ANALYSIS ON THE ASSOCIATION BETWEEN WELL-BEING AND DISCLOSURE TRANSFORMATIONS AMONG COLLEGE STUDENTS POST-PANDEMIC

By

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A capstone project submitted for Graduation with University Honors

May 7, 2023

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University of California, Riverside

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ABSTRACT

The World Health Organization (WHO) declared Coronavirus (COVID-19) as a global public health emergency of international concern in January 2020, and a global pandemic by Mach 2020 (Cucinotta & Vanelli, 2020). With 1,400 deaths reported globally by February 2020 (Harapan et al., 2020), many studies began identifying the -rather unsurprising- rapid social and cognitive transformations, and the positive and negative pandemic-related consequences (Wagner, 2023). However, the overview on university students and how social disclosures shifted throughout the pandemic and beyond virtual means post-pandemic is limited. Moreover, less is known about whether an unexpected online curriculum negatively altered student's well-being in each wave of the pandemic through communication mediums to maintain peer relationships. The current study sets out to examine whether different disclosure mediums to maintain social engagement throughout the pandemic altered well-being and a connection to others. "Daily Diary" surveys were collected for 10 days from undergraduate students at the University of California, Riverside in three waves (pre-pandemic, pandemic, and post-pandemic) to measure social disclosures and well-being from different interactions encountered each day through different mediums. We used mixed effect linear regression models via deviation coding to analyze the changes of mood and feelings of connection across the various waves of the pandemic. For further analysis we also used interactions variables to better understand the factors influencing mood and feelings of connection in the sample of participants engaging in a variety of disclosure mediums across different waves of the pandemic.

ACKNOWLEDGMENTS

Foremost, I would like to thank Dr. Brent Hughes, who has not only provided me the incredible resources and support system for this capstone project, but for also allowing me to experience continuous professional development in a warn and engaging environment like the Social Neuroscience Lab (SNL). I have learned so much about research and data analysis that I have been able to explore the different tools of research from this lab alone. After working in SNL for two and half years, I have been inspired by the work ethic of the lab, and the hard work Dr. Brent Hughes puts into the lab for all his team members.

I would also like to thank my team within SNL, Team Eleanor: PhD candidate Eleanor Collier, Research Coordinator Genesis Garza Morales, and Research Assistants Isabel Sakawich, Zoe Butler, and Alexia Villagran. Without the support system and the creative minds of this team, I would not have been able to accomplish a project like this. Being exposed to high-level information and understanding the significance of psychological analysis was made possible with the generous aid from my team. Thank you, Team Eleanor, for your endless support throughout this challenging process.

Lastly, I would like to especially thank PhD candidate Eleanor Collier, Research Coordinator Genesis Garza Morales, and Research Manager Arshyia Aggarwal for their hard work and consistent support through the entire duration of this project and my time working in SNL. They have been major contributors to both my academic and personal growth. Working with them the majority of my undergrad has been the most fulfilling journey as their gracious feedback and countless encouragement has supported me inside, and outside the lab.

TABLE OF CONTENTS

Introduction

According to the American Psychology Association (APA), a social disclosure relates to the act of revealing personal or private information about one's self to others (*APA Dictionary of Psychology*, 2024). A disclosure its self can occur in various settings, including in-person conversations with family, texting or calling friends, community gatherings, and various social media platforms. Moreover, sustaining social disclosures encompass a wide range of topics that center around individual feelings, thoughts, opinions, goals, and even challenges. It is within these disclosures that can amplify the building blocks of maintaining social connections by fostering trust and empathy with others. These disclosures that are maintained within a variety of communication contexts are motivated and preserved in both personal and professional settings; however, how have disclosures changed from increased use of virtually tools, and a global pandemic caused by a SARS-CoV-2 virus in 2020?

First, it is important to understand the facets of social disclosures in specific contexts: social disclosure in personal relationships and the factors affecting social disclosures. Social disclosure is the primary way individuals increase intimacy, as well as declaring close personal relationships (Hargie, 2006, pp. 217–258). Exposing personal information can help people advance in future networks and even recover from negative first-impressions by establishing common connections and shaping individual identities through mutual social connections. Indulging in disclosures serves as the force that helps to sustain and nurture established relationships as individual sense of self is also enhanced (Hargie, 2006, pp. 217–258). By promoting liking and reducing uncertainty, social disclosures can provide comprehensive and mutual feelings among individuals for a greater and longer purpose.

Especially when unfolding the relationship of interpersonal communication and academic success among college students, a number of communication variables can indicate that communication is an important attribute to a college students' academic performance and social life (Hawken et al., 1991). The importance of communication in a classroom setting is understood by the quality of research in this area (McCroskey et al., 1989); however, researchers have expanded their interest to the study of communication within the larger college environment. Moreover, the influence of communication variables on academic performance is beginning to be explored in the research field. For instance, Hawken and researchers emphasize that students' abilities to communicate with peers, roommates, professors, and faculty have a major impact on their success, establishing academic and personal relationships, and their own satisfaction with the college and university of attendance (Hawken et al., 1991). From constantly meeting with academic obstacles and challenges all while trying to create the important networking groups in a students' social space, all of these sub-groups have significant aspects that affect personal and professional journeys at college and universities.

Alternately, when an infectious disease caused by SARS-CoV-2 virus contributed to the most recent global pandemic (Centers for Disease Control and Prevention, 2020), this forced the nation to change their social habits and schedules. People infected with the COVID-19 virus experienced mild to moderate respiratory illness, loss of taste or smell, and other moderate to severe symptoms (Centers for Disease Control and Prevention, 2020). Although both the influenza (flu) and COVID-19 are both contagious respiratory illnesses, these conditions cannot be differentiated from symptoms alone because of the underlying similarities. Yet, those who already obtain other medical conditions like cardiovascular disease or asthma are especially more susceptible to getting sick with COVID-19 or becoming seriously ill (Centers for Disease

Control and Prevention, 2020). By March 13, 2020 the United States has declared a national emergency and issued an additional travel ban, and two days later schools and universities implemented restrictions as well (CDC, 2023). Indeed, these shutdowns were executed in order to prevent the spread of the virus and ensure the safety of public health. With this national protocol, it led many college and universities campuses to implement online education until campus can fully reopen and function back into in-person instruction. As campuses continued students' learning through online sources, this left many students to shift their social lives in different virtual forms (CDC, 2023).

As previously mentioned, researchers and scholars are broadening their research in communication within larger college environments. As media and digital access advanced, this topic also continued to puzzle researchers for decades. Social media and other forms of virtual communication have created a large phenomenon in the internet where students are able to use sites to create and sustain networking and peer relationships with others for personal or professional use. In particular, 72% of college students have a social media account, with 45% using their social media site at least once a day (Sponcil & Gitimu, 2012). With social media offering new and non-personal ways to disclose with others, a media site (e.g. Facebook, Instagram, Tiktok, LinkedIn, or Indeed) allows people to interact with multiple people at the same time and maintain relationships with those who live near or far from them.

According to Lenhart et al., (2010), 57% of social media communicators are between the ages of 18-29 years. Before the pandemic, one study identified that majority of students were visiting social media and social networking sites several times a day for approximately 30 minutes each time (Sheldon, 2008). When internet and social technology has sky rocketed in

popularity, it is absolutely appropriate to be curious about its impact against in-person self-disclosures. Communication produced online is only a small part of everyday interactions college students are voluntarily participating in; yet, it seems to producing a massive influence on behavior and attitude as described later.

Although, exploring the impact of the pandemic on variables concerning the personal and professional growth of college students is limited, there is still initial data that does suggest that students' academic journey have negatively impacted their lives in some way. In a Chinese community sample, researchers found that majority of Chinese students reported that the psychological impact of the pandemic was scored moderate to severe (Zhang et al., 2020). Besides a college students' academic success, Chinese college students also reported that the COVID-19 pandemic impacted their financial and daily life that affected their self-reported anxiety scale (Zhang et al., 2020). How would these studies and reports look like when placed among American students in the United States? More research is needed to further investigate the significant impact of COIVD-19 on how a students' personal and professional lives were compressed when in-person social disclosures where immediately removed in response to a global change.

The Association Between Social Disclosures and Peer Relationships

Peer relationships are more than just a system that relies on others to obtain information. Specially for university students, participating in such peer relationships is found to be positively associated with organizational outcomes (e.g. job satisfaction, involvement, and productivity) (Winstead et al., 1995). Most students attended university to learn cooperative and important skills to amplify future professional endeavors. Moreover, most students work as part of a larger

network of pees, supervisors, and subordinates and face many interpersonal relations at work and social settings. These interpersonal relationships and self-disclosures, amongst these relations are especially useful because they promote general well-being of the relationship and provide emotional support and encouragement in their social environment (Winstead et al., 1995).

Within these peer relationships that student's participant in are different classifications. Likewise, students can engage in conversation as a means of information exchange as the primary purpose (Myers & Johnson, 2004). For instance, sharing information with a coworker or fellow student who is in the same class as them. Another type of disclosure among students can be described with moderate level of closeness; thus, the communication is more intimate compared to communication between information peer relationships (Myers & Johnson, 2004). Another type of disclosure a college student might take part in is special peer relationships where the primary purpose of communication is supported by emotional and personal feedback (Myers & Johnson, 2004). Moreover, this type of communication can be described as when a fellow student is providing positive encouragement for their hard work to their college roommate after failing their exam.

Furthermore, researchers have concluded that organizational members have a greater number of information peer relationships (Myers & Johnson, 2004). Moreover, the development of peer relationships is affected by different models of communication and individual influences. Certain contextual inferences also have a major influence on the development of these peer informational relationships; such as proximity, life events, shared tasks, and other organizational socializations (Myers & Johnson, 2004). Individual influences of the impact of these peer relationships would include perceived similarities (sharing similar beliefs and values), and

certain personality traits. With all traits considered, it is clear that peer relationships serve both instrumental and expressive functions; intimate socialization, information seeking, and even organizational productivity. Thus, research classifies intimate relationships by solidarity (feelings of closeness), self-disclosure, and trust (holding favorable impressions about another individual's behavior) (Myers & Johnson, 2004). Likewise, these characteristics of intimate relationships, and the underlying types of communication among organizational and college peers will likely depend on the specific peer type with the individual members that are interacting in that disclosure. Additionally, these relationships between communication apprehension and academic achievement among college students can also be seen as a result of these characteristics of intimate relationships. As different models of communication have expanded over the years (e.g. social media interactions, emails, text messages, Zoom or other video chats) it is incredibly important to incorporate these expansions of communication when interpreting the specific characteristics of intimate relationships, and how they influence peer relationships and other academic achievements among students.

Association Between Connection to Others and Mediums of Communication

Not so surprisingly, after establishing the importance of understanding the relationship between communication and academic achievement among college students based on the specific characteristics that create intimate relationships, it is especially significant to also understand the fundamental basis of different communication mediums. Moreover, considering that communication is an integral part of everyday life, interactions can be impacted incidental. Communicators communicate through different modalities, channels, or devices. Thus, this

offers us a framework to further understand how mediums in which communicators communicate can shape a message and affect intimate relationships and overall well-being.

Considering the communication is ubiquitous, it has a wide range of impact on behavior between communicators (Oba & Berger, 2023). From attitudes and evaluations, it affects our choices and how people behave successfully. Due to this, researchers have suggested that the differences between mediums, in turn, changes the contact of communication (Oba & Berger, 2023). With these varying affects that communication can impact, researchers have simplified these effects into two constructs: deliberation and audience salience (Oba & Berger, 2023). Deliberation would explain the extent to which communicators consider what they were going to say, and how they are going to express their communication. Moreover, researchers have suggested that having deliberation can help communicators consider alternate words, as it also affects how much communicators are going to think about their message after it has been produced (Oba & Berger, 2023). Hence, deliberation should also encourage communicators to express clear and more organized content when speaking to other communicators. Salience, in regards to communication, is a way to express the degree in which communicators are concentrating on their audience. Consequently, when any communication medium is providing more information, this may increase audience salience as it increases the motivation to use the appropriate language that is relevant to that audience (Oba & Berger, 2023).

Subsequently, speaking, and writing are found to be the most common modalities of communication. Speaking can be represented through in-person communication, video conferences, or online instruction for students as it is involving the production of words through a communicators voice (Oba & Berger, 2023). On the other hand, writing involves text

messages, comments on social media, and emails that are sent text-based (Oba & Berger, 2023). To explore their significance, researchers emphasize the importance unraveling modality's and their impacts from other aspects of communication. For instance, although speech is considered to be more synchronous than writing, other forms of speaking (e.g. leaving a voicemail) is seen to be less synchronous then other ways of writing (e.g. sending a text message on a cell phone) (Oba & Berger, 2023).

With all things considered, it can be evaluated how these different mediums of communication are affecting psychological well-being and other feelings of connection to others. Further, are self-disclosures through digital media (an overused form of communication) improving or harming individuals psychological well-being and feelings of connection? In one study, researchers had found that while phone calls and texting were positively correlated to well-being, online gaming and other forms of social media were negatively associated with well-being (Liu et al., 2021). To emphasize this significance, researchers had also found that negative social well-being was positively associated with levels of media pertaining to interpersonal interactions among adolescent girls (e.g. cell phone or social media communication) (Pea et al., 2012). Additionally, researchers had also found that communication performed via video media was strongly associated with negative social well-being (Pea et al., 2012).

How would these results look like if they are pertaining to college students who experienced a global pandemic like COVID-19? Since social media and other virtual mediums of communication provide easy and quick feedback, this can impact the attitudes of college students (Sponcil & Gitimu, 2012). Moreover, media empowers all users to take an active role in their own socialization process based on the amount of personal information a user is desire to share

about themselves. This type of self-disclosure is a significant way college student open themselves up about their self-concepts, how they want others to perceive them, and to help create relationships with others.

COVID-19 and Virtual Interactions Among University Students

Due to the COID-19 pandemic, nearly all higher education across the nation transitioned to online instruction beginning Spring of 2020 (Centers for Disease Control and Prevention, 2020). As students merged in this transition, students reported in other studies that they their courses were becoming less enjoyable, less interesting, and facilitated less attention in online classes (Garris & Fleck, 2020). Online courses are not new in higher educations to help untraditional students to complete their education in a more flexible timeframe; however, in response to COVID-19, college presidents across the country mandated that all courses to be shifted to remote instruction. To help reduce transmission of the COVID-19 outbreak, authorities require people to not be in close contact with each other, and must maintain a distance of at least 6 feet apart (Centers for Disease Control and Prevention, 2020). Thus, hosting a normal classroom, setting on a college campus was considered impossible with these new policies and procedures.

Researchers found that among graduating high school seniors, 20% reported that they were unlikely to attend college in Fall 2020 due to the pandemic, and 11% said that they were unsure about attending college at all (Garris & Fleck, 2020). Furthermore, 24% of students reported that their college choice had been affected because of the pandemic (Garris & Fleck, 2020). Further, it is significantly important to understand how this global pandemic may impact students larger than what is projected if 41% of college students during the pandemic reported

that their instruction had worsened since the pandemic began (Garris & Fleck, 2020). Moreover, current research is trying to further investigate students' perceptions of the transition and how this impacted students' general well-being when in-person communication and social relationships are a substantial part of a college students' academic journey.

Interest is important for motivation and enjoyment. Since many students did not choose to take their classes online, and we're forced into it, situational interest has been found to be correlated with self-regulation and engagement (Garris & Fleck, 2020). Thus, it is important to also evaluate emotional well-being based on how students perceive their classes and how this affects their academic performance. Emotional well-being can arise from experiences within the classroom, or experiences in a students' life beyond their attendance at a university. Considering that COVID-19 has obstructed society from drastic unemployment to reduction in socialization, it can be anticipated that students will be impacted emotionally. One pandemic survey by the National Alliance on Mental Health found that 27% of college students were commonly diagnosed with depression, and 11% of students were diagnosed with anxiety (Gruttadaro & Crudo, 2012). Another annual report from the National College Health Assessment found strong variables of stress and anxiety greeting to students as feelings of exhaustion, and overwhelmed from school (American College Health Association, 2018). With these concerning results, it can be hypothesized that a pandemic can impact students' ability to succeed in college when battling with mental health symptoms and a disruption in their social environment. Although the research exploring the specific impact of the COVID-19 pandemic on mental health variable is limited, initial data still suggest that it has negatively impacted students in important ways.

Guiding Question

Since researchers and current studies today have limited data on the academic courses that transitioned to online mid semester/quarter in higher education, the COVID-19 pandemic provided a rare opportunity to study this occurrence. From interest, connection to others, mediums of communication, and mental health concerns, I used these dimensions too create a guiding question to better formulate research questions on this topic.

- How do different mediums of communication play influence to university students' connection to others and overall well-being throughout each wave of the COVID-19 global pandemic?

Hypothesis

Based on the above literature and guiding question, I have formulated three research questions and related hypotheses:

Q1: Did communication in-person result in a decrease in positive or negative mood based on Waves I, II, and III?

H1: Positive mood decreases as a result of the pandemic, whereas negative mood increases as a result of the global pandemic.

Q2: Did communication virtually result in a decrease or increase in negative mood based on Waves I, II, and III?

H2: Maintaining peer relationships virtually during COVID-19 for university students increased negative mood during Wave II, whereas communication in-person reports a greater increase in negative mood in Wave III such that students have become adjusted to online mediums of communication to participate in social disclosure.

Q3: Did communication virtually or in-person result in an increase in feelings of connection for others based on Waves I, II, and III?

H3: There is a positive association between feelings of connections to others and virtual communication in Waves II and III of the pandemic, whereas a negative association is viewed between feelings of connection to others and in-person communication in Waves II and III.

Methods

Participants

Undergraduate students from the University of California, Riverside using the Psychology Research Participation System (SONA) were recruited (n = 498). Student's age ranged from 18-22 years (M = 19.5. SD =1.709). Students who volunteered to complete the 10-day *Daily Dairy* surveys received 1 SONA credit if they completed the bassline survey and less than seven *Daily Dairy* surveys. Participants were granted 2 SONA credits if they completed the bassline survey and seven or more *Daily Diary* surveys.

Table 1. *Demographics of Participants*

Participants	Descriptive Statistics	%
Age		
Mean	19.5	
SD	1.709	
Range (age in years)	18-22	
Female	249	50%
Male	249	50%
Race		
White	82	16.5%
African American	90	18.07%
Asian	83	16.7%
Hispanic	82	16.47%
Mixed	81	16.27%
Other	80	16.06%
Education		
High School/GED	184	36.94%
Less than High School	140	28.11%
Some College	174	34.93%

Note. $N = 498$: Participants were students at the University of California, Riverside and were on average 19.5 years old ($SD = 1.706$). Participants did not differ from each wave of the pandemic as all were students who were attending UC Riverside the time they completed the study.

Materials

Expiwell

Expiwell, an assessment app and data platform, was used to remind students to complete a *Daily Diary* survey every day for the following ten days of their participation. Participants will have until midnight of each day to complete a survey. Software app also included *Qualtrics* link for students to compete the survey of each day.

Qualtrics

Daily Diary surveys were completed on the online survey platform Qualtrics. The link to each survey for the day was provided within the app *Epiwell* to record all responses. Positive mood was self-reported (0-100), and reversed these scores to find negative mood. To determine how connected participants felt with an interacting partner during that interaction was also scored 0-100. To categorizes the mood and connection of participants based on different mediums of communication, participants choose their disclosure medium (audio, video, Social Media Comment, in-person, and Instant Messaging) for each interaction they experienced in each day.

Table 2. *Means and Standard Deviations*

Cohort	Positive Mood		Negative Mood		Disclosure connection	
	M	SD	*M*	SD	*M*	SD
Wave 1 (N=92)	62.86	17.62	81.48	3.68	77.84	21.54
Wave 2 (N=243)	56.51	22.24	72.01	20.51	79.13	22.16

Wave 3 (N=351)	60.16	21.42	66.99	21.86	76.19	23.44

Note. Participants average positive mood, negative mood (revered scored), and disclosure connection for each cohort. *Wave 1* correlates to pandemic, *Wave 2* represents during the pandemic, and *Wave 3* reflects post-pandemic.

Bassline Questionnaire

Upon coming into the lab of the students' selected session time, students were instructed by the Research Assistants to download all software apps and to complete a Bassline Questionnaire. The Bassline Questionnaire was used to collect demographics from all participants, and were also asked to rate and write their current emotional well-being.

Procedure

Undergraduate students at UC Riverside who are enrolled in lower division *Introduction to Psychology* courses are enrolled in the Psychology Research Participation System (SONA). These students can choose to participate in the study to receive SONA credit. This study was completed and coordinated under the direct supervision of PhD candidate Eleanor Collier as I served as her student Research Assistant. Pre-pandemic and pandemic survey responses were collected prior my lab enrollment. Moreover, following Eleanor Collier's instructions for post-pandemic wave, the study was conducted first in-person at the Social Neuroscience Lab (SNL) where students were prompted to download the online platform *Expiwell* and create an account to collect all their completed surveys. Students were assigned a participant ID in order to complete all necessary surveys and questionnaires. After completing a trail *Daily Dairy* survey in *Expiwell* to confirm students did not have technical difficulties or challenges finishing the

survey, a bassline survey (which also included the consent form) was sent to their email and completed in the lab.

Both the *Daily Dairy* survey and the bassline survey were collected through Qualtrics. A link to *Qualtrics* was included in each day in the *Expiwell* online platform. Participants were instructed that for the next ten days, starting from the first day of completion of the bassline survey, to use their Participant ID to access their survey for each day. Students are notified that completion of *Daily Dairy* survey was needed via a notification sent to the students' mobile device at 6PM, and surveys will remain open until 12AM. Participants were asked, in the surveys, to rate their current well-being for that day (e.g, mood, stress, meaning in life, physical health, social stress, loneness etc.). This process continued for ten days and all data was collected through *Qualtrics* contained all information of each students and their survey responses.

Using statistical software R (v4.3.0; R Core Team 2024), I ran several regression analyses regression analyses using positive mood, negative moon, and connection to others as the main variables. These variables were identified as the dependent variable and the independent was represents as Cohort, or the waves of each pandemic (e.g. Pre-pandemic, Pandemic, and Post-Pandemic). Entries were also executed with missing values or inconsistent scales, creating the sample n = 498.

For *H1, H2*, and *H3,* positive/negative mood and feelings of connection were placed in a mixed effects linear regression model with deviation coding. This specific model was chosen as it is more suitable for repeated measures within individuals over time to analyze the changes of positive and negative mood across the various waves of the pandemic. 'Cohort' in the analysis is used as the fixed effects predictor, allowing us to examine how mood and feelings of connection

changes across the different phases of the pandemic. Moreover, this analysis should show the strength between (1) positive mood and Cohort, and (2) negative mood and Cohort.

For further analysis for *H2* and *H3*, we also used interactions variables to further analyze and better understand the factors influencing negative mood and feelings of connection in these sample of participants who are engaging in those variety disclosure mediums across different waves of the pandemic. Furthermore, the disclosure medium interaction terms allow us to understand how the relationship between the predictors and the outcomes may change under different circumstances. The circumstances, moreover, are the different mediums of communication participants are engaging in throughout the ten-day survey. Correlation coefficients ranging from negative one to one were also calculated. Positive values indicate positive relationships, whereas negative values indicated negative relationships, and values close to zero suggest weak or no linear relationship.

Results

Mixed Effect Linear Regression for Positive and Negative Mood

Table 3. *Mixed Effect Linear regression for 'Mood.pos' with 'Cohort'*

Cohort	Estimate	St. Error	t value	Pr (> |t|)
(Intercept)	57.8909	2.3990	24.131	< 2e – 16 ***
Wave II	-1.4730	3.1237	-0.472	0.6373
Wave III	-0.1713	2.6429	-0.065	0.9483

Note. Reference level in analysis is Wave I. Significance indicators: '***' indicates $p < 0.001$, '**' indicates $p < 0.01$, '*' indicates $p < 0.05$.

The mixed effect linear regression analysis (see Table 3) examines the relationship between 'Cohort' waves and positive mood when all other predictors are zero. The intercept, which represents the estimated mean for positive mood when the reference is at Wave I, was highly significant [t=24.131, p<2e-16]. Contrary to the hypothesis, the coefficients for Wave II and Wave III were not significant compared to Wave I. Specifically, Wave II had an estimate of -1.473 [t= -0.472, p = 0.6373] and Wave III had an estimate of -0.1713 [t= −0.065, p = 0.9483], indicating significant difference in positive mood during the pandemic, and post-pandemic. However, when interpreting the influence of communication mediums, there was significant effects of in person, communication, mediums associated with significantly higher positive mood compared to Wave I.

Table 4. *Mixed Effect Linear regression for 'Mood.pos' with 'Cohort'*

Cohort	Estimate	St. Error	t value	Pr (> |t|)
(Intercept)	56.42	2.001	28.200	< 2e – 16***
Wave I	1.473	3.124	0.472	0.6373
Wave III	1.3002	2.287	0.569	0.5694

Note. Reference level in analysis is Wave II. Significance indicators: '***' indicates p < 0.001, '**' indicates p < 0.01, '*' indicates p < 0.05.

A second mixed effect linear regression model (see Table 4) was computed, and the intercept represents the estimated mean for the reference group Wave II. With a highly significant value [t = 280200, p< 2e-16] indicating significantly positive mood overall, the coefficients for Wave I and Wave II are contrary to the hypothesis. With an estimate of 1.473 [t = 0.472, p = 0.6373] for Wave I and an estimate of 1.3002 [t = 0.569, p = 0.5694] for Wave III, suggest that there are no significant differences in positive mood when compared to Wave II. Among the communication mediums, also examined, only in person communication was marginally associated with higher positive mood with an estimate of 2.53 [t = 1.67, p = 0.096].

The last mixed effect linear regression model (see Table 5) reveals a highly significant intercept [t = 52.045, p < 2e-16] when all other predictors are zero, which indicates significantly positive mood overall. However, again, contrary to our hypothesis, the coefficients for Wave I and Wave II are not significant compared to Wave III. Specifically, Wave I had an estimate of 0.1713 [t = 0.065, p = 0.94834], and Wave II had an estimate of -1.302 [t = -0.569, p = 0.56939].

Additionally, there is no significant difference between positive mood and in person disclosures. However, among the other communication mediums examined, instant messaging was found in associated with significantly lower positive mood with an estimate of -1.84 [$t = 0.83$, $p = 0.027$].

Table 5. *Mixed Effect Linear regression for 'Mood.pos' with 'Cohort'*

Cohort	Estimate	St. Error	t value	Pr (> |t|)
(Intercept)	57.772	1.109	52.045	< 2e – 16 ***
Wave I	0.1713	2.643	0.065	0.94834
Wave II	-1.302	2.287	-0.569	0.56939

Note. Reference level in analysis is Wave III. Significance indicators: '***' indicates p < 0.001, '**' indicates p < 0.01, '*' indicates p < 0.05.

Table 6. *Mixed Effect Linear regression for 'Mood.neg_rev' with 'Cohort'*

Cohort	Estimate	St. Error	t value	Pr (> |t|)
(Intercept)	59.3488	2.4183	2.4183	< 2e – 16 ***
Wave II	10.5726	3.1160	3.393	0.000718***
Wave III	6.9237	2.6647	2.598	0.009527**

Note. Reference level in analysis is Wave I. Significance indicators: '***' indicates p < 0.001, '**' indicates p < 0.01, '*' indicates p < 0.05.

Likewise, a mixed effect linear regression model between negative mood and 'Cohort' with the reference level set at Wave I (see Table 6) was computed with a highly significant intercept [$t = 24.54$, $p < 0.001$], indicating a significantly negative mood overall. The coefficients for Wave II and Wave III were significant compared Wave I. Specifically Wave II had an estimate of 10.57 [$t = 3.3$, $p = 0.001$], and Wave II had an estimate of 6.92 [$t = 2.60$, $p = 0.010$], suggesting that negative mood increases during the pandemic and post- pandemic compared to pre-pandemic. Among the communication mediums examined, in-person communication was associated with significantly higher negative mood with an estimate of 3.51 [$t = 2.57$, $p = 0.010$].

With the reference level set at Wave II (see Table 7), it's intercept of the estimated mean of negative mood is highly significant [$t = 35.58$, $p < 2e\text{-}16$], indicating a significantly negative mood overall. The coefficients for Wave I and Wave III were significant compared to Wave II. Specifically Wave I that had an estimate of -10.57 [$t = -3.39$, $p = 0.001$], which is suggesting a decrease in negative mood in the pre-pandemic wave compared to the pandemic wave. Wave III had an estimate of -3.65 [$t = -1.61$, $p < 0.107$], which indicates a marginally significant decrease negative mood during the post-pandemic wave compared to the pandemic wave. Among the communication mediums examined, non-showed a significant effect on negative mode.

Table 7. *Mixed Effect Linear regression for 'Mood.neg_rev' with 'Cohort'*

Cohort	Estimate	St. Error	t value	Pr (> |t|)
(Intercept)	69.6214	1.9650	35.583	< 2e – 16 ***
Wave I	-10.5726	3.1160	-3.393	0.000718***

Wave III	-3.6489	2.2613	-1.614	0.106860

Note. Reference level in analysis is Wave II. Significance indicators: '***' indicates p < 0.001, '**' indicates p < 0.01, '*' indicates p < 0.05.

Finally, with the reference level set at Wave III (see Table 8), the intercept reveals a highly significant value [$t = 59.23$, $p < 2e\text{-}16$]. Indicating a significantly negative mood overall. The coefficients for Wave I was significant compared t Wave II, specifically, Wave I had an estimate of -6.924 [$t = -2.60$, $p = 0.010$], suggesting a decrease in negative mood during the pre-pandemic wave compared to the pandemic wave. However, Wave II was not significant compared to wave II with an estimate of 3.65 [$t = 1.614$, $p = 0.107$], which in the kids that there is no significant decrease in negative mood between Wave II and Wave III. Among the communication mediums examined, none showed significant effect on negative mode.

Table 8. *Mixed Effect Linear regression for 'Mood.neg_rev' with 'Cohort'*

Cohort	Estimate	St. Error	t value	Pr (> |t|)
(Intercept)	66.27	1.119	59.225	< 2e – 16 ***
Wave I	-6.924	2.665	-2.598	0.00953***
Wave II	3.649	2.261	1.614	0.10686

Note. Reference level in analysis is Wave III. Significance indicators: '***' indicates p < 0.001, '**' indicates p < 0.01, '*' indicates p < 0.05.

Mixed Effect Linear Regression with Mood and Cohort with Disclosure Medium

When the reference level is set at Wave I, the estimate of 10.57 ($p<0.001$) suggest that during Wave II, there was a significant increase in negative mood compared to Wave I. Although this aligns with the second hypothesis, the interaction between Wave II and instant messaging shows the estimate of -0.34 ($p=0.870$) and suggest that the effects of maintaining peer relationships virtually during Wave II did no significantly differ from Wave I ($p=0.59$). Compared to Wave II with in-person interactions, the estimate of -1.59 ($p=0.410$) suggests that the effects of communication university students had in-person during Wave II was not significantly different from Wave I. Compared to Wave III, the estimate 6.92 ($p=0.010$) suggest that during post-pandemic, there was a significant increase in negative mood, compared to pre-pandemic. This partially aligns with the hypothesis given that the interactions between post pandemic and in-person disclosures had the estimate of -2.75 ($p=0.067$).

When the reference level is changed to Wave II, it reveals that Wave I had a significant decrease in negative mood compared to Wave II with an estimate of -10.57 ($p=0.000718$). Compared to Wave III, there was a non-significant decrease in negative mood compared to Wave II with an estimate of -3.65 ($p=0.106860$). The effects of communication showed that instant messaging (Estimate = 0.47, $p=7.50$), social media (Estimate= 2.07, $p=0.515$), and video (Estimate= -0.33, $p=0.826$) communication revealed a non-significant effect on negative mood in both Wave I and Wave III compared to Wave II. Interaction effects also revealed that both Wave I and Wave III had all non-significant interaction effects ($p>0.05$).

Finally, when the reference level is set at Wave III, the baseline effect of Wave I revealed that there was a non-significant increase in negative mood compared to Wave III (Estimate=

3.649, p=0.10686). Wave I revealed the negative mood significantly decreased compared to Wave II (estimate= -6.924, p-=0.00953). The effects of communication medium showed that in-person (Estimate = 0.7594, p = 0.92976), instant messaging (Estimate= -0.06617, p= 0.92976), social media (Estimate = 3.606, p = 0.15447), and video (Estimate = 1.321, p = 0.10127) communication had no significant increase in negative mood.

Mixed Effect Linear Regression with Connection Cohort with Disclosure Medium

For virtual communication, there is no consistent positive association with feelings of connection to others in Waves II and III when compared to Wave I. In fact, instant messaging and social media comments show negative associations. Based on the results of the mixed-effects model, instant messaging ($p<0.0001$) and social media ($p = 0.3551$) virtual communication in Wave II revealed a significant negative association. In Wave III, instant messaging ($p = 0.8661$), social media ($p= 0.9789$), and video ($p = 0.1147$) interactions showed non-significant associations. Additionally, in-person communication revealed marginally significant negative association in Wave II ($p = 0.0380$), and a non-significant association in Wave III.

When the reference level is changed to Wave II, instant messaging disclosures have a negative coefficient of -5.3611, which contradicts the hypothesis as this implies that when students communicate through instant messaging, feelings of connection to others decreases. The interaction term between Wave III and video communication has a positive coefficient of 4.3742, which partly supports the hypothesis of a positive association. Moreover, in-person disclosure mediums have a negative coefficient of -2.6733, but not statistically significant ($p =0.16507$) . Furthermore, the main effects of Waves I and III are not significant, indicating that there's no significant difference in feelings of connection compared to Wave II.

Finally, when the reference level is set at Wave III, the analysis revealed a significant negative association between in person, communication and feelings of connection (Estimate = -5.7820, $p<0.001$). Conversely, the association with virtual communication was mixed as instant messaging was found to significantly decrease feelings of connection (Estimate = -8.5886, $p<0.001$). However, video communication showed a positive trend as it can suggested that there could be a positive association between feelings of connection and video communication, yet not statistically significant (Estimate = 2.20004, $p = 0.554$).

Discussion

The first hypothesis question investigated whether positive mood decreases as a result of the pandemic, whereas negative mood generally increases in response to the global pandemic. Overall, the findings in this mixed effect linear regression did not find evidence to support the hypothesis that patient in person resulted in a decrease in positive mood across the different pandemic waves. Instead, when the reference level was set at Wave I, in-person communication was actually associated with higher positive mood. With the reference at Wave II, the results did not find evidence to support the hypothesis that communication in-person resulted in a decrease of positive mood across the different waves of the pandemic. Instead, only in-person disclosures showed a marginal association with higher positive mood. Finally, when the reference level set at Wave III, the findings in the mixed effect linear aggression to not find evidence to support the hypothesis. Instead, instant messaging was found to be associated with lower positive mood rather than in-person disclosures.

Likewise, when negative mood was examined under the mixed effect linear regression model with the reference level set at Wave I, the analysis did find evidence that partially supports the hypothesis that negative mood increases across the different way to the pandemic. Specifically, negative mood was significantly higher during the pandemic and post pandemic compared to the pre-pandemic wave. However, regarding the influence of in-person, communication on negative mode, this was associated with significantly higher negative mood as suggested by the marginally significant interaction effects. When the reference level was set at Wave II, the analysis found evidence to support that negative mood varied across the different waves of the COVID-19 pandemic, with Wave I showing a significant decrease in negative mood compared to Wave II. However, Wave III did not significantly differ from Wave II. Moreover, none of the disclosure mediums showed a significant effect on negative. Lastly, when the reference level was set to Wave III, analysis found evidence contradicts the hypothesis that negative mood varied across different waves of the pandemic with Wave I revealing a significant decrease in negative mood compared to Wave II. Moreover, in terms of in-person communication, did not show significant effect on negative mood.

The second hypothesis question explored whether maintaining pier relationships virtually increased negative mood during Wave II among university students, whereas communication in-person reported a greater increase in negative mood in Wave III. In contrast with the reference level set at Wave I with the mixed effect analysis on negative mood, the results implied that the effects of in-person communication during Wave III tends to be more negative compared to Wave I, but it is marginally significant. Meaning, that this partially supports the hypothesis. When the reference was set at Wave II, it revealed that maintaining peer relationships virtually during the pandemic did not increase negative mood, nor did in-person communication report a

greater increase in negative mood post-pandemic. The non-significant effects of communication medium on negative mood across the pandemic waves suggests that there is a nuanced relationship that demands further investigation. Furthermore, when the reference level was set at Wave III, results showed that Wave II did not significantly increase negative mood, suggesting a possible conflict to the ongoing pandemic. However, Wave I showed a significant decrease in negative mood. The influence of communication mediums on a negative mood was generally not significant, except for a small effect of in-person communication in Wave I. Moreover, these results indicate a complex relationship between the pandemic waves and the different communication mediums on students' mood that requires further investigation and analysis.

Finally, the third hypothesis investigates whether there is a positive association between feelings of connection to others and virtual communication during the pandemic and post-pandemic waves, and a negative association between feelings of connection to others when interacting with in-person communication. When the reference is set at Wave I, the results partially support the hypothesis. While there is a negative association between feelings of connection to others and in-person communication among university students in Wave II (marginally significant), the association is weakened in Wave III. However, the positive association between feelings of connection and virtual communication is not constantly observed across the pandemic and post-pandemic. When the reference level is set to Wave II, the results partly support the hypothesis that there is a positive association between feelings of connection to others in virtual (via video) communication in Wave III. However, the negative association between in person, communication and feelings of connection was not strongly supported. Lastly, when the reference level is set at Wave III, the overall result support that negative association between in person communication and feelings of connection are present, but the

results do not strongly support positive association between virtual communication and feelings of connection.

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