Effects of Social Media Use on Undergraduate Students' Mental Health during the COVID-19 Pandemic

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The COVID-19 pandemic has exacerbated the mental health crisis among college students in the United States. As college students battle with record high levels of depression, anxiety, and lonliness, students are increasingly turning to social media to help cope. Increased social media use is determiential to college students' mental health and wellbeing. Over the course of 21 days, social media use and wellbeing were recorded. Decreased social media use was significantly correlated with improved psychological wellbeing.

pandemic | mental health | college | undergraduates

The United States is facing a mental health crisis among college undergraduate students. According to the American College Health Association, in Spring 2019, 65.7% of college students experienced overwhelming anxiety, while 45.1% felt so depressed that it was difficult to function (1). Over 50% of students surveyed categorized academics as traumatic or difficult to handle (1).

The coronavirus disease 2019 (COVID-19) pandemic has only worsened the mental health crisis among college students. In Fall 2020, over 75% of surveyed college students indicated that COVID-19 had worsened their mental health (2), with 30.5% of students reporting that their mental health impaired their academic performance3, a nearly 10% increase compared to 2019 (3). The COVID-19 pandemic has increased the difficulties of seeking appropriate mental health resources, with 60% of college students citing increased difficulties in accessing mental health care (3). As college students grapple with two disasters, the worsening mental health crisis, and the COVID-19 pandemic, rates of suicidal ideations significantly increased. In October 2020, roughly 1 in 5 college students reported suicidal ideations (3).

The COVID-19 pandemic presents a two-pronged attack on the psychological wellbeing of college students. Just over one year since the World Health Organization declared COVID-19 a pandemic(4), over 500,000 Americans have died from the disease (5). While college students are statistically unlikely to die from COVID-19 (6), students are concerned with transmitting the disease to a vulnerable family member or loved one. Approximately 64% of surveyed college students were anxious about a person they cared about being infected (3). Excessive worrying during disease outbreaks is not uncommon and a known contributor to poor mental health (7)

Furthermore, safety measures enacted to prevent the transmission of COVID-19 inadvertently worsened college students' psychological wellbeing. To slow the transmission of COVID-19, government officials implemented several mass quarantine orders, including stay-at-home orders and curfews, to restrict any unnecessary gatherings (8). The Center for Disease Control and Prevention (CDC) prohibited gatherings of more than 10 individuals and mandated at least six feet of separation between individuals (9). Consequently, universities shifted to fully virtual learning to comply with public health regulations. During the Spring 2020 semester, 1,413 four-year institutions transitioned to online learning (10). Virtual learning continued throughout the summer and fall semester, with only 51 four-year institutions fully in-person for the Autumn 2020 semester (10).

The abrupt shift to virtual learning and restrictions on in-person gatherings led to heightened social isolation. For adolescents, individuals between the ages of 10 to 24, social interactions are a critical component of their development (11). Adolescents are increasingly sensitive to acceptance, rejection, and opinions among peers (12). An adolescent's social environment greatly impacts the development of their social brain network. The social brain network refers to a cluster of brain regions and structures involved in social cognitive functions, such as face-processing, mentalizing, and social emotion (11). Poor development of the social brain network is correlated with elevated risks of engaging in risky behavior and substance use (11). Poor social interactions, such as rejection, and loneliness, are known risk factors for mental illness development (13). Furthermore, healthy social interactions serve as protective factors against the development of mental illnesses (12). As students struggle with social isolation, many turned to social media to replicate in-person social interactions.

Before the pandemic, social media use was an area of much debate. While moderate social media use can be beneficial, excessive use is detrimental to one's mental wellbeing. Increased social media use is directly correlated with decreased psychological wellbeing (14) and self-esteem, as well as increased

Significance Statement

This paper was compiled as supporting documentation for submission in the Oak Ridge Institute for Science and Education (ORISE) Mental Health Awareness: Undergraduate Challenge. The ORISE Mental Health Awareness: Undergraduate Challenge encourages students to research, implement, and document a healthy coping mechanism to improve their mental well-being. As the mental health crisis continues to ravish college students across the nation, it is imperative for students to practice healthy coping skills. The development of a podcast targeted at undergraduate students will increase students' awareness of the benefits of implementing healthy coping mechanisms.

anxiety and depression (15). Specifically, individuals who use social media are more likely to perceive themselves and others negatively. In a 2017 study of over 700 college students, researchers Tandoc and Ferrucci discovered that increased Facebook use resulted in a phenomenon dubbed "Facebook envy," which is an accurate predictor of future depressive symptoms (16). As college students continue to use social media to cope with the COVID-19 pandemic, much concern exists about their psychological wellbeing.

As college students struggle with their mental health during the COVID-19 pandemic, students must implement healthy coping mechanisms. Since excessive social media use is predictive of lower mental wellbeing, I chose to investigate if limiting social media improved my mood. I committed to limiting my social media use for 21 days to improve my mental health.

Methods

Social Media Measures. Social media is defined as "the collection of software that enables individuals and communities to gather, communicate, share, and in some cases collaborate or play" (17). Users can access social media through most internet-connected appliances, with the majority accessing social media through web-browsers or smartphone applications ("apps") (18). For this experiment, a website and/or app is classified as social media if it meets the following criteria:

1. Facilitates communication and engagement among users
2. Allows the creation, access and sharing of user-generated content

Mobile messaging apps, such as WhatsApp, WeChat, and Kik, were excluded from the study. Social media use was recorded using Apple's screen time app (19), which records daily screen time usage. The screen time app records daily social media usage and social media usage by the specific app.

Psychological Measures. Mood assessments occurred throughout the experiment. Three assessments, the Perceived Stress Scale, Center for Epidemiologic Studies Depression Scale-Revised, and General Anxiety Disorder-7, were administered twice, on Day 1 and Day 21. A high-frequency mood assessment was completed daily.

Stress perception was measured through the assessment of the Perceived Stress Scale (PSS) (20). The PSS evaluates an individual's perceived stress level through the administration of ten questions. Each question asks the individual to evaluate recent stressful events or conditions produced in response to stress. Responses were measured with a Likert scale (0 = *"never"* to 4 = *"very often"*) that assessed the frequency of perceived stress events. Total scores ranged from 0 to 40, with a higher score indicative of higher stress levels. The PSS is a reliable indicator of short-term stress (21), with strong correlatives in undergraduate student populations (22). High levels of internal consistency (23) and validity suggest that using the PSS to assess stress in undergraduate student populations is sufficient (22). For the experiment, the PSS was modified to assess stress changes over the duration of three weeks instead of a month.

The Center for Epidemiologic Studies Depression Scale (CESD) (24) is a widely used self-assessment in measures of depressive-like symptoms (25). In 2004, the CESD was revised to reflect recent changes to the Diagnostic and Statistical Manual of Mental Disorders' reclassification of depressive symptoms. The Center for Epidemiologic Studies Depression Scale-Revised (CESD-R) comprises 20 questions that correspond with the nine groupings of depressive symptoms categorized by the DSM, dysphoria, anhedonia, appetite, sleep, concentration, worthlessness, fatigue, agitation, and suicidal ideations (25). Each question prompts the individual to respond on a Likert scale, with 5 possible responses: *"not at all or less than 1 day"*, *"1–2 days"*, *"3–4 days"*, *"5–7 days"*, and *"nearly every day for 2 weeks"*. Any score less than 16 indicates a lack of significant depression symptoms. Recent analysis supports the use of the CESD-R to measure depressive symptoms in the general population, citing strong internal consistency and convergent and divergent validity (26). Further research confirmed the validity of the CESD-R in undergraduate populations (27), making it an appropriate assessment choice for the experiment.

To measure changes in anxiety symptoms, the General Anxiety Disorder-7 (GAD-7) (28) was selected for its high reliability and validity (29). The GAD-7 assesses anxiety severity through 7 questions, each prompting the individual to respond with one of 4 possible choices: *"not at all"*, *"several days"*, *"more than half the days"*, *"nearly every day"*. Answers were scored on a Likert scale, with *"not at all"* as 0 and *"nearly every day"* as 4. A higher score correlates with more severe anxiety (28).

A high-frequency mood assessment was administered daily to measure frequent mood changes that may not be adequately captured by the PSS, CESD-R, or GAD-7. The daily mood assessment consists of four questions. Each question prompted the participant to select a value from 0, "strongly disagree" to 100, "strongly agree" on a visual analog scale. The four questions of the high-frequency mood assessment were:

1. I feel very anxious today.
2. I feel unhappy, sad, and/or useless today.
3. I am unable to concentrate and/or feel unmotivated.
4. I feel lonely.

Values from each question were summed together to yield the total score, with a range of 0 to 400, with 400 indicating significant mental distress. Please see Appendix A in the Supplementary Material file for a full list of questions used in the questionnaires.

Results

All statistical analysis and data visualizations were performed with R software (30), psych package (31), and several helper functions (32–43).

Six social media apps were used throughout the duration of the experiment: Facebook, Instagram, Linkedin, Snapchat, TikTok and Twitter. The average amount of social media use was 103.5 minutes a day. Twitter was the most used social media app, with an average of 38.50 minutes per day, while Facebook was the least used, with an average of 0.36 minutes per day. Use varied throughout the three weeks, with the most social media use occurring on February 18 (160 minutes) and the least amount on February 21 (39 minutes). Social media use initially trended downward, before briefly spiking upward and then gradually continued on a downward trend.

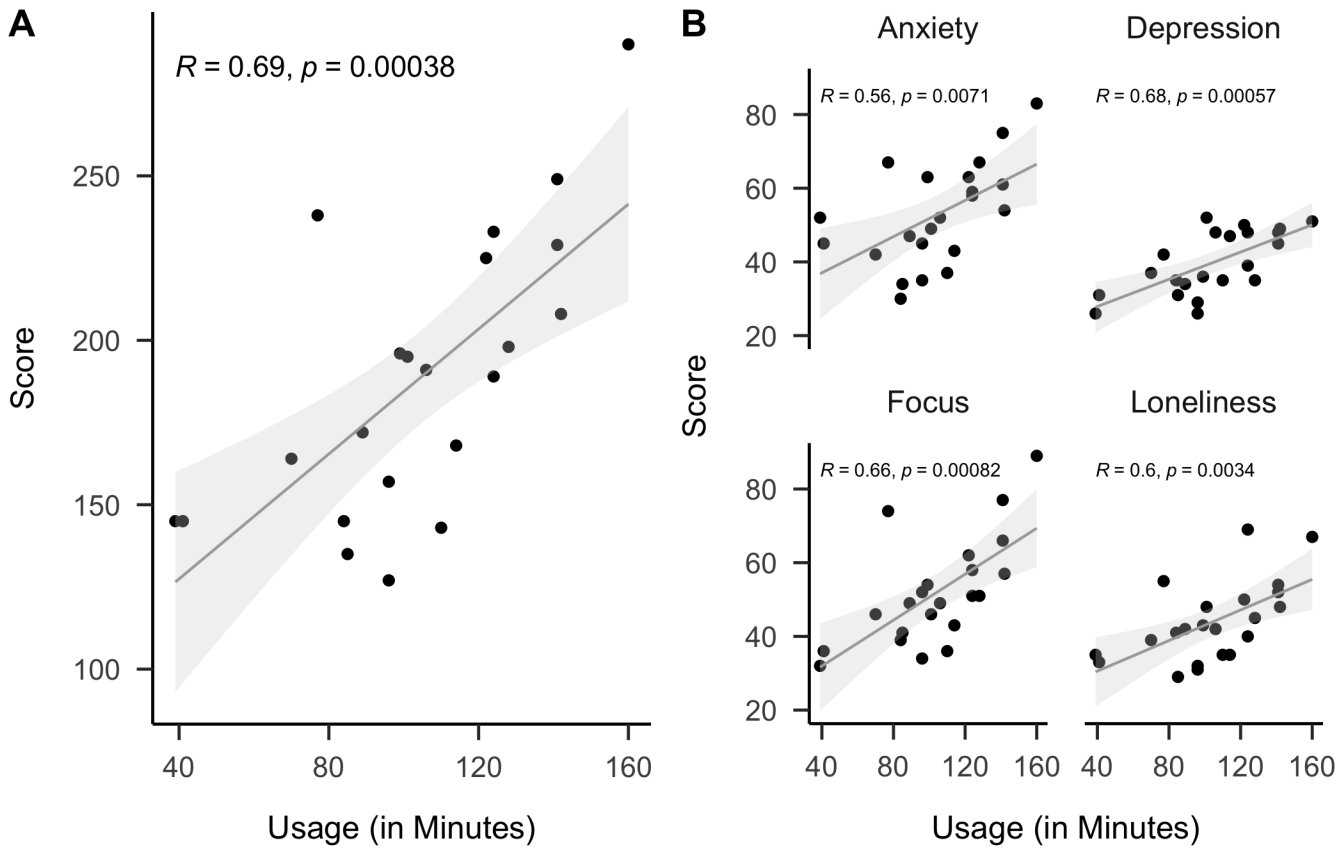

Fig. 1. The relationship between daily social media use and score from the high frequency mood assessment is represented in panel A. The relationship between daily social media use and the four subcomponents of the high frequency mood assessment, anxiety, depression, concentration, and loneliness, is depicted in panel B.

Table 1. Descriptive statistics of scores of high frequency mood assessment to capture daily fluctuations in mood. Daily scores were defined as the sum of the four subscores: anxiety, depression, focus, and loneliness. S.D. refers to standard deviation and S.E. refers to standard error

	Mean	S.D	Min	Max	Range	S.E.
Anxiety	52.8	13.8	30.0	83.0	53.0	2.9
Depression	39.7	8.5	26.0	52.0	26.0	1.8
Focus	51.9	14.7	32.0	89.0	57.0	3.1
Loneliness	43.9	10.8	29.0	69.0	40.0	2.3
Daily Score	188.3	42.9	127.0	290.0	163.0	9.1

The high frequency mood assessment was administered daily from February 1, 2021 to February 28, 2021. The average total score was 190. The highest total score occurred on February 18, 2021 at 290 while the lowest total score occurred on February 28, 2021 at 127. The average scores for anxiety, depression, focus and loneliness were 52, 38, 50, and 42 respectfully. Table 1 summarizes data obtained from the high frequency daily mood assessment.

The Pearson product-moment correlation coefficient was used to test for any significant relationships between social media use and scores of the high frequency mood assessment. To ensure compliance with the Pearson's test, the Shapiro–Wilk test was performed to confirm a normal distribution. The Shapiro-Wilk test analyzed five variables, total social media use (total SM), daily anxiety scores, daily depression scores, daily focus scores, daily loneliness scores, and total daily scores. For each variable, the Shapiro-Wilk test returned a p value greater than 0.05, which suggests that the data does not significantly deviate from a normal distribution. Therefore, the data was assumed to be normally distributed and appropriate for the use of the Pearson's test. The results of the Shapiro-Wilk test can be viewed in Table C1 in Appendix C. There was a significant correlation between social media use and daily mood score, with a Pearson's correlation coefficient of 0.69 and a p value less then 0.001. Additionally, significant correlation existed between social media use and daily anxiety ($r = 0.56$, $p = 0.0071$), daily depression ($r = 0.68$, $p = 0.00057$), daily focus ($r = 0.66$, $p = 0.00082$), and daily loneliness ($r = 0.60$, $p = 0.003409$). Figure 1 illustrates the relationship between social media use and daily mood score.

When analyzing the relationship between individual social media applications and total daily score, only TikTok had a significant correlation with total daily score. TikTok use was positively related to total daily score, with a correlation coefficient of 0.47 and a p value of 0.026.

On February 1, 2021, the PSS, CESD-R and GAD-7 were administered to serve as a baseline measure. Each test was then summed together to provide an overall composite score of 68 out of a possible 121 points. Administration of the PSS recorded a score of 23 points out of a possible 40, while the CESD-R recorded 34 points out of 60 and the GAD-7 measured 11 points out of 21.

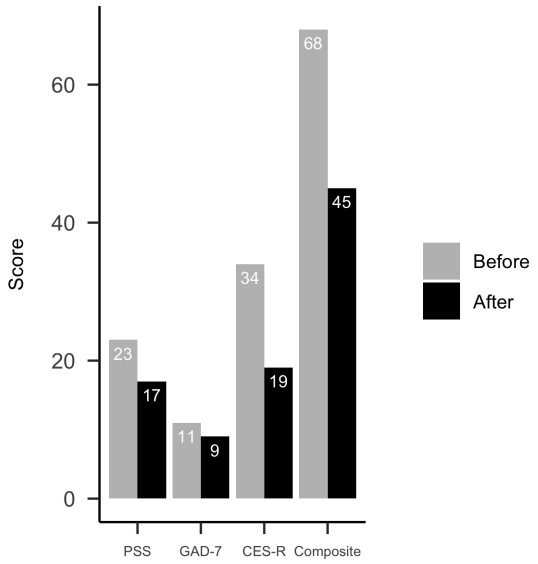

Fig. 2. Comparison of scores of the PSS, GAD-7, CEDS-R and total composite, before and after the 21 day experiment period. Tests were first administered on February 1, 2021 and administered a second time on Feburary 28, 2021

The PSS, CESD-R, and GAD-7 were administered again following the 21 day period. Administration of the PSS recorded a score of 17 points, administration of the GAD-7 recorded a score of 9 points, and the administration of the CES-R recorded a score of 19. The total composite score was 45, out of a possible 121 points. There was a 15% decrease in PSS scores, 10% decrease in GAD-7 scores, 25% decrease in CEDS-R scores and an overall 19% in total composite score. Figure 2 illustrates the results obtained in both pre/post administration of the assessments.

Project Decision

I decided to communicate the results of my findings through a podcast. From my experience as an undergraduate, I notice that the majority of my peers listen to podcasts. Therefore, I believe that a podcast would be the most efficient way to convince fellow college students about the effects of social media use on mental health. Managing mental health during the pandemic is of utmost importance, so I believe it is essential to communicate my findings in a way that appeals to the majority of undergraduate students.

I recorded the audio narrative for the podcast with QuickTime player (44) and rendered the clips in Davinci Resolve(45).

In addition to the podcast, I created a website to serve as a supplement. The website consists of an about page, as well as the podcast transcript and citations. I also included mental health resources for those who may listen to the podcast and seek additional help. The podcast website can be viewed at juliacat23.github.io/podcastwebsite. A pdf of the website is attached to the project submission.

ACKNOWLEDGMENTS. This paper was compiled in RMarkdown with the assistance of the `pnas_article()` template from the `rticles` package. The data, scripts, and source code used to generate this document can be found at github.com/juliacat23/pandemic-mental-health

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Appendix A: Questionnaires

Table A1. Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts during the last three weeks. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.	Never	Almost Never	Sometimes	Fairly Often	Very Often
1. In the last three weeks, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. In the last three weeks, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3. In the last three weeks, how often have you felt nervous and "stressed"?	0	1	2	3	4
4. In the last three weeks, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
5. In the last three weeks, how often have you felt that things were going your way?	0	1	2	3	4
6. In the last three weeks, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7. In the last three weeks, how often have you been able to control irritations in your life?	0	1	2	3	4
8. In the last three weeks, how often have you felt that you were on top of things?	0	1	2	3	4
9. In the last three weeks how often have you been angered because of things that were outside of your control?	0	1	2	3	4
10. In the last three weeks, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Table A2. Generalized Anxiety Disorder-7 (2006)

The questions in this scale ask you about your feelings and thoughts during the last three weeks. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.	Not at all	Several days	More than half	Nearly everyday
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid, as if something awful might happen	0	1	2	3

Table A3. Center for Epidemiologic Studies Depression Scale - Revised (2004)

	Below is a list of the ways you might have felt or behaved. Please check the boxes that best describe how often you have felt this way in the past week or so.				
	Not at all	1-2 days	3-4 days	5-7 days	Nearly everyday
1. My appetite was poor.	0	1	2	3	4
2. I could not shake off the blues.	0	1	2	3	4
3. I had trouble keeping my mind on what I was doing.	0	1	2	3	4
4. I felt depressed.	0	1	2	3	4
5. My sleep was restless.	0	1	2	3	4
6. I felt sad.	0	1	2	3	4
7. I could not get going.	0	1	2	3	4
8. Nothing made me happy.	0	1	2	3	4
9. I felt like a bad person.	0	1	2	3	4
10. I lost interest in my usual activities.	0	1	2	3	4
11. I slept much more than normal.	0	1	2	3	4
12. I felt like I was moving.	0	1	2	3	4
13. I felt fidgety.	0	1	2	3	4
14. I wished I were dead.	0	1	2	3	4
15. I wanted to hurt myself.	0	1	2	3	4
16. I was tired all the time.	0	1	2	3	4
17. I did not like myself.	0	1	2	3	4
18. I lost a lot of weight without trying.	0	1	2	3	4
19. I had a lot of trouble getting to sleep.	0	1	2	3	4
20. I could not focus on the important things.	0	1	2	3	4

Appendix B: Data

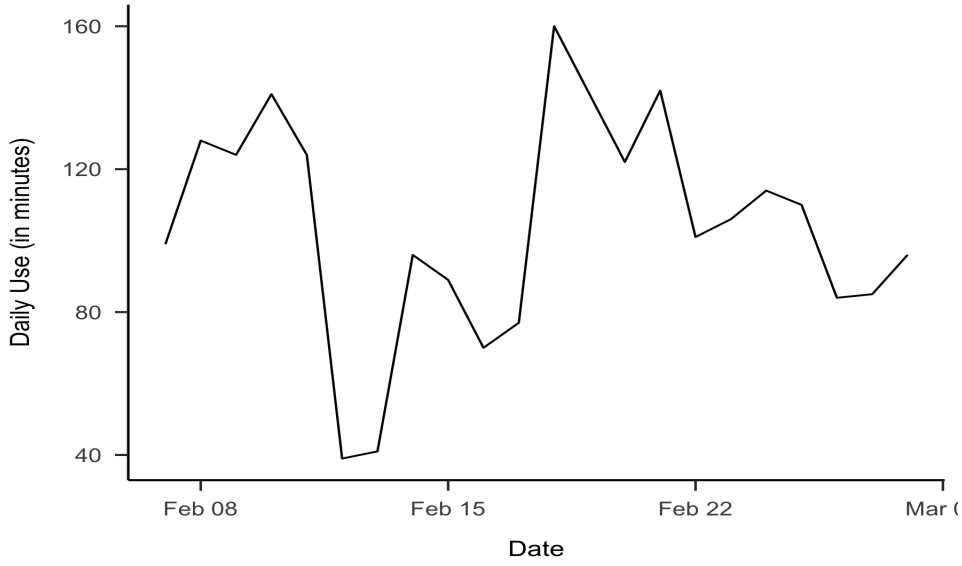

Fig. B1. Daily social media use across the duration of the experiment (Feburary 1 - Feburary 28). Measured in minutes by the Apple screen time app

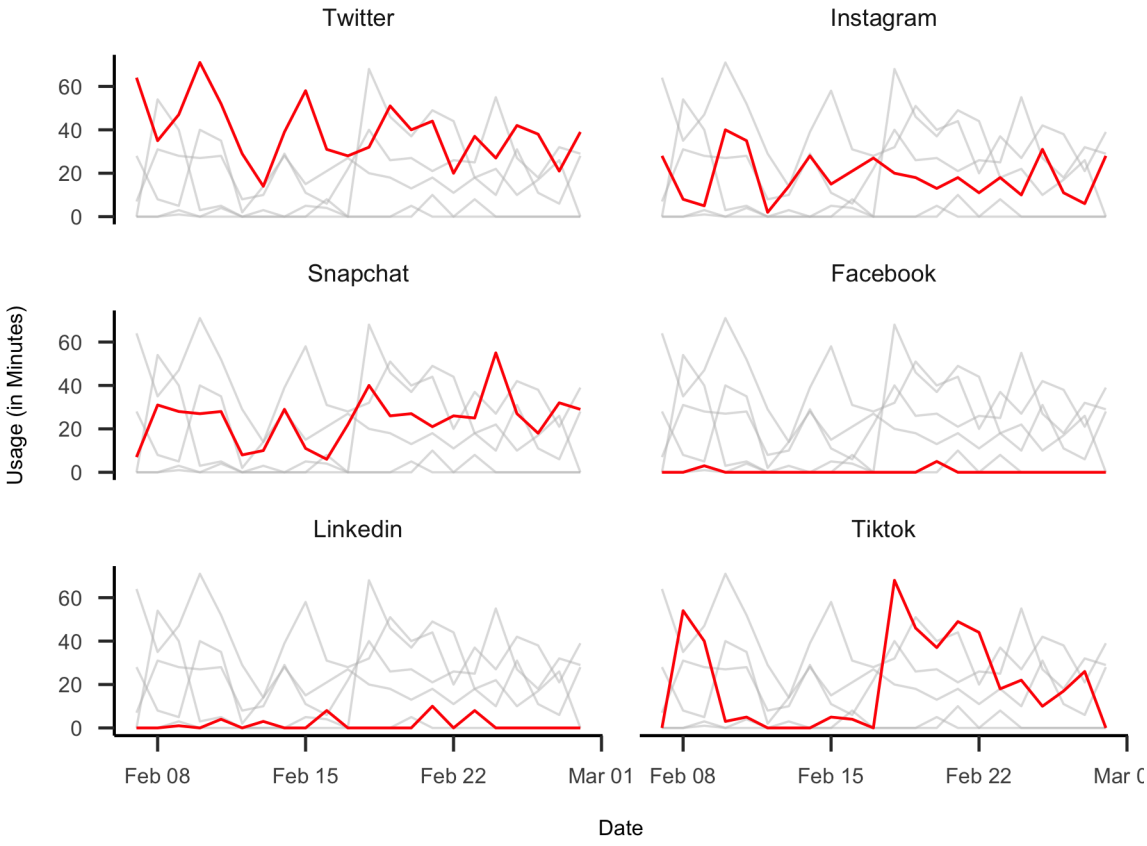

Fig. B2. Daily use by social media app, in minutes, as measured by the Apple screen time app.

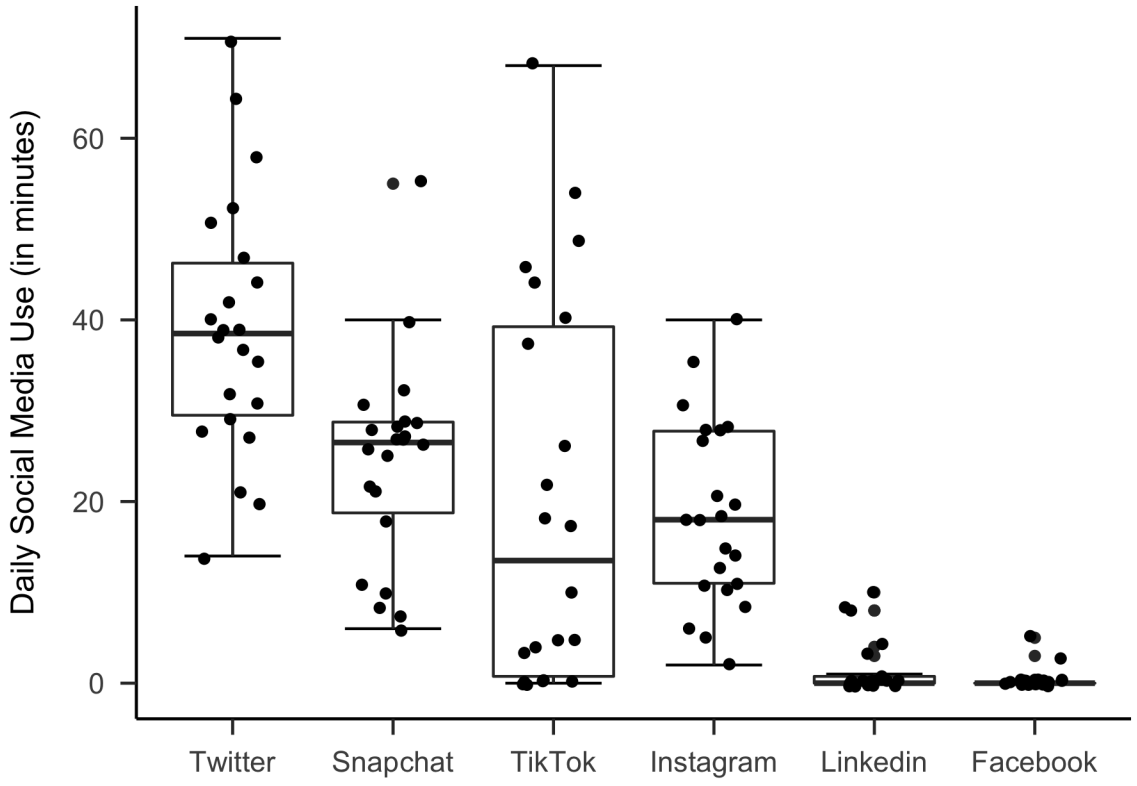

Fig. B3. Distribution of daily use by social media app.

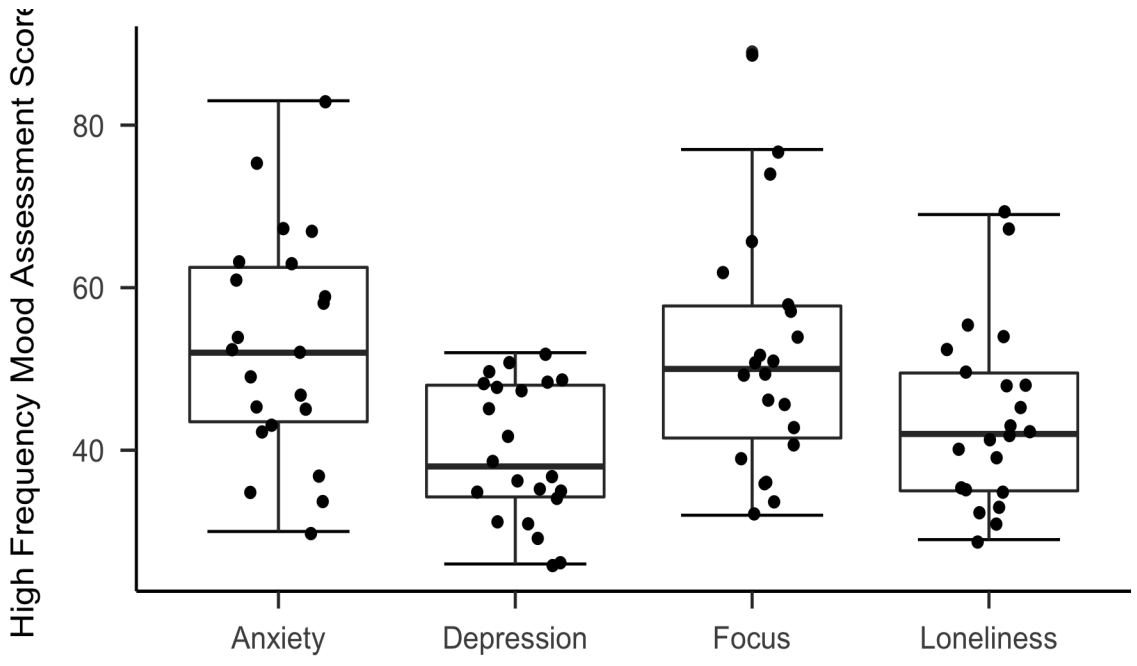

Fig. B4. Distribution of high frequency mood assessment scores.

Table B1. Descriptive statistics of social media use. Social media use was recorded in minutes with the Apple screen time app. S.D. refers to standard deviation and S.E. refers to standard error

	Mean	S.D.	Min	Max	Range	S.E.
Twitter	39.04	14.19	14	71	57	3.03
Instagram	18.50	10.26	2	40	38	2.18
Snapchat	24.22	11.40	6	55	49	2.43
Facebook	0.36	1.21	0	5	5	0.25
Linkedin	1.54	3.09	0	10	10	0.66
Tiktok	20.36	21.58	0	68	68	4.60
Total SM Use	104.04	31.15	39	160	121	6.64

Appendix C: Analysis

Table C1. Tests of Normality for the High-Frequency Mood Assessment

	Shapiro-Wilk			Kolmogorov Smirnov		
	Statistic	df	Sig.	Statistic	df	Sig.
Anxiety	0.97993	22	0.915	0.077612	22	0.9994
Depression	0.91983	22	0.07541	0.16682	22	0.5729
Focus	0.93635	22	0.1664	0.1339	22	0.8251
Loneliness	0.93132	22	0.1307	0.1339	22	0.8251
Total Composite	0.95189	22	0.3442	0.11627	22	0.9274

Table C2. Correlations of Social Media Usage and Daily Mood Composite Score, where * p < .05, ** p < .01, *** p < .001, **** p < .0001. Social media is abbreviated with 'SM'.

	Total SM Use	Twitter	Instagram	Snapchat	Facebook	Linkedin	Tiktok
Twitter	0.48*						
Instagram	0.27	0.54**					
Snapchat	0.59**	-0.14	-0.02				
Facebook	0.19	0.08	-0.26	0.09			
Linkedin	0.02	-0.05	0.07	-0.26	-0.12		
Tiktok	0.67***	-0.14	-0.42*	0.46*	0.26	0.02	
Daily Score	0.69***	0.35	0.32	0.25	0.17	0.03	0.47*

Table C3. Correlations of total social media use and components of high frequency mood assessment, where * p < .05, ** p < .01, *** p < .001, **** p < .0001. Social media is abbreviated with 'SM'.

	Total SM Use	Anxiety	Depression	Focus	Loneliness
Anxiety	0.56**				
Depression	0.68***	0.53*			
Focus	0.66***	0.86****	0.64**		
Loneliness	0.60**	0.74****	0.73***	0.80****	
Daily Score	0.69***	0.91****	0.77****	0.95****	0.91****