The Relationship of Students' Loneliness and Smartphone Use in a Time of Distance Learning Due to the COVID-19 Pandemic

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Abstract

University campuses and classes provide an environment where individuals can meet new people and establish a community. When universities moved to distant or online learning during the novel coronavirus disease 2019 (COVID-19) pandemic, little was known about how these changes may have impacted students' loneliness. The present study looks at differences in loneliness and smartphone use in university students in the time of COVID-19. Participants were first year undergraduate students. One group completed an online survey from February to March 13, 2020 (Wave 1; $N = 226$, 127 women, 98 men, 1 undisclosed) while they were taking in-person courses. Another group of students completed the same survey November to December 2020 (Wave 2; $N = 251$, 112 women, 138 men, 1 undisclosed) while they were taking courses via distance learning. The survey included a self-report questionnaire on loneliness (UCLA Loneliness Scale), as well as participant-entered information about smartphone use. Smartphone use included frequency, duration, and purpose. Overall, average duration of use was significantly higher in the distance learning group than the pre-pandemic group, with a decreased use of information apps. Ratings of loneliness did not change significantly between the in-class and distance-learning groups. The relationship with loneliness and smartphone use remained similar across the two waves. The correlation between social media app use and loneliness decreased from Wave 1 to Wave 2. The results suggest that students managed to cope with the changes to on-line learning and that the relationship of social media and loneliness has shifted.

Keywords

Loneliness, COVID-19, smartphone, social media

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1 The Relationship of Students' Loneliness and Smartphone Use in a Time of Distance Learning Due to the COVID-19 Pandemic

Distance learning is a solution that provides flexible access to education to overcome challenges of scheduling or health concerns; however, students describe the lack of community as a substantial drawback to the distance learning format. Loneliness is a serious concern for students in university and has been associated with smartphone use (MacDonald & Schermer, 2021). While there have been studies on loneliness at the beginning of the pandemic, few have examined loneliness in university students during a term of exclusively distance learning and have not studied the role of communication technology, such as smartphone use. Engaging solely in distance learning completely changed the university experience, and information from students about their loneliness and its relationship with smartphone usage is needed to guide future programming.

For university students in Ontario, Canada, the COVID-19 pandemic meant moving all classes to a distance learning format for the last few weeks of the winter 2020 term, which continued through the 2020–2021 school year. Distance learning is not unique to COVID-19 as secondary and post-secondary institutions frequently offer courses and programs delivered in a virtual format. There are advantages such as not having to move for a program, being able to have flexibility around other work or family commitments, or more access for students with mobility concerns. On the other hand, previous studies have found that the lack of community in distance learning can be a challenge (Song et al., 2004), and that collaboration and peer connectedness were key parts of decreasing loneliness in distance learning (Kaufmann & Vallade, 2020; Shearer et al., 2020). Moving all classes to distance learning increases the challenge of building a community of peers for many students.

Young adults are at risk for greater loneliness which has negative implications for their academic success. The COVID-19 pandemic brought reductions in social gatherings, through which increased loneliness is almost inevitable. For many adults, social distancing and gathering rules meant less time with others and most studies conducted near the beginning of the pandemic identified that loneliness increased during initial lockdowns compared to before (Bu et al., 2020; Lee et al., 2020). Young adults were identified as being particularly at risk (Lisitsa et al., 2020; Losada-Baltar et al., 2021). Attending post-secondary education is a process of significant change for many students, and past non-pandemic studies have consistently found that young adults in their 20's have higher levels of loneliness and experience more distress from loneliness than other age groups (MacDonald et al., 2020; Rokach, 2000; Victor & Yang, 2012). Loneliness is associated with negative outcomes in higher education, such as lower grades and intention to quit (Fandrem et al., 2021). Factors that prevent loneliness in university include making close friendships in first year, developing a broad group of acquaintances, and staying in touch with old friends (Thomas et al., 2020). Students who were starting their university expe-

rience during the distance learning period would have had more difficulty making close relationships without living in residence or participating in campus groups. On the other hand, developing a network of acquaintances would be possible if courses have been set up to encourage peer interaction through video or messaging. Furthermore, with distance learning, more students were living at home and thus were more likely to maintain friendships in their hometown. While first-year university students are more at risk of loneliness, protective factors like remaining at home may mitigate that risk.

One study that did not find a significant increase in loneliness in the first two months of the pandemic noted that there was in fact an increase in perceived support in their sample (Luchetti et al., 2020). A possible source of support may have been the use of technology to communicate with others. The Internet is a regular part of life as nearly 100% of Canadian youth are online daily (Statistics Canada, 2018). Social communication by instant messaging and social media has been common in the pandemic as over 70% of Canadians aged 18 to 65 chose to communicate with those methods in 2020 (Statistics Canada, 2021). The number is likely higher in emerging adults as MacDonald and Schermer (2021) found that 99% of university undergraduate students have at least one communication or social media applications (apps) as one of their top five most used apps. Communication technology has become a key part of social relationships.

When it comes to social technology use, Internet and social media use that is used to enhance offline relationships can be beneficial ("stimulation hypothesis"). On the other hand, social Internet use that takes away from time spent face-to-face is detrimental ("displacement hypothesis"; Nowland et al., 2018; Winstone et al., 2021). During the pandemic, face-to-face communication with others decreased due to social distancing, which means that relationships may have relied more on smartphone use. Studies found that overall duration of use was higher during the first COVID-19 lockdown than the month prior to any restrictions (Ohme et al., 2020; Sañudo et al., 2020), and that smartphone addiction was high during lockdowns (Hu et al., 2022). An in-depth look into smartphone usage between February and March 2020 revealed that the frequency (number of pick-ups) remained stable, but that more time was spent on news apps, communication apps, and social media (Ohme et al., 2020). Students often report using digital technologies to cope with loneliness, using smartphones for social support, as well as for distraction (Vasileiou et al., 2019) and escape from uncomfortable feelings (Li et al., 2021). Smartphone use has been demonstrated to be a moderator for feelings of social connection due to social distancing restrictions such that greater smartphone use lessens the negative impact of social distancing on feelings of social connectedness (David & Roberts, 2021). The way that people use technology may be important in understanding how smartphones can relate to social connection as Lisitsa et al. (2020) found that during COVID-19, greater social media use mediated the relationship between age group and loneliness scores. The studies above have examined smartphone use and loneliness within the pandemic, but to our knowledge, no studies compared the relationship of loneliness and smartphone

use before the pandemic to the same relationship several months into the pandemic. In addition, little is yet known about changes in behaviour and mental health in later waves compared to pre-COVID-19.

2 Present Study

We collected two groups of data to examine the impact of changes due to COVID-19 on self-report loneliness and smartphone use. Studies in the COVID-19 era suggest longer duration of smartphone use, as well as increased use of news, social media, and communication apps than before the pandemic announcement. Most studies have also found that loneliness increased. In addition, smartphone use has been found to mitigate the negative impacts of social distancing measures (David & Roberts, 2021). Based on these findings, we tested three hypotheses:

Hypothesis 1: In comparing the pre-COVID-19 sample to the during-COVID-19 sample, participants would report greater loneliness, longer duration of smartphone use, and increased use of communication, social media, and information apps.

Hypothesis 2: Smartphone use in the sample during COVID-19 would be associated with lower loneliness than smartphone use duration in the pre-COVID-19 sample.

Hypothesis 3: Social media app use in the sample during COVID-19 would be associated with lower loneliness than social media app use in the pre-COVID-19 sample.

3 Method

3.1 Data Preparation

Initially, 714 surveys were completed where participants reached the end of the survey and spent more than five minutes completing the survey. Data were eliminated on a listwise basis further for a number of conditions to confirm accurate data entry. Participants (n = 54) were excluded if they did not pass the attention checks. Participants also entered both the average screen time and total screen time for a one-week period from their personal smartphone. Several steps are involved for individuals to access this information correctly. To assess for possible reporting errors, we divided the total screen time minutes by the average. According to Wilcockson et al. (2018), five days of screen time data is sufficient to represent a reliable average. Following, we kept cases that fell between five and eight days (n = 149 eliminated). In the data for average pickups, there were some unusual outliers. We kept cases that had more than five and less than 400 pickups (n = 27 eliminated). We also divided the total number of pickups by the average as a precaution; retaining participants who had between two and eight days of data as Wilcockson et al.

(2018) found that pickup data was reliable within two days. This screening eliminated seven additional participants.

3.2 Participants

The first group of participants were 226 (127 women, 98 men, and 1 preferred not to disclose) undergraduate students recruited from a first-year management and organizational studies between February 10 and March 13, 2020. A second group of participants was recruited between November 4, 2020 and December 9, 2020. This sample included 251 (112 women, 138 men, 1 preferred not to disclose). The resulting complete sample was 477 (239 women and 236 men, 2 preferred not to disclose) with a mean of age of 18.50 years (SD_{AGE} = 0.99). The sample was comprised of undergraduate students, with an age range of 17 to 24 and median age of 18; the age distribution was not normal (positively skewed and highly leptokurtic). In addition to age and gender, participants choose from options that best described their living situation: "Alone" (N = 43), "With roommates (shared common spaces)" (N = 314), "With a spouse/long term partner" (N = 11), "With parents/relatives/caregivers" (N = 105) or "Other (please specify)" (N = 4). Participants who rated "other" generally described a combination of living with roommates and with family.

3.3 Procedure

Participants accessed an online survey through Qualtrics. Ethics approval was granted by the ethics board of the institution. The online survey contained demographic questions about participants' age, gender, living situation, and the measures listed below.

3.4 Measures

3.4.1 University of California Los Angeles (UCLA) Loneliness Scale (Version 3; Russell, 1996)

The UCLA Loneliness Scale is one of the most widely used self-report measures of loneliness (Russell, 1996), consisting of 20 items, each responded to using a 4-point Likert scale of "0 = Never", "1 = Rarely", "2 = Sometimes", and "3 = Often". The scale has been shown to have good reliability (Vassar & Crosby, 2008) and good construct and convergent validity (Russell, 1996). The present study resulted in high internal consistency (α = .94).

3.4.2 Smartphone Use

Smartphone use was evaluated using three different types of information taken from built-in applications ("apps") on Apple iPhone devices and Huawei Android devices. These two types of devices collect weekly totals of the information, which gives more robust information about smartphone use than a daily total. Participants were instructed with text and photos on how to access the appropriate information. Participants entered

weekly total and daily average "screen time" (measured in hours and minutes, calculated to minutes for analysis) and number of "pick-ups" (iPhone) or "unlocks" (Huawei), as an estimate of how frequently individuals used and checked their smartphones (note, the term "pickups" is used by the iPhone, but it does not register the count unless the user unlocks the smartphone).

The third type of information participants entered was their five most used apps. We created a coding system for the apps based on their primary function since there is little consistent criteria in the developer-assigned categories. In research about smartphones, the number of app categories can range from two (process and social, as described in Elhai et al., 2017) to twenty-nine (Zhao et al., 2016). Participants in the current study reported using their smartphone 6–7 hours per day and reported over 150 different apps, so two categories did not capture the variety of uses, but 29 categories was too broad for our sample size. We used the methods from a study on smartphone use and personality by Kim et al. (2015) as a guideline for app categories. The authors used five categories: E-commerce, entertainment, literacy, information, and relational. Examining the data we had, the e-commerce and literacy categories were small, so we expanded e-commerce to include other task-oriented apps (such as fitness trackers, maps, or timers) for a category called 'productivity'. Literacy apps were subsumed under entertainment. The biggest category was 'relational', and since we wanted to specifically look at social media, we split these apps into 'social media' and 'communication'. The descriptions for the categories were sent to an independent rater. Coding 10% of the total number of apps resulted in a high level of consensus (Cohen's Kappa = .99).

Once the apps were coded, we arranged them into counts of each category. For example, if a participant recorded their five most used apps as: Twitter, Messages, Clock, Netflix, Podcasts; the data would be: Social Media = 1, Communication = 1, Entertainment = 2, Productivity = 1, Information = 0.

4 Results

The data was analyzed using R version 4.0.2 (R Core Team, 2020). Descriptive statistics of the full sample can be found in Table 1.

Table 1: Descriptive Statistics and Inter Correlations Between Demographic and Scale Study Variables

Variable	*N*	*M*	*SD*	**1**	2	3	4	5
1. Age	476	18.50	0.99	1.00				
2. Gender[a]	475	0.50	0.50	.10	1.00			
3. Screen time	476	372.65	144.46	.08	.04	1.00		
4. Pickups	477	123.02	64.09	-.09	.06	.13	1.00	
5. Loneliness	475	22.28	11.94	.08	.06	.13	-.13	1.00

Note: Sample sizes varied due to missing data; Screen time = average daily smartphone screen time in minutes; Pickups = Average daily number of smartphone pickups; Loneliness = UCLA Loneliness Scale (Russell, 1996).
[a] Male = 0, female = 1
* $p < .05$, ** $p < .01$; two-tailed

The sample was divided into two groups. Wave 1 ($N = 226$) was a sample collected between February 19 to March 13, 2020. Wave 2 ($N = 251$) was collected from November 5 to December 9, 2020. This allows two distinct groups of one prior to COVID-19 restrictions, and one during COVID-19.

One-way ANOVA analysis revealed that participants did not vary in loneliness based on living arrangement ($F(4, 470) = 0.68$, $p = .604$) for the whole sample, nor was there an interaction that would suggest that being in Wave 1 or 2 would have a moderating effect ($p = .413$). *T*-tests showed that female students reported higher loneliness scores compared to male students in Wave 2 ($t_{\text{WELCH}}(246.55) = 2.559$, Cohen's $d = -0.57$, $p = .011$). The difference between male and female students in Wave 1 was not significant ($t(222) = -0.71$, Cohen's $d = -0.17$ $p = .478$).

Independent group *t*-tests were conducted to compare the two samples on UCLA Loneliness sale scores and smartphone use, including duration, frequency, information app use, social media app use, communication app use. Smartphone use duration (average screen time) increased significantly from Wave 1 ($M = 358.01$, $SD = 143.14$) to Wave 2 ($M = 385.78$, $SD = 144.67$, $t(474) = -2.10$, $p = .036$, $d = -.19$). Use of information apps was evaluated by the Mann-Whitney U test due to non-normality and unequal variances; information app use decreased significantly from Wave 1 ($M = 0.58$, $SD = 0.64$) to Wave 2 ($M = 0.19$, $SD = .51$; $p < .001$, $r = .36$; see Figure 1).

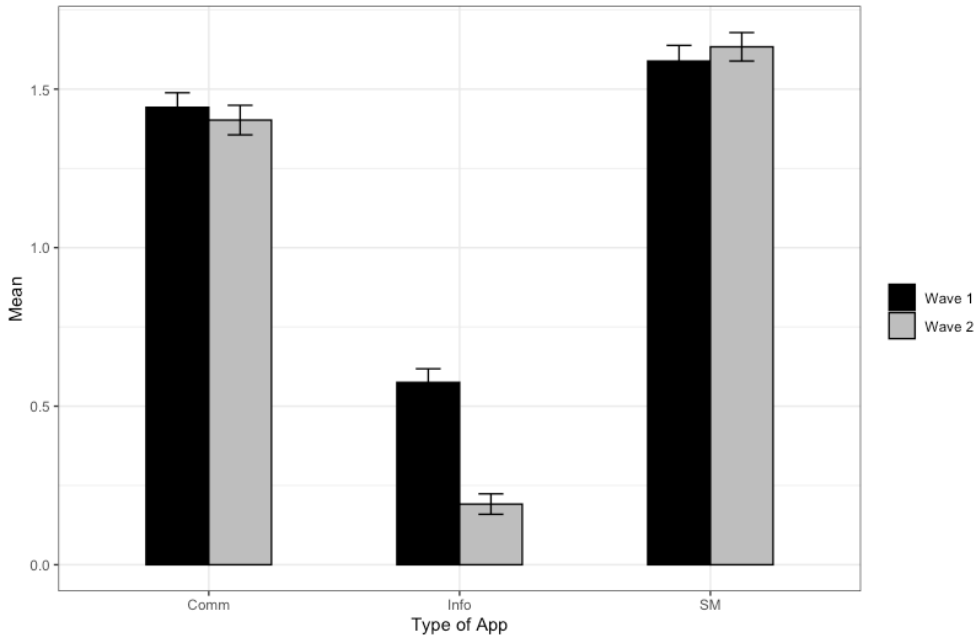

Figure 1: Means and standard errors for usage of app Type across waves

Ratings of loneliness and reports of smartphone use frequency, social media app use, and communication app use were not statistically different from Wave 1 to Wave 2. To examine whether there are changes in the relationship of loneliness and smartphone use between the two samples, the correlations of loneliness and smartphone duration were compared. Correlation coefficients for Wave 1 (r = .14) and Wave 2 (r = .11) were transformed to z scores using Fisher's r to z transformation and compared with the following equation (from Warner, 2012):

$$\frac{z_1 - z_2}{\sqrt{\frac{1}{N_1 - 3} + \frac{1}{N_2 - 3}}} \quad (1)$$

The correlations were not statistically different (z = .33, p = .363). The same method was used to compare correlations between loneliness and social media use from Wave 1 (r = .12) and Wave 2 (r = -.04), with a significant difference between the two groups (z = 1.74, p = .041), suggesting that social media was more highly correlated with loneliness in the pre-COVID-19 sample than in the sample during COVID-19 as depicted in Figure 2.

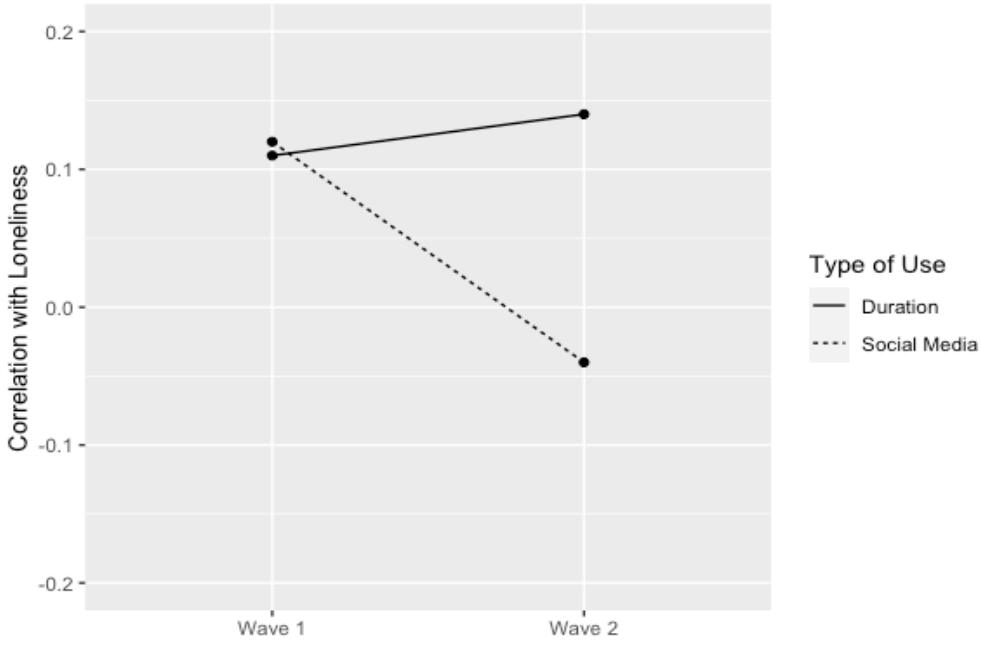

Figure 2: Correlations of smartphone use with loneliness across wave 1 and 2.

5 Discussion

The current study was uniquely placed to be able to compare loneliness and smartphone use before the COVID-19 pandemic, and eight months after the pandemic was declared. With Hypothesis 1, we expected that participants would report greater loneliness, longer duration of smartphone use, and increased use of information, communication, and social media apps in Wave 2, during the pandemic. These predictions were only partially supported. The present study found a significant increase in smartphone duration, consistent with findings from research at the outset of pandemic lockdowns (Ohme et al., 2020; Sañudo et al., 2020). Smartphone use overall increased by almost half an hour a day (to an overall average of about six hours and 40 minutes). In contrast to expectation, information app use (which includes news apps) decreased from Wave 1 to Wave 2. News and information apps may have been more important earlier in the pandemic (Ohme et al., 2020), but as the current study occurred eight months later, smartphone use may have been focussed elsewhere.

Results did not show an increased number of social media or communication app use, but since these two types of apps are already very popular, it is possible that there may be a ceiling effect with respect to the use of these apps. Future studies that wish to focus on types of use would benefit from measuring time spent in each app. There was no significant difference between average loneliness in February – March 2020 and average loneliness in November – December 2020. While this is not consistent with most prior studies on loneliness pre- and post-pandemic declaration, the prior studies were all conducted within the first few months of the pandemic; at the same time as some of the strictest lockdown measures. In November – December 2020 in London, Ontario, the situation was not considered a strict lockdown, with gathering restrictions at 10 people indoors and 25 people outdoors. While students were participating in distance learning instead of in-person classes, there were opportunities to be with other people face-to-face in the community. The measure of loneliness used in the present study is generally considered to measure loneliness as a trait, so while feelings of loneliness may have fluctuated during stricter lockdown measures, it appears likely that when measures are more relaxed, reports of loneliness are at a typical level. The two studies that found significant increases in loneliness had used shorter, three item measures of the UCLA Loneliness Scale (Bu et al., 2020; Lee et al., 2020), which may capture more of a state feeling of isolation (the three items ask about lack of companionship, feeling isolated from others, and feeling left out), as found in a factor analysis of the UCLA Loneliness Scale (Lee & Cagle, 2017). The research by Luchetti et al. (2020), who found no significant change in loneliness, used a longer 11-item measure, which includes item items related to social connections and sense of belonging (Lee & Cagle, 2017). Thus, while the COVID-19 lockdown restrictions result in feelings of isolation, other aspects of loneliness such as social connections and a sense of belonging may be less affected.

In addition, several recent studies have found that psychological responses to COVID-19, as measured by anxiety, depression, or loneliness, have followed a similar trajectory to that of other large-scale tragic events as proposed by Bonanno (2004). Bonanno (2004) described four different trajectories following a tragedy, including resilience (functioning normally soon after), recovery [experiencing post-traumatic distress disorder (PTSD) and recovering over time], delayed (increasing dysfunction), and chronic (continued dysfunctional response). He proposed that resilience was the main response to an adverse event; that most people return to a typical psychological state soon after. While the early a priori hypothesis for the present study expected an increase in loneliness, the result of no difference between the groups is consistent with new research that is finding that resilience is the dominant trajectory throughout the first year of COVID-19 (Gambin et al., 2021; Kimhi et al., 2021; Laham et al., 2021).

There are many pathways to resilience (Bonanno, 2004), and changes in behaviours associated with lower loneliness provide insight into the ways that young adults are managing the challenges of distance learning. Hypotheses 2 and 3 relate to the idea put forth by

David and Roberts (2021) that in the time of social distancing and isolation, smartphone technology becomes a primary means of connection with others, and therefore would be less related to loneliness and may even support feelings of positive social support. This prediction was not supported with general smartphone use; the relationship between duration of smartphone use and loneliness was not statistically different from Wave 1 to Wave 2. Hypothesis 3 was supported as an increased use of social media apps was significantly less associated with loneliness in Wave 2. Prior to the COVID-19 pandemic, use of social media apps was significantly associated with loneliness; however, during COVID-19, the relationship became non-significant and near zero. This result suggests that when in-person interactions are limited, use of social media apps is not related to overall reports of loneliness. There are several possible reasons for this. In keeping with the displacement hypothesis (as described in Nowland et al., 2018), if social media app use is not displacing in-person socializing, it becomes less related to feelings of loneliness. This may also be due to individuals who are not chronically lonely spending more time on social media apps during COVID-19, and thereby reducing the correlation. Another possibility may be a shift in how social media is used. Vasileiou et al. (2019) identified that coping mechanisms for loneliness were often distraction and seeking support; it is possible that social media has been used more as a tool for seeking support in the pandemic than a tool for distraction.

While it is not possible to speculate whether students were interacting with their classmates on social media in the present study, those designing distance education courses may consider the benefits of social media functions for student interaction. Social media provides individuals with space to present themselves, express their ideas, learn about others, and communicate directly with others. Making use of similar functions in the distance learning software and social media could allow students to interact more personally. The personal interactions can increase feelings of peer support and collaboration, which are key elements to decreasing loneliness that is often associated with distance learning (Kaufmann & Vallade, 2020; Shearer et al., 2020).

Despite the challenges of a move to distance learning in 2020, the present study results are encouraging, suggesting that student loneliness did not change significantly. Students' mobile social media use became less associated with loneliness over time, even though most other smartphone use patterns had not changed. In the face of reduced connections with peers, students in distance learning have found ways to access social support.

Open Science Practices

Prior to analysis, this study and its hypotheses were pre-registered on the Open Science Framework (https://osf.io/v7wnb).

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