considered all dimensions as different manifestations of a common construct, namely connectedness. This approach was suggested because depressed participants often did not report changes in specific dimensions of connectedness after treatment, but in connectedness as a whole (Watts et al., 2017). Therefore, this more holistic approach to connectedness is consistent with the way people experience connectedness, which may have led to greater participant engagement as they feel validated in their experiences. In addition, the research findings can better reflect the everyday lives of participants making them more practical for the design of interventions.

Second, this study was the first to examine how connectedness may influence the relationship between SNS use and mental health. The relationship between SNS use and mental health is complex, as SNS use has been shown to have both positive and negative effects on mental health (Allen et al., 2017; O'Reilly et al., 2018). However, as SNS use is such a large part of today's society, it is important to understand why it has more negative effects for some people

than others. This study addressed this challenge by suggesting that connectedness may influence this relationship. In doing so, it contributed important insights into the role of connectedness and encourages other researchers to examine the construct of connectedness and possible other moderating variables to explain the controversial effects of SNS use on mental health.

Despite these strengths, the following main limitations were identified. First, some participants reported that they found it difficult to answer the SONTUS. The reasons for this were that participants did not like the 11 response options as they felt that in today's society, almost everyone would have to choose the highest response options. They found the layout of the questionnaire confusing as they had to scroll up the page to see the 11 answer choices when answering the questions. They also stated that they were bored when answering the scale and therefore lost motivation which for one participant was the reason to drop out of the study. The scale and its presentation therefore did not seem to differentiate well enough between participants and were not user-friendly, which may also have influenced the research results

Connected to this, this study was based on self-reported time spent on SNS. This represents a limitation as reported behavior is not an accurate representation of actual behavior, but rather a measure of what people believe their behavior looks like (Scharkow, 2016). Previous research has therefore shown that people do not accurately report the amount of time they spend online as they over- or under-report, although it should be noted that people appear to be more accurate when it comes to reporting specific use of online content such as SNS (Scharkow, 2016). Therefore, when interpreting the results, one must be cognizant of the fact that even if SNS were assessed, participants may have provided biased responses.

In addition, the G*Power analysis yielded a required sample size of 311 participants to draw valid conclusions, but the sample for this study consisted of only 103 participants suggesting that the study was underpowered. Furthermore, not all statistical assumptions could be met. Consequently, bootstrapping was used to compensate for these limitations. However, the results should be interpreted with caution as in bootstrapping the fabricated sample is based on resampling from the original sample and is therefore influenced by significant outliers. Although the outliers in this study did not show an obvious pattern in their responses and consequently were not excluded from the sample, they were still significant as the value of Cook's distance was above the threshold of n divided by 4 (Hardin et al., 2007). This could have influenced the results in the direction of the outliers and must be taken into account when interpreting the results.

Future Research

To account for the limitations and to investigate the possible explanations for the results of this study, future research is needed. First, it should investigate the effects of connectedness when assessing SNS differently. For example, instead of measuring the time spent using SNS, it could focus on measuring how important SNS use is for the individual. Maybe for some people, SNS use is more important than for others making it more influential for their mental health independent of how often they use it. Future research could also measure with what motivation SNS is being used, as previous research has shown that envy as the motivation for SNS use is associated with more negative effects (Verduyn et al., 2020). Therefore, it could investigate how different forms of motivation to use SNS influence mental health.

Furthermore, future research should look more into possible moderating effects of other variables that influence the relationship between SNS use and mental health. For example, possible other variables such as personality type should be assessed to see whether they are influential. One possible starting point would be to investigate which constructs influence social comparison, passive SNS use, and self-idealization as those constructs were shown to influence the relationship between SNS and mental health (Bailey et al., 2020; Bij de Vaate et al., 2020; Braghieri et al., 2022; Wang et al., 2018). Consequently, future research should focus on for example investigating which personality type uses SNS more passively, engages in more social comparisons and in more self-idealization online, and therefore has more negative effects of SNS use on mental health.

Conclusion

The results highlight the complexity of the relationship between SNS use and mental health. While connectedness influences people's mental health, it does not explain the controversial effects of SNS use on mental health. Furthermore, the results suggest that measuring time spent on SNS does not influence SNS users' mental health. These findings emphasize the importance of connectedness for mental health and provide a basis for future interventions. Furthermore, they emphasize the need for future research to investigate what other variables influence the relationship between SNS use and mental health and what type of SNS use affects mental health.

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Appendices

Appendix A

Materials: The Connectedness Survey

Connectedness Survey

Beginning of Block: Introduction

Q1 Introduction

What is the survey about?

This survey is about assessing the relationships between feeling connected and social networking site use, compassion, authenticity, and political orientations.

Am I suitable to take part?

In order to participate in this survey you need to be at least 18 years old and have sufficient english skills.

Do I need to take part?

No, you are not obliged to take part in this study. Once you have given your consent, you will be redirected to the questionnaires. However, you can withdraw from the study at any time by simply closing your browser. You do not have to give a reason for your withdrawal and there will be no consequences for you. If you decide to cancel the study by closing your browser, all data collected up to that point will be deleted. However, if you finish the study, the researchers will no longer be able to delete your data. This is because your data will be recorded anonymously so the researchers can no longer identify your data once it has been recorded.

What will happen when I take part in this survey?

If you agree to participate in this study, you will be redirected to the questionnaire, which will take about 20 minutes to complete. There are no right or wrong answers for any of the questionnaires and we ask you to answer as fully as possible as we are interested in your own opinion. At the end of this survey, you will be asked questions about your demographic data, but these will not include questions about identifiable information. However, you are free not to provide your demographic information.

What are the risks of taking part in this survey?

During this research, you will answer questions relating to your general mental health and feeling of connectedness. If you struggle with that you are welcome to contact the following services:

- <https://www.therapyroute.com/article/suicide-hotlines-and-crisis-lines-in-germany>
- <https://www.government.nl/topics/mental-health-services/question-and-answer/help-for-mental-health-problems>

After the survey, what will happen to my data and the results of this survey?

No identifiable information will be collected during this survey. The collected data will be stored on password-protected devices for at least 10 years, which complies with the audit requirements

of the research integrity policy. Furthermore, the recorded data will only be analysed by the research team, which consists of psychology students from the University of Twente who are analysing this data for their bachelor theses. However, the research data may be shared with the research community, published in research articles or used for future research, but only in anonymised form.

This research project is supervised by: Mirjam Radstaak



Q2 Please indicate whether you consent

- I consent to take part in this study (1)
- I do not consent to take part in this study (2)

End of Block: Introduction

Beginning of Block: Social Networking Sites (SNS).

Q3 Kindly use the scale below to indicate how often you always use the social networking sites like Facebook, Instagram, WhatsApp, Twitter, Myspace, Pinterest etc., during the past week in the following situations and places:

- 1 = Not applicable to me during the past week.
- 2 = I never used it during the past week.
- 3 = I used it once during the past week but spend less than 10 min.
- 4 = I used it once during the past week but spend between 10 and 30 min.
- 5 = I used it once during the past week but spent more than 30 min.
- 6 = I used it between 2 and 3 times during the past week but spend less than 10 min each time.
- 7 = I used it between 2 and 3 times during the past week but spend between 10 and 30 min each time.
- 8 = I used it between 2 and 3 times during the past week but spent more than 30 min each time.
- 9 = I used it more than 3 times during the past week but spend less than 10 min each time.
- 10 = I used it more than 3 times during the past week but spend between 10 and 30 min each

time 11 = I used it more than 3 times during the past week but spent more than 30 min each time.

25. When you need to find people you haven't seen for a while (25)
26. When you are waiting for your boss in her office for at least 2 min when she is not attending to you (26)
27. When you are trying to forget your financial challenges (27)
28. When you are online doing school or job-related works e.g., project, homework (28)
29. Watching academic-related video lectures or those related to your job (29)

End of Block: Social Networking Sites (SNS).

Beginning of Block: Compassion

Q4 Please read each statement carefully before answering. To each item indicate with a number from 1 to 4 how much you agree with each statement.

	do not agree (1)	agree slightly (2)	agree moderately (3)	agree strongly (4)
1. Other people tend to be understanding. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Generally people do not try to understand others' problems. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I like to listen to other peoples' experiences. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. When I am upset, I try to be warm, sensitive and sympathetic to myself. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I tend to become attuned to other peoples' feelings. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. People generally don't tend to listen to others. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Generally people dismiss other peoples' problems. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I find it hard to understand other people's problems. (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Other people I know tend to be sensitive to my wellbeing. (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Other people I know are empathetic when I make a mistake. (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- | | | | | |
|--|-----------------------|-----------------------|-----------------------|-----------------------|
| 11. I don't know what to do when other people are distressed. (11) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 12. When I am emotionally upset I try to see my thoughts and feelings as valid. (12) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 13. When I am emotionally upset I treat myself with kindness and care. (13) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 14. I am interested to understand others' experiences and emotions. (14) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 15. Other people I know tend to show understanding and caring. (15) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 16. Other people I know are caring when I am distress. (16) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

End of Block: Compassion

Beginning of Block: Authenticity

Q5 Please select if the following items do not describe you at all (1) or describe you very well (7.)

“I always stand by what I believe in.” (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
“I am true to myself in most situations.” (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
“I feel out of touch with the ‘real me.’” (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
“I live in accordance with my values and beliefs.” (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
“I feel alienated from myself.” (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Authenticity

Beginning of Block: Mental Health

Q6 Please Indicate, How often during the past month did you feel...

10. good at managing the responsibilities of your daily life? (10)

11. that you had warm and trusting relationships with others? (11)

12. that you had experiences that challenged you to grow and become a better person? (12)

13. confident to think or express your own ideas and opinions? (13)

14. that your life has a sense of direction or meaning to it? (14)

End of Block: Mental Health

Beginning of Block: Political orientation

Q7 Please indicate where you would place yourself on a left-right political spectrum.

extreme left extreme right

1 2 3 4 5 6 7 8 9

Place on spectrum ()









End of Block: Political orientation

Beginning of Block: Connectedness

Q8 Reflecting on how you have felt over the past 2 weeks, please rate the following items on a scale from “Not at all” to “Entirely” according to how you have felt over this time period. Please answer every item, even if you are unsure or feel the item is unclear or poorly worded. Drag the indicator to a position on the scale that shows how much you agree or disagree with each of the following statements.

	Not at all	Entirely
	0	100
I have felt trapped in my mind ()		
I have felt connected to my heart/emotion ()		
I have felt connected to my senses (touch, taste, sight, smell, hearing) ()		
I have felt connected to a range of emotions ()		
If I had chosen to, I could have 'sat with' painful memories ()		
I have felt connected to my body ()		
I have been able to fully experience emotion, whether positive or negative ()		
I have felt alone ()		
I have felt connected to friends and/or family ()		
I have felt connected to a community ()		
I have felt connected to all humanity ()		
I have felt unwelcome amongst others ()		
I have felt separate from the world around me ()		

I have felt connected to a purpose in life ()	
I have felt connected to nature ()	
I have felt connected to a spiritual essence (in the secular or religious sense) ()	
I have felt connected to a source of universal love ()	
I have seen things from a broad perspective, 'the bigger picture' ()	
I have felt that everything is interconnected ()	

End of Block: Connectedness

Beginning of Block: Demographic data

Q9 How old are you?

Q10 What gender do you identify as ?

Female (1)

Male (2)

Diverse (3)

Other (4) _____

Prefer not to say (5)

Q11 What is your nationality ?

- German (1)
- Dutch (2)
- Other (3) _____
-

Q12 What is your level of education ?

- Didn't finish secondary education (1)
- High-school (2)
- College education (3)
- Bachelors degree (4)
- Masters degree (5)
- Ph.D. or other higher qualification (6)
- Prefer not to say (7)
-

Q13 For users of SurveyCircle (www.surveycircle.com): The Survey Code is: LTKF-26XH-EB81-KE1V

Redeem survey code with one click: <https://www.surveycircle.com/LTKF-26XH-EB81-KE1V/>

Please continue to the last page to finalize your participation :)

End of Block: Demographic data

Note. The scales used in the online questionnaire, which were not related to the dependent variables of the current study but to the dependent variables of the other group members, were removed from this report.

Appendix B

R Script

```
library(tidyverse)
library(car)
library(boot)
library(Kendall)
library(broom)
library(ppcor)
library(modelr)
library(ggplot2)
library(psych)

#Import data
dataraw <- read.csv("Connectedness_22. April 2024_03.14.csv",sep="," )
view(dataraw)

#Clean the data
# Filter rows where finished equals 1
data_filtered <- dataraw %>%
  filter(Finished == 'True')

view(data_filtered)

# Delete participants who said 'withdraw my data'
data_filtered <- data_filtered %>%
  filter(Q2 == 'I consent to take part in this study')

#Delet the one unreliable participant
data_filtered <- data_filtered[-1,]

#Exploring the data
#Gender
gender_count <- table(data_filtered$Q10)
gender_percentage <- prop.table(gender_count) * 100
print(gender_count)
print(gender_percentage)

#Education
education_count <- table(data_filtered$Q12)
education_percentage <- prop.table(education_count) * 100
print(education_count)
print(education_percentage)

#Nationality
nationality_count <- table(data_filtered$Q11)
nationality_percentage <- prop.table(nationality_count) * 100
```

```
print(nationality_count)
print(nationality_percentage)
```

```
#Age
```

```
mean(data_filtered$Q9)
class(data_filtered$Q9)
data_filtered$Q9 <- as.numeric(data_filtered$Q9)
without_NA <- na.omit(data_filtered$Q9)
mean(without_NA)
sd(without_NA)
```

```
#Make a dataset with my variables
```

```
mydata <- data_filtered %>%
select(Q3_1,Q3_2,Q3_3,Q3_4,Q3_5,Q3_6,Q3_7,Q3_8,Q3_9,Q3_10,Q3_11,Q3_12,Q3_13,Q3_1
4,Q3_15,Q3_16,Q3_17,Q3_18,Q3_19,Q3_20,Q3_21,Q3_22,Q3_23,Q3_24,Q3_25,Q3_26,Q3_27
,Q3_28,Q3_29,
Q6_1,Q6_2,Q6_3,Q6_4,Q6_5,Q6_6,Q6_7,Q6_8,Q6_9,Q6_10,Q6_11,Q6_12,Q6_13,Q6_14,
Q8_1,Q8_2,Q8_3,Q8_4,Q8_5,Q8_6,Q8_7,Q8_8,Q8_9,Q8_10,Q8_11,Q8_12,Q8_13,Q8_14,Q8_
15,Q8_16,Q8_17,Q8_18,Q8_19,
)
```

```
view(mydata)
```

```
#Make SNS variable
```

```
class(mydata$Q3_10)
```

```
mydata$Q3_1 <- as.numeric(mydata$Q3_1)
mydata$Q3_2 <- as.numeric(mydata$Q3_2)
mydata$Q3_3 <- as.numeric(mydata$Q3_3)
mydata$Q3_4 <- as.numeric(mydata$Q3_4)
mydata$Q3_5 <- as.numeric(mydata$Q3_5)
mydata$Q3_6 <- as.numeric(mydata$Q3_6)
mydata$Q3_7 <- as.numeric(mydata$Q3_7)
mydata$Q3_8 <- as.numeric(mydata$Q3_8)
mydata$Q3_9 <- as.numeric(mydata$Q3_9)
mydata$Q3_10<- as.numeric(mydata$Q3_10)
mydata$Q3_11<- as.numeric(mydata$Q3_11)
mydata$Q3_12<- as.numeric(mydata$Q3_12)
mydata$Q3_13<- as.numeric(mydata$Q3_13)
mydata$Q3_14<- as.numeric(mydata$Q3_14)
mydata$Q3_15<- as.numeric(mydata$Q3_15)
mydata$Q3_16<- as.numeric(mydata$Q3_16)
mydata$Q3_17<- as.numeric(mydata$Q3_17)
mydata$Q3_18<- as.numeric(mydata$Q3_18)
mydata$Q3_19<- as.numeric(mydata$Q3_19)
mydata$Q3_20<- as.numeric(mydata$Q3_20)
```

```

mydata$Q3_21<- as.numeric(mydata$Q3_21)
mydata$Q3_22<- as.numeric(mydata$Q3_22)
mydata$Q3_23<- as.numeric(mydata$Q3_23)
mydata$Q3_24<- as.numeric(mydata$Q3_24)
mydata$Q3_25<- as.numeric(mydata$Q3_25)
mydata$Q3_26<- as.numeric(mydata$Q3_26)
mydata$Q3_27<- as.numeric(mydata$Q3_27)
mydata$Q3_28<- as.numeric(mydata$Q3_28)
mydata$Q3_29<- as.numeric(mydata$Q3_29)

```

```

mydata<- mydata %>%
  mutate(SNS = Q3_1 + Q3_2 + Q3_3 + Q3_4 + Q3_5 + Q3_6 + Q3_7 + Q3_8 + Q3_9 + Q3_10
+ Q3_11 + Q3_12 + Q3_13 + Q3_14 + Q3_15 + Q3_16 + Q3_17 + Q3_18 + Q3_19 + Q3_20 +
Q3_21 + Q3_22 + Q3_23 + Q3_24 + Q3_25 + Q3_26 + Q3_27 + Q3_28 + Q3_29)

```

```

#Make connectedness variable

```

```

#Make numeric

```

```

class(mydata$Q8_1)
mydata$Q8_1 <- as.numeric(mydata$Q8_1)
mydata$Q8_2 <- as.numeric(mydata$Q8_2)
mydata$Q8_3 <- as.numeric(mydata$Q8_3)
mydata$Q8_4 <- as.numeric(mydata$Q8_4)
mydata$Q8_5 <- as.numeric(mydata$Q8_5)
mydata$Q8_6 <- as.numeric(mydata$Q8_6)
mydata$Q8_7 <- as.numeric(mydata$Q8_7)
mydata$Q8_8 <- as.numeric(mydata$Q8_8)
mydata$Q8_9 <- as.numeric(mydata$Q8_9)
mydata$Q8_10<- as.numeric(mydata$Q8_10)
mydata$Q8_11<- as.numeric(mydata$Q8_11)
mydata$Q8_12<- as.numeric(mydata$Q8_12)
mydata$Q8_13<- as.numeric(mydata$Q8_13)
mydata$Q8_14<- as.numeric(mydata$Q8_14)
mydata$Q8_15<- as.numeric(mydata$Q8_15)
mydata$Q8_16<- as.numeric(mydata$Q8_16)
mydata$Q8_17<- as.numeric(mydata$Q8_17)
mydata$Q8_18<- as.numeric(mydata$Q8_18)
mydata$Q8_19<- as.numeric(mydata$Q8_19)

```

```

#Reverse scores

```

```

mydata <- mydata %>%
  mutate(reverseQ8_1 = 100 - Q8_1)
mydata <- mydata %>%
  mutate(reverseQ8_8 = 100 - Q8_8)
mydata <- mydata %>%
  mutate(reverseQ8_12 = 100 - Q8_12)
mydata <- mydata %>%
  mutate(reverseQ8_13 = 100 - Q8_13)

```

```
view(mydata)
```

```
#Make new variable
```

```
mydata<- mydata %>%
```

```
  mutate(connectedness = reverseQ8_1 + Q8_2 + Q8_3 + Q8_4 + Q8_5 + Q8_6 + Q8_7 +
reverseQ8_8 + Q8_9 + Q8_10 + Q8_11 + reverseQ8_12 + reverseQ8_13 + Q8_14 + Q8_15 +
Q8_16 + Q8_17 + Q8_18 + Q8_19)
```

```
#Create dimension variables
```

```
#Self
```

```
mydata<- mydata %>%
```

```
  mutate(self_connectedness = Q8_2 + Q8_3 + Q8_4 + Q8_5 + Q8_6 + Q8_7)
```

```
#Others
```

```
mydata<- mydata %>%
```

```
  mutate(other_connectedness = reverseQ8_1 + reverseQ8_8 + Q8_9 + Q8_10 + reverseQ8_12 +
reverseQ8_13)
```

```
#World
```

```
mydata<- mydata %>%
```

```
  mutate(world_connectedness = Q8_11 + Q8_14 + Q8_15 + Q8_16 + Q8_17 + Q8_18 + Q8_19)
```

```
#Make mental health variables
```

```
#Give values
```

```
mydata <- mydata %>%
```

```
  mutate(Q6_1 = case_when(
    Q6_1 == 'every day' ~ 5,
    Q6_1 == 'almost every day' ~ 4,
    Q6_1 == 'about 2 or 3 times a week' ~ 3,
    Q6_1 == 'about once a week' ~ 2,
    Q6_1 == 'once or twice' ~ 1,
    Q6_1 == 'never' ~ 0,
  ))
```

```
mydata <- mydata %>%
```

```
  mutate(Q6_2 = case_when(
    Q6_2 == 'every day' ~ 5,
    Q6_2 == 'almost every day' ~ 4,
    Q6_2 == 'about 2 or 3 times a week' ~ 3,
    Q6_2 == 'about once a week' ~ 2,
    Q6_2 == 'once or twice' ~ 1,
    Q6_2 == 'never' ~ 0,
  ))
```

```
mydata <- mydata %>%
```

```
  mutate(Q6_3 = case_when(
    Q6_3 == 'every day' ~ 5,
    Q6_3 == 'almost every day' ~ 4,
    Q6_3 == 'about 2 or 3 times a week' ~ 3,
    Q6_3 == 'about once a week' ~ 2,
    Q6_3 == 'once or twice' ~ 1,
  ))
```



```

    Q6_3 == 'never' ~ 0,
  ))
mydata <- mydata %>%
  mutate(Q6_4 = case_when(
    Q6_4 == 'every day' ~ 5,
    Q6_4 == 'almost every day' ~ 4,
    Q6_4 == 'about 2 or 3 times a week' ~ 3,
    Q6_4 == 'about once a week' ~ 2,
    Q6_4 == 'once or twice' ~ 1,
    Q6_4 == 'never' ~ 0,
  ))
mydata <- mydata %>%
  mutate(Q6_5 = case_when(
    Q6_5 == 'every day' ~ 5,
    Q6_5 == 'almost every day' ~ 4,
    Q6_5 == 'about 2 or 3 times a week' ~ 3,
    Q6_5 == 'about once a week' ~ 2,
    Q6_5 == 'once or twice' ~ 1,
    Q6_5 == 'never' ~ 0,
  ))
mydata <- mydata %>%
  mutate(Q6_6 = case_when(
    Q6_6 == 'every day' ~ 5,
    Q6_6 == 'almost every day' ~ 4,
    Q6_6 == 'about 2 or 3 times a week' ~ 3,
    Q6_6 == 'about once a week' ~ 2,
    Q6_6 == 'once or twice' ~ 1,
    Q6_6 == 'never' ~ 0,
  ))
mydata <- mydata %>%
  mutate(Q6_7 = case_when(
    Q6_7 == 'every day' ~ 5,
    Q6_7 == 'almost every day' ~ 4,
    Q6_7 == 'about 2 or 3 times a week' ~ 3,
    Q6_7 == 'about once a week' ~ 2,
    Q6_7 == 'once or twice' ~ 1,
    Q6_7 == 'never' ~ 0,
  ))
mydata <- mydata %>%
  mutate(Q6_8 = case_when(
    Q6_8 == 'every day' ~ 5,
    Q6_8 == 'almost every day' ~ 4,
    Q6_8 == 'about 2 or 3 times a week' ~ 3,
    Q6_8 == 'about once a week' ~ 2,
    Q6_8 == 'once or twice' ~ 1,
    Q6_8 == 'never' ~ 0,
  ))

```

```

mydata <- mydata %>%
  mutate(Q6_9 = case_when(
    Q6_9 == 'every day' ~ 5,
    Q6_9 == 'almost every day' ~ 4,
    Q6_9 == 'about 2 or 3 times a week' ~ 3,
    Q6_9 == 'about once a week' ~ 2,
    Q6_9 == 'once or twice' ~ 1,
    Q6_9 == 'never' ~ 0,
  ))
mydata <- mydata %>%
  mutate(Q6_10 = case_when(
    Q6_10 == 'every day' ~ 5,
    Q6_10 == 'almost every day' ~ 4,
    Q6_10 == 'about 2 or 3 times a week' ~ 3,
    Q6_10 == 'about once a week' ~ 2,
    Q6_10 == 'once or twice' ~ 1,
    Q6_10 == 'never' ~ 0,
  ))
mydata <- mydata %>%
  mutate(Q6_11 = case_when(
    Q6_11 == 'every day' ~ 5,
    Q6_11 == 'almost every day' ~ 4,
    Q6_11 == 'about 2 or 3 times a week' ~ 3,
    Q6_11 == 'about once a week' ~ 2,
    Q6_11 == 'once or twice' ~ 1,
    Q6_11 == 'never' ~ 0,
  ))
mydata <- mydata %>%
  mutate(Q6_12 = case_when(
    Q6_12 == 'every day' ~ 5,
    Q6_12 == 'almost every day' ~ 4,
    Q6_12 == 'about 2 or 3 times a week' ~ 3,
    Q6_12 == 'about once a week' ~ 2,
    Q6_12 == 'once or twice' ~ 1,
    Q6_12 == 'never' ~ 0,
  ))
mydata <- mydata %>%
  mutate(Q6_13 = case_when(
    Q6_13 == 'every day' ~ 5,
    Q6_13 == 'almost every day' ~ 4,
    Q6_13 == 'about 2 or 3 times a week' ~ 3,
    Q6_13 == 'about once a week' ~ 2,
    Q6_13 == 'once or twice' ~ 1,
    Q6_13 == 'never' ~ 0,
  ))
mydata <- mydata %>%
  mutate(Q6_14 = case_when(

```

```

Q6_14 == 'every day' ~ 5,
Q6_14 == 'almost every day' ~ 4,
Q6_14 == 'about 2 or 3 times a week' ~ 3,
Q6_14 == 'about once a week' ~ 2,
Q6_14 == 'once or twice' ~ 1,
Q6_14 == 'never' ~ 0,
))

```

```
#Make numeric
```

```

mydata$Q6_1 <- as.numeric(mydata$Q6_1)
mydata$Q6_2 <- as.numeric(mydata$Q6_2)
mydata$Q6_3 <- as.numeric(mydata$Q6_3)
mydata$Q6_4 <- as.numeric(mydata$Q6_4)
mydata$Q6_5 <- as.numeric(mydata$Q6_5)
mydata$Q6_6 <- as.numeric(mydata$Q6_6)
mydata$Q6_7 <- as.numeric(mydata$Q6_7)
mydata$Q6_8 <- as.numeric(mydata$Q6_8)
mydata$Q6_9 <- as.numeric(mydata$Q6_9)
mydata$Q6_10 <- as.numeric(mydata$Q6_10)
mydata$Q6_11 <- as.numeric(mydata$Q6_11)
mydata$Q6_12 <- as.numeric(mydata$Q6_12)
mydata$Q6_13 <- as.numeric(mydata$Q6_13)
mydata$Q6_14 <- as.numeric(mydata$Q6_14)

```

```
#Add new variable
```

```

mydata <- mydata %>%
  mutate(mental = Q6_1 + Q6_2 + Q6_3 + Q6_4 + Q6_5 + Q6_6 + Q6_7 + Q6_8 + Q6_9 +
Q6_10 + Q6_11 + Q6_12 + Q6_13 + Q6_14)

```

```
view(mydata)
```

```
#Descriptive statistics connectedness
```

```

summary(mydata$connectedness)
mean(mydata$connectedness)
sd(mydata$connectedness)

```

```
#Descriptive statistics mental health
```

```

mean(mydata$mental)
sd(mydata$mental)

```

```
#Descriptive statistics SNS use
```

```

mean(mydata$SNS)
sd(mydata$SNS)

```

```
#Assumption check
```

```

model_interaction <- lm(mental ~ SNS * connectedness, data = mydata)
summary(model_interaction)

```

```

#Linearity and independence
mydata %>%
  add_predictions(model_interaction) %>%
  add_residuals(model_interaction) %>%
  ggplot(aes(x = pred, y = resid)) +
  geom_point()

mydata %>%
  add_predictions(model_interaction) %>%
  add_residuals(model_interaction) %>%
  ggplot(aes(x = pred, y = resid)) +
  geom_point() +
  geom_smooth(method = "loess", se = FALSE)

#Other assumptions
par(mfrow=c(2,2))

vif(model_interaction)
vif(model_interaction, type = 'predictor')

#Correlation analysis Kendall's tau
mydata %>%
  dplyr::select(mental, SNS, connectedness) %>%
  pcor(method = "kendall")

# Add p value
pcor_results <- mydata %>%
  dplyr::select(mental, SNS, connectedness) %>%
  pcor(method = "kendall")

estimates <- pcor_results$estimate
p_values <- pcor_results$p.value
statistics <- pcor_results$statistic

combined_table <- data.frame(
  Variable1 = rep(rownames(estimates), times = ncol(estimates)),
  Variable2 = rep(colnames(estimates), each = nrow(estimates)),
  Estimate = as.vector(estimates),
  P_Value = as.vector(p_values),
  Statistic = as.vector(statistics)
)

combined_table <- combined_table %>%
  filter(Variable1 != Variable2)

print(combined_table)

```

```

#Moderation analysis using bootstrapping
set.seed(12345)
model_b <- lm(mental ~ SNS * connectedness, data = mydata)
fit_b <- Boot(model_b, R = 5000)

summary(fit_b)
confint(fit_b, level = .95)
hist(fit_b)

#Add p values
boot_coefficients <- fit_b$t

original_coefficients <- coef(model_b)

p_values <- apply(boot_coefficients, 2, function(boot_sample) {
  mean(boot_sample < 0) * 2
})

results <- data.frame(
  Estimate = original_coefficients,
  `95% CI Lower` = confint(fit_b, level = .95)[, 1],
  `95% CI Upper` = confint(fit_b, level = .95)[, 2],
  p_value = p_values
)

print(results)

#Internal consistency of the scales
#Testing Cronbach's alpha
items <- mydata[, paste0("Q6_", 1:14)]
items <- mydata[, paste0("Q8_", 1:19)]
items <- mydata[, paste0("Q3_", 1:29)]
items <- mydata[, c("reverseQ8_1", "Q8_2", "Q8_3", "Q8_4", "Q8_5", "Q8_6", "Q8_7",
"reverseQ8_8", "Q8_9", "Q8_10", "Q8_11", "reverseQ8_12", "reverseQ8_13", "Q8_14",
"Q8_15", "Q8_16", "Q8_17", "Q8_18", "Q8_19")]

cronbach_alpha <- alpha(items)$total$alpha
alpha(items)
summary(alpha(items))$total$alpha

cronbach_alpha

#Average time spend
data_filtered$Duration..in.seconds. <- as.numeric(data_filtered$Duration..in.seconds.)
mean(data_filtered$Duration..in.seconds.)

```

Appendix C*Artificial Intelligences Statement*

During the preparation of this work the author used translator Deepl in order to find appropriate vocabulary and formulations. Furthermore, Grammarly was used in order to check for spelling and grammar mistakes. Google drive was also used to identify spelling mistakes. Additionally, ChatGPT was used in order to assist with the data analysis by finding suitable R codes. After using these tools/services, the author reviewed and edited the content as needed and takes full responsibility for the content of the work.