

**Only the Lonely: Learning, Use of Skills, and Sense of Meaning Buffer  
the Costs of Reduced Social Connection for Life Satisfaction**

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## **Only the Lonely: Learning, Use of Skills, and Sense of Meaning Buffer the Costs of Reduced Social Connection for Life Satisfaction**

Humans are motivated to connect, be autonomous, and exercise competence. When the social distancing compelled by COVID-19 compromised people's abilities to connect, did certain autonomy- and competence-fulfilling behaviors and psychological resources compensate for reductions in social connection? To address this question, the present study assessed changes in social connection, changes in life satisfaction, and the potential buffering effects of positive shifts in competence- and autonomy-related behaviors and resources before to after the onset of the pandemic in 2020. An online panel completed surveys in January/February 2020 ( $N_{T1} = 396$ ), April 2020 ( $N_{T2} = 336$ ), and May 2020 ( $N_{T3} = 299$ ). Sharper decreases in connectedness and sharper increases in loneliness from January/February 2020 to May 2020 predicted sharper decreases in life satisfaction. However, these effects were buffered among those who reported sharper-than-average growth in learning, sense of meaning/purpose, and use of skills.

Keywords: subjective well-being, life satisfaction, social connection, psychological needs, learning

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What psychological resources fuel human well-being? Mother Theresa proposed that loneliness is the “the most terrible poverty,” and John Wooden, beloved basketball coach and recipient of the Presidential Medal of Freedom, contended, “When I am through learning, then I am through” (Castel, 2011). Psychological theory and research support these views, indicating that people are fundamentally agentic and motivated to learn, relate to others, and fulfill their basic human needs of autonomy, competence, and relatedness (aka connection; Ryan & Deci, 2000). According to self-determination theory (SDT), autonomy, competence, and social connection are fundamental—in other words, the fulfillment of all three needs are essential for human flourishing, and the absence of any these needs compromises well-being. Additionally, SDT maintains that

although these basic human needs are enduring, their salience and the possible ways to fulfill them vary across the lifespan.

In recent history, the COVID-19 pandemic deeply altered the environmental affordances that allowed people to satisfy these basic psychological needs, particularly social connection. The present study focused on how shifts in social connection impacted life satisfaction, specifically exploring: 1) the extent to which such shifts changed over the course of the early COVID-19 pandemic and 2) the extent to which people's competence- and autonomy-fulfilling resources and behaviors (e.g., engaging in learning, use of skills, having a sense of meaning/purpose) may have buffered this relationship.

### ***Social Connection and Well-Being***

The link between social connection and well-being is robust (Cacioppo et al., 2008; Diener & Seligman, 2002; Lyubomirsky et al., 2005; Ryan & Deci, 2000). Self-report data and audio recordings of daily behavior indicate that higher quantity of conversations (Bernstein et al., 2018; Mehl et al., 2010; Milek et al., 2018), and higher quality conversations are robustly related to well-being (Carmichael et al., 2015; Sun et al., 2019). Importantly, experimental work has also shown that people who are prompted to engage in more social behavior report greater connectedness and positive emotion (Fritz et al., 2023; Jacques-Hamilton et al., 2019; Margolis & Lyubomirsky, 2020). Social connection positively relates to happiness, whether these connections are with close others or strangers. For example, participants report greater happiness when connecting with close others in response to day reconstruction surveys (Kahneman et al., 2004). Participants also report well-being boosts in experimental studies when instructed to interact with strangers, including fellow bus commuters (Epley & Schroeder, 2014) and baristas (Sandstrom & Dunn, 2013, 2014). Taken together,

research has shown that engaging in social interactions, whether with close others or passing strangers, produces greater overall feelings of social connection, and subsequently, improved well-being.

### ***Social Connection During the COVID-19 Pandemic***

The relationship between social connection and well-being has been replicated in the context of the COVID-19 pandemic. For example, individuals who increased in loneliness from before to during the pandemic simultaneously reported declines in life satisfaction (Folk et al., 2020). Similarly, those with poor social support were more likely to report greater depressive symptoms (Frank et al., 2020). In a 3-day daily diary study, greater adherence to social distancing guidelines was related to worse well-being and less social connection (Ford, 2021).

Other research points to human resilience, suggesting that some psychological qualities, behaviors, or life circumstances may have buffer against declines in social connection and well-being during challenging or adverse experiences like the pandemic. For example, a study in Wuhan, China during the early stages of quarantine found that longer time in quarantine was linked to worse well-being; however, experiencing flow (i.e., engaging in fully absorbing activities that are sufficiently challenging and engage one's skills) during this time buffered people from declines in well-being (Sweeny et al., 2020). As such, perhaps experiencing flow during social isolation and uncertain times helped people productively redirect their attention to activities that fulfill their psychological needs of competence and autonomy, thus protecting their well-being. Plausibly, engaging in competency- and autonomy-fulfilling behaviors may compensate for deficits to social connection when social connection needs cannot be fulfilled.

### ***Competence, Autonomy, and Well-Being***

According to self-determination theory, human nature is active, aimed towards striving, and flourishes in conditions that support social connection, competence, and autonomy (Ryan & Deci, 2000). Indeed, daily diary studies establish that the extent to which daily activities fulfill one's sense of autonomy, competence, and relatedness predicts well-being among 17- to 68-year old adults (Reis et al., 2000). Humans actively engage with their environments first through learning. Learning fosters creativity and well-being in childhood (Gordon & O'Toole, 2015) and plays an important role in individuals' ability to thrive across the lifespan as environments change (Wu & Strickland-Hughes, 2019). In adopting and practicing new skills, both children and adults develop their sense of self-efficacy, or their belief in their ability to master challenges (Bandura, 1982). Importantly, having high self-efficacy facilitates continued striving in the face of stress. Furthermore, having a sense of purpose or meaning organizes daily goals and behaviors, motivates engagement and a sense of agency, and promotes resilience in the confrontation of challenges and stressors (McKnight & Kashdan, 2009). Such psychological experiences and resources could be particularly helpful during taxing periods such as the COVID-19 pandemic.

Although the benefits of learning, exercising new skills, and engaging in mastery experiences extend well past childhood, researchers maintain that these opportunities are rarefied privileges in later and older adulthood, as society mainly supports dedicated infrastructure, time, and resources for supporting children and adolescents in these pursuits (Wu et al., 2021). Learning, taking on mastery experiences, and exercising competencies in adulthood can bolster well-being and successful adaptation to an ever-changing modern world, including public health changes during the COVID-19 pandemic. By contrast, the cultural neglect of supporting these psychologically-enriching opportunities in adulthood compromises these potential

benefits (Wu et al., 2021). As such, more research is needed to further investigate the benefits of adult learning and the exercise of competence in the face of challenging circumstances, including social isolation during the pandemic. Accordingly, the current study assessed how self-reported learning, sense of meaning/purpose, self-efficacy, self-worth, use of skills, and sense of accomplishment may buffer the relationship between social connection loss and life satisfaction.

### **The Present Study**

Given the well-established relationship between social connection and well-being, research is needed to identify ways to combat declines in social connection and loneliness when connecting with others is not possible. One way to accomplish this is to investigate the types of behaviors (e.g., learning new things) and psychological qualities (e.g., greater meaning/purpose in life) that people possessed or engaged in during the pandemic that protected or bolstered well-being. To address these questions, we analyzed data collected from January 2020 to May 2020 to examine how the link between social connection and life satisfaction may have been buffered by participants' unique psychological resources and behaviors during the pandemic, particularly those that are conducive to the fulfillment of competence and autonomy. These data were collected as part of a larger project on interpersonal connection during COVID-19. Findings on the trajectories of loneliness and life satisfaction during the pandemic using data collected at T<sub>1</sub> and T<sub>2</sub> are published elsewhere (Folk et al., 2020; Okabe-Miyamoto et al., 2021).

The present study addresses the following preregistered research questions using the full longitudinal dataset:

**Research Question 1:** Did overall social connection change as a result of the COVID-19 pandemic?

**Research Question 2:** Did well-being (as indexed by life satisfaction) change as a result of the COVID-19 pandemic?

**Research Question 3:** Did changes in overall social connection predict changes in well-being (life satisfaction) and, specifically, were these effects moderated by a set of candidate moderating variables, including learning, meaning/purpose, self-efficacy, self-worth, skills, and accomplishment?

Research questions, the analytic plan, and measure instruments associated with this study are pre-registered on the Open Science Foundation website:

[https://osf.io/ufb5g/?view\\_only=9ec92b98f9904e7baceb5e0097f5ae35](https://osf.io/ufb5g/?view_only=9ec92b98f9904e7baceb5e0097f5ae35).

## ***Materials and Methods***

### *Participants*

Participants were recruited in three waves from Prolific Academic, an online platform that has been shown to provide quality online data (Peer et al., 2017). To participate in the study, participants were required to be fluent in English and have an “approval rating” of over 90% on Prolific (i.e., were previously approved for compensation in over 90% of studies in which they previously engaged on Prolific for providing quality responses that were not rushed, incomplete, or failed attention checks).

In Wave 1, participants were recruited in January and February 2020. After excluding two participants who reported being younger than 18, our final sample was 396. In Wave 2, participants ( $N = 336$ ) were recontacted in April 2020. In Wave 3, participants ( $N = 299$ ) were re-recruited in May 2020. Full participant demographics can be found in Table 1.

### *Procedure*

Participants enrolled in a study titled “A Social Interaction Psychological Research Survey” on Prolific Academic and completed three 20-to-25-min Qualtrics surveys online. They were compensated \$3.75 for their time. Following consent, participants answered questions regarding their feelings of social connection, life satisfaction, and other psychological and behavioral indicators of thriving (e.g., accomplishment, learning, and sense of meaning/purpose). Descriptive statistics and alpha reliabilities for all measures can be found in Table 1.

### *Measurements*

*Subjective Well-Being.* Participants completed the 5-item Satisfaction With Life Scale (Diener et al., 1985), which includes items such as “I am satisfied with my life,” rated on a 1 (*strongly disagree*) to 7 (*strongly agree*) Likert scale.

### *Social Connection.*

***Relatedness.*** Participants responded to the 6-item relatedness (i.e., connectedness) subscale of the Balanced Measure of Psychological Needs Scale (BMPN; Sheldon & Hilpert, 2012), which includes items like “I felt a sense of contact with people who care for me and whom I care for” and “I felt close and connected with other people who are important to me,” rated on a 1 (*strongly disagree*) to 7 (*strongly agree*) Likert scale.

***Loneliness.*** Participants completed the 20-item UCLA Loneliness Scale (Russell et al., 1980). Sample items include “No one really knows me well” and “My social relationships are superficial,” rated on a 1 (*never*) to 4 (*often*) Likert scale, with higher scores indicating greater loneliness.

***COVID-Related Changes in Connection.*** Participants were asked to respond to 3 items asking how connected they felt to particular groups across the onset of the COVID-19 pandemic. These items were administered at Wave 3 (May 2020) and



inquired, “Compared to life before COVID-19, how connected do you feel to your family and friends?, [...] to your neighborhood, [...] to your country?,” rated on 1 (*a lot less connected*) to 5 (*a lot more connected*) Likert scale.

*Psychological and Behavioral Resources.* Participants completed the Comprehensive Inventory of Thriving (CIT; Su et al., 2014), which contains 54 items with 18 subscales rated on 1 (*strongly disagree*) to 5 (*strongly agree*) Likert scales. As pre-registered, in the present article, we focused on the following six subscales: accomplishment (e.g., “I am achieving most of my goals”), learning (e.g., “I learned something new yesterday”), meaning and purpose (e.g., “My life has a clear sense of purpose”), self-efficacy (e.g., “I believe that I am capable in most things”), self-worth (e.g., “What I do in life is valuable and worthwhile”), and skills (e.g., “I use my skills a lot in my everyday life”).

#### *Analytic Plan*

*Sample Size and Power.* For Wave 1, we enabled as many participants to enroll in our study as possible from January 6 to February 12, 2020 ( $N = 396$ ). Then, participants were invited to complete follow-up surveys from April 1 to April 8, 2020 (Wave 2;  $N = 336$ ), and again from May 16 to May 26, 2023 (Wave 3;  $N = 299$ ). We did not conduct an a priori power analysis and focused on maximizing participant enrollment. However, a Monte Carlo Simulation indicates that a sample size of 200 was sufficient for detecting a medium direct effect ( $\rho = 0.30$ ) at 80% power in a two-level model (Arend & Schäfer, 2019). Accordingly, the present study is sufficiently powered to detect the effects of interest.

*Analytic Strategy.* To address our first research question, about whether overall social connection changed as a result of the COVID-19 pandemic, we conducted two complementary sets of analyses. First, we assessed self-perceived changes in connection from before to after COVID-19 at Wave 3 (May 2020) with one’s family and friends,

one's neighborhood, and one's country rated on 5-point Likert scales (*1 = less connected, 3 = no difference in connection, 5 = more connected*) using a series of one sample, two-tailed *t*-tests to assess whether the mean for the sample is significantly different from 3 (*no difference in connection*).

Second, changes in social connection (as measured by relatedness and loneliness) were directly modeled using multilevel growth models to account for repeated measures (level 1) nested within people (level 2). We used a model-building approach to select the most appropriate model for each outcome. That is, we incrementally added fixed then random effects of time to an unconditional model to determine which parameters significantly improved model fit.

To address Research Question 2, about whether well-being changed as a result of the COVID-19 pandemic, we again used multilevel models to assess change in life satisfaction across the three data collection waves using the same model-building approach.

To address the third and final research question, about whether a set of moderators impact the extent to which changes in overall social connection predict changes in life satisfaction, we deployed a two-stage least squares regression approach to model the extent to which changes in one variable predicted changes in another. In this two-stage approach, we first calculated slopes for relatedness and life satisfaction for each individual using data from all three waves using ordinary least squares (OLS) regression models. In the second step, these individual slopes were inputted into a subsequent set of OLS models in which changes (slopes) in life satisfaction were predicted by changes (slopes) in social connection. This analysis was repeated separately for loneliness. Although social connection and loneliness were our focal

constructs, we present additional analyses for belonging and support (as measured by CIT subscales) in our Supplementary Materials.

To address the moderation hypotheses included in Research Question 3, we tested the significance of an interaction term reflecting changes in social connection ( $X_1$ )  $\times$  changes in each pre-registered moderator ( $X_2$ ) in our models predicting life satisfaction. Specifically, we tested the potential moderating effects of learning, sense of meaning/purpose, self-efficacy, self-worth, skills, and accomplishment.

## Results

### *Changes in Social Connection*

One-sample *t*-tests revealed that participants reported feeling marginally closer to family and friends from before to after the pandemic,  $t(297) = 1.85, p = 0.065$ , but significantly less connected to their neighborhood,  $t(297) = -3.48, p < 0.001$ , and their country,  $t(297) = -3.48, p < 0.001$  (see Table 2).

In addition to these retrospective reports of *perceived* changes in social connection, multilevel models assessing repeated measures of relatedness and loneliness indicate that participants felt significantly lonelier in May 2020 than they did in January/February 2020,  $\beta = 0.07, p < 0.001$  (see Table 3). Allowing trajectories to randomly vary improved model fit for our loneliness model,  $\chi^2(2) = 40.94, p < 0.001$ , indicating significant variation in rates of change in loneliness between participants. (See Table 4 for multilevel model comparisons and fit indices predicting loneliness.) We also detected a significant quadratic relationship between loneliness and time,  $\beta = 0.11, p < 0.001$ . However, because three timepoints is the minimum number of timepoints required to estimate a quadratic trend, we conservatively decided to not over-interpret this effect.

### *Changes in Life Satisfaction*

Our multilevel models (Table 5) indicate that life satisfaction did not significantly change from before to after the onset of the pandemic,  $\beta = 0.02, p = 0.18$ . Although we detected significant variability in participants' trajectories,  $\chi^2(2) = 11.62, p = 0.01$ , life satisfaction remained largely unchanged from January/February 2020 to May 2020, on average,  $\beta = -0.01, p = 0.21$ ).

### ***Changes in Social Connection Predicting Changes in Life Satisfaction and Protective Factors***

Our two-stage least squares regression models (see Table 6) yield further insight into factors that may have impacted significant variability in participants' trajectories in life satisfaction. Although life satisfaction remained largely stable over the assessment period, the two-stage least squares models showed that steeper increases in relatedness positively predicted steeper increases in life satisfaction,  $\beta = 0.29, p < 0.001$ , and that steeper increases in loneliness negatively predicted steeper decreases in life satisfaction,  $\beta = -0.35, p < 0.001$ .

To further investigate the association between changes in life satisfaction and changes in social connection, we tested a series of pre-registered moderators. That is, we tested the extent to which changes in participants' sense 1) that they were using their skills in daily life, 2) that they were learning, 3) that they were feeling accomplished, 4) that they had meaning/purpose in life, as well as their feelings of 5) self-worth and 6) self-efficacy, buffered their overall life satisfaction from declines in social connection. Our two-stage least squares regression models (see Table 7) indicated a significant interaction between changes in relatedness and changes in learning,  $\beta = -0.12, p = -0.03$ , sense of meaning/purpose,  $\beta = -0.06, p = 0.04$ ), and use of skills,  $\beta = -0.08, p = -0.01$ . These findings suggest that individuals who experienced reductions in relatedness during the onset of the pandemic, yet reported greater-than-average (by 1 SD) growth in

learning, meaning/purpose, and use of skills during that time, were protected against steeper decreases in life satisfaction (see Figures 1-3).

Additionally, changes in sense of meaning/purpose interacted with changes in loneliness,  $\beta = 0.06$ ,  $p = 0.03$ , such that those who reported 1 SD greater-than-average growth in sense of meaning/purpose and who experienced increases in loneliness were protected against sharper declines in life satisfaction (Figure 4). Moreover, learning,  $\beta = 0.08$ ,  $p = 0.06$ , and self-worth,  $\beta = -0.01$ ,  $p = 0.07$ , marginally interacted with loneliness separately, such that those who reported 1 SD greater-than-average in learning and self-worth and who reported increases in loneliness were protected against sharper decreases in life satisfaction, respectively (Figures 5 and 6).

## **Discussion**

As active agents of their lives, people are intrinsically motivated to connect, be autonomous, and exercise their competencies (Ryan & Deci, 2000). The onset of COVID-19 with its accompanying public health social distancing measures, although necessary, fundamentally compromised people's abilities to connect. When the environment suddenly limits one's fulfillment of the basic need of social connection, do other behaviors and psychological resources compensate for missed opportunities to connect? The present study explored this question by assessing changes in social connection, changes in life satisfaction, and the potential buffering effects of competency- and autonomy-related behaviors and resources in the wake of the pandemic.

Not surprisingly, our findings indicated that social connection was compromised before to after the onset of the pandemic. Retrospective perceptions of changes in social connection since the onset of the pandemic reveal that, on average, people felt significantly less connected to their neighborhood and country and marginally closer to

family and friends. This is perhaps a consequence of stay-at-home and social distancing measures, which restricted interaction to family and roommates, and reduced opportunities to interact with the community at large. Multilevel growth models using repeated measures corroborate these one-time retrospective perceptions of decreases in social connection, and suggest people felt significantly lonelier in May, 2020 than they did in January/February, 2020.

Despite the uncertainty and multiple challenges during the early stages of the pandemic, life satisfaction remained largely stable over this time period. However, on average, sharper increases in loneliness and sharper decreases in relatedness negatively predicted changes in life satisfaction. That is, the sharper loss of connection over the pandemic, the sharper loss of satisfaction (and vice versa). When probing the potential protective effects of competence- and autonomy-related behaviors and resources, we found those who reported sharper decreases in relatedness during the beginning of the COVID-19 pandemic—yet greater-than-average growth (by 1 SD) in learning, sense of meaning/purpose, and use of their skills—were buffered against sharper decreases to life satisfaction over this time period. Put another way, those who experienced sharper gains than average in using their skills and talents in everyday life, learning new things daily, or feeling their life had a clear sense of meaning/purpose reported more gradual declines in life satisfaction when they experienced decreased social connection compared to those who experienced similar levels of social connection loss but reported average or lower-than-average gains in these domains. One interpretation is that having greater daily mastery experiences (learning and use of skills), as well as a broader sense of purpose that organizes one's day-to-day experiences (meaning/purpose), compensates for impoverished social connection when social connection is not afforded.

Greater-than-average increases in competence- and autonomy-supporting behaviors and resources also seemed to attenuate the negative relationship between changes in loneliness and changes in life satisfaction. Specifically, those who reported increases in loneliness but also greater-than-average increases in meaning/purpose reported significantly smaller decreases in life satisfaction than would be expected, on average. The same—albeit marginally significant—pattern held for people who reported greater-than-average changes in learning and self-worth.

Notably, participants who reported increases in relatedness and greater-than-average growth in learning and use of skills did not report changes in life satisfaction comparable to those who reported average or lower-than-average gains in these domains. One plausible explanation for these initially counterintuitive effects is that these increases in social connection and competence- and autonomy-enhancing behaviors may have come at the expense of compliance with social distancing recommendations (i.e., those involving seeing people beyond one's household), and a confound like guilt or dissatisfaction with public health circumstances may be driving these effects. Beyond these speculations, by and large, we take our findings to mean that positive increases in learning and use of skills protected life satisfaction among those who were vulnerable in the pandemic (i.e., whose decreases in relatedness and increases in loneliness negatively predicted changes in life satisfaction).

Like other research indicating that engaging in flow activities protected against negative changes to life satisfaction during the pandemic (Sweeny et al., 2020), the present study suggests that positively engaging one's attention and efforts towards novel and challenging activities may protect well-being in the face of impoverished social connection. The psychological benefits, and perhaps environmental necessity, of finding new forms of engagement might explain the proliferation during the pandemic of online

learning platforms like Coursera and Skillshare (Koksal, 2020), which offer courses in a range of subjects from art to computer science, as well as the rise of at-home digital health solutions like the Peloton Bike and Nintendo Fit (Ruth et al., 2022).

This study is not without limitations. First, given the correlational design of this longitudinal survey study, we cannot establish directionality of effects. Second, we acknowledge that our data span a relatively short period of the pandemic. Importantly, however, our data capture changes in social connection and well-being from before to after the onset of the pandemic, and we consider this a pivotal transition and important contextual backdrop in which to interpret our results. More pointedly, our study offers insight into the immediate psychological shifts following a far-reaching societal event (i.e., the pandemic onset). The mounting global political, ecological, and technological divides of the 21<sup>st</sup> century, which surely will entail future wide-reaching turning points, render the study of the relationship between subjective well-being, social connection, and psychological need satisfaction in the context of uncertainty an on-going, pertinent area of empirical concern.

Although this study was conducted during the COVID-19 pandemic, it bears relevance for other life circumstances that may limit the fulfillment of social connection needs, such as those incurred by a variety of life transitions, including moving to a new city or culture, receiving a serious diagnosis for self or family, and losing social networks due to retirement or advancing age. As articulated elsewhere, learning is adaptive across the lifespan in the face of rapidly changing environments (Wu & Strickland-Hughes, 2019), and yet, most formal learning opportunities are generally targeted towards children and adolescents, making learning, the exercise of new skills, and opportunities to build self-efficacy restricted privileges in adulthood and advanced age (Wu et al., 2021). Limited access to learning opportunities and mastery experiences



in adulthood is further problematized by the fact that novel skill learning may be even less accessible to low-income and minoritized adults (Rodriguez et al., 2022). In light of our findings, as well as related converging research, we contend that, although the need for social connection cannot be fully replaced, opportunities to learn new skills, exercise one's talents, and strengthen one's sense of meaning/purpose can be vital to well-being when the ability to connect with others is limited or absent, and these opportunities may be a particularly crucial lifeline for those who are vulnerable.

**Disclosure Statement**

The authors report there are no competing interests to declare.

**Data Availability Statement**

Research questions, the analytic plan, measure instruments, data, and analytic code associated with this study are available on the Open Science Foundation website:

[https://osf.io/ufb5g/?view\\_only=9ec92b98f9904e7baceb5e0097f5ae35](https://osf.io/ufb5g/?view_only=9ec92b98f9904e7baceb5e0097f5ae35).

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Table 1. Participant Demographics, Descriptive Statistics, and Alpha Reliabilities.

	<b>Wave 1</b> Jan./Feb. 2020	<b>Wave 2</b> April 2020	<b>Wave 3</b> May 2020
<b>Participant Demographics</b>			
N	396	336	299
Age	31.59 (11.87) Range: 18 – 76	32.03 (11.94) Range: 18 – 72	32.13 (11.92) Range: 18 – 69
Gender	55% Male	55% Male	53% Male
Ethnicity	80% Caucasian	80% Caucasian	81% Caucasian
Country	32% U.S. 27% U.K. 41% Other	31% U.S. 27% U.K. 42% Other	28% U.S. 27% U.K. 45% Other
<b>Descriptive Statistics &amp; Alpha Reliabilities</b>			
Life Satisfaction	3.96 (1.55) $\alpha = .92$	3.99 (1.45) $\alpha = .92$	4.08 (1.53) $\alpha = .93$
Relatedness	4.88 (1.10) $\alpha = .76$	4.91 (1.14) $\alpha = .77$	4.91 (1.16) $\alpha = .80$
Loneliness	2.23 (.52) $\alpha = .94$	2.16 (.49) $\alpha = .88$	2.27 (.63) $\alpha = .93$
Accomplishment	4.33 (1.53) $\alpha = .92$	4.25 (1.44) $\alpha = .91$	4.28 (1.51) $\alpha = .84$
Learning	5.35 (1.10) $\alpha = .76$	5.18 (1.12) $\alpha = .74$	5.16 (1.21) $\alpha = .83$
Meaning/Purpose	4.49 (1.52) $\alpha = .90$	4.50 (1.49) $\alpha = .90$	4.59 (1.46) $\alpha = .90$
Self-Efficacy	5.15 (1.22) $\alpha = .81$	5.14 (1.12) $\alpha = .78$	5.16 (1.20) $\alpha = .82$
Self-Worth	4.70 (1.40) $\alpha = .88$	4.66 (1.30) $\alpha = .84$	4.63 (1.28) $\alpha = .85$
Skills	4.60 (1.45) $\alpha = .88$	4.60 (1.36) $\alpha = .89$	4.56 (1.36) $\alpha = .87$



Table 2. Results: One-Sample Two-Tailed T-Tests.

Connection Outcome	<i>M</i>	<i>SD</i>	<i>t</i> (297)	95% CI		<i>p</i>
				LL	UL	
Family and friends	3.11	1.00	1.85	2.99	3.22	0.065
Neighborhood	2.83	0.87	-3.48	2.73	2.92	< 0.001
Country	2.83	0.86	-3.38	2.73	2.93	< 0.001

*Note.* CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

Table 3. Results of Multilevel Models Predicting Changes in Social Connection from Time (Fixed).

Effect	Relatedness				Loneliness			
	$\beta$	95% CI		<i>p</i>	$\beta$	95% CI		<i>p</i>
		LL	UL			LL	UL	
Intercept	-0.02	-0.10	-0.07	0.70	0.04	-0.05	0.14	0.38
Time (fixed)	-0.00	-0.05	-0.05	0.93	0.07	0.04	0.10	<0.001
$\sigma^2_{ij}$	0.45	–	–	–	0.20	–	–	–
$\tau_{00}$	0.55	–	–	–	0.81	–	–	–

*Note.* CI = confidence interval; *LL* = lower limit; *UL* = upper limit;  $\sigma^2_{ij}$  = Level-1 residual variance;  $\tau_{00}$  = Level-2 residual variance.

Table 4. Results of Multilevel Models Predicting Changes in Loneliness from Time.

	Fully Unconditional				Fixed Slope				Random Slope			
	Estimate	95% CI		<i>p</i>	Estimate	95% CI		<i>p</i>	Estimate	95% CI		<i>p</i>
		LL	UL			LL	UL			LL	UL	
<b>Fixed Effects</b>												
Intercept	0.03	-0.06	-0.12	0.54	0.04	-0.05	0.14	0.38	0.05	-0.05	0.14	0.31
Time (Linear)	–	–	–	–	0.07	0.04	0.10	<0.001	0.08	0.04	0.12	<0.001
Time (Quadratic)	–	–	–	–	0.17	0.11	0.22	<0.001	–	–	–	–
<b>Random Effects</b>												
$\sigma^2_{ij}$	0.20	–	–	–	0.20	–	–	–	0.17	–	–	–
$\tau_{00}$	0.80	–	–	–	0.81	–	–	–	0.85	–	–	–
Time	–	–	–	–	–	–	–	–	0.03	–	–	–
<b>Model Fit</b>												
Deviance	2209	–	–	–	2193	–	–	–	2152	–	–	–
$\chi^2$	–	–	–	–	15.37	–	–	<0.001	40.94	–	–	<0.001

Note. CI = confidence interval; LL = lower limit; UL = upper limit;  $\sigma^2_{ij}$  = Level-1 residual variance;  $\tau_{00}$  = Level-2 residual variance.

Table 5. Results of Multilevel Models Predicting Changes in Life Satisfaction from Time.

	Fully Unconditional				Fixed Slope				Random Slope			
	95% CI				95% CI				95% CI			
	Estimate	LL	UL	<i>p</i>	Estimate	LL	UL	<i>p</i>	Estimate	LL	UL	<i>p</i>
<b>Fixed Effects</b>												
Intercept	-0.02	-0.11	0.08	0.75	-0.01	-0.11	0.08	0.82	-0.01	-0.11	0.08	0.82
Time	–	–	–	–	0.02	-0.01	0.05	0.18	0.02	-0.01	0.06	0.21
<b>Random Effects</b>												
$\sigma^2_{ij}$	0.17	–	–	–	0.17	–	–	–	0.16	–	–	–
$\tau_{00}$	0.85	–	–	–	0.85	–	–	–	0.86	–	–	–
Time	–	–	–	–	–	–	–	–	0.03	–	–	–
<b>Model Fit</b>												
Deviance	2111	–	–	–	2109	–	–	–	2099	–	–	–
$\chi^2$	–	–	–	–	1.84	–	–	0.17	11.62	–	–	0.01

Note. CI = confidence interval; LL = lower limit; UL = upper limit;  $\sigma^2_{ij}$  = Level-1 residual variance;  $\tau_{00}$  = Level-2 residual variance.

Table 6. Results of Two-Stage Least Squares Regression Models Predicting Changes in Life Satisfaction from Changes in Social Connection.

Effect	$\beta$	Relatedness			Loneliness			
		95% CI			$\beta$	95% CI		
		LL	UL	<i>p</i>		LL	UL	<i>p</i>
Intercept	0.00	-0.10	0.10	1.00	0.00	-0.10	0.10	1.00
$\Delta$ S.C.	0.29	0.19	0.40	<0.001	-0.35	-0.45	-0.25	<0.001

Note. CI = confidence interval; LL = lower limit; UL = upper limit;  $\Delta$  S.C. = Change in Social Connection.

Table 7. Results of Two-Stage Least Squares Moderation Models.

	Relatedness				Loneliness			
	Estimate	95% CI		<i>p</i>	Estimate	95% CI		<i>p</i>
		LL	UL			LL	UL	
<b>Model 1: Learning</b>								
Intercept	0.01	-0.09	0.12	0.78	0.01	-0.09	0.1	0.85
Δ S.C.	0.27	0.16	0.37	<0.001	-0.35	-0.45	-0.24	<0.001
Δ Learning	0.07	-0.03	0.17	0.19	0.07	-0.03	0.17	0.18
Δ S.C. x Learn.	-0.12	-0.21	-0.03	0.01	0.08	-0.00	0.17	0.06
<b>Model 2: Sense of Meaning/Purpose</b>								
Intercept	0.02	-0.08	0.12	0.73	0.02	-0.08	0.11	0.74
Δ S.C.	0.21	0.11	0.31	<0.001	-0.24	-0.35	-0.14	<0.001
Δ Mean./Purp.	0.27	0.17	0.37	<0.001	0.25	0.15	0.35	<0.001
Δ S.C. x Mean.	-0.06	-0.12	-0.00	0.04	0.06	0.01	0.12	0.03
<b>Model 3: Self-Efficacy</b>								
Intercept	0.00	-0.10	0.10	0.98	0.00	-0.10	0.11	0.98
Δ S.C.	0.29	0.18	0.39	<0.001	-0.36	-0.47	-0.25	<0.001
Δ Self-Efficacy	0.02	-0.09	0.12	0.78	-0.05	-0.16	0.05	0.78
Δ S.C. x S.E.	-0.01	-0.08	0.06	0.74	0.01	-0.06	0.09	0.74
<b>Model 4: Self-Worth</b>								
Intercept	0.01	-0.09	0.11	0.81	0.02	-0.08	0.12	0.73
Δ S.C.	0.25	0.15	0.35	<0.001	-0.28	-0.39	0.18	<0.001
Δ Self-Worth	0.19	0.09	0.29	<0.001	0.15	0.05	0.26	0.004
Δ S.C. x S.W.	-0.07	-0.16	0.02	0.12	0.07	-0.01	0.16	0.07
<b>Model 5: Skills</b>								
Intercept	0.02	-0.08	0.12	0.74	0.00	-0.10	0.10	1.00
Δ S.C.	0.24	0.13	0.34	<0.001	-0.31	-0.42	-0.20	<0.001
Δ Skills	0.17	0.07	0.27	0.001	0.14	0.03	0.25	0.01
Δ S.C. x Skills	-0.08	-0.15	-0.01	0.02	0.00	-0.06	0.06	0.98
<b>Model 6: Accomplishment</b>								
Intercept	-0.00	-0.10	0.10	0.99	0.01	-0.09	0.10	0.90
Δ S.C.	0.20	0.10	0.30	<0.001	-0.25	-0.35	-0.15	<0.001
Δ Accomplish.	0.37	0.27	0.47	<0.001	0.35	0.25	0.45	<0.001
Δ S.C. x Accm.	0.00	-0.08	0.08	0.95	0.02	-0.06	0.11	0.57

Note. CI = confidence interval; *LL* = lower limit; *UL* = upper limit; Δ S.C. = Change in Social Connection.

Figure 1. Predicted Changes in Life Satisfaction by Changes in Relatedness and Changes in Learning.

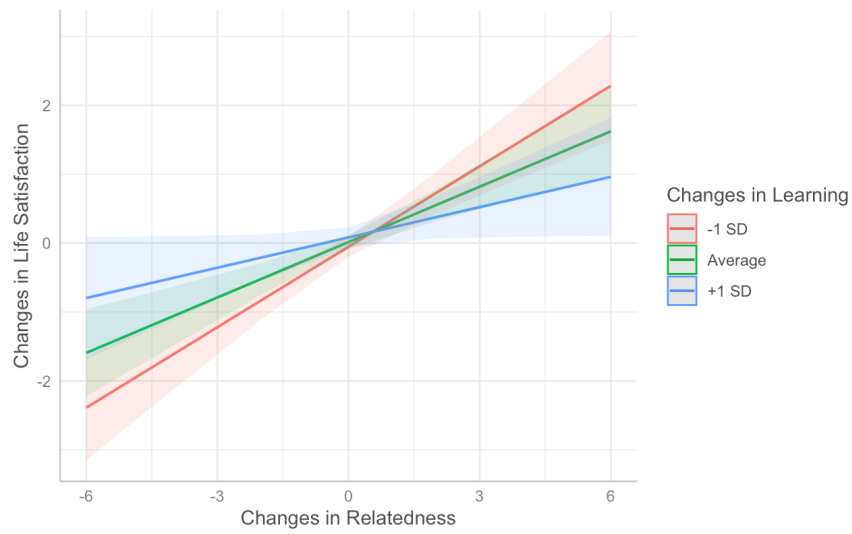


Figure 2. Predicted Changes in Life Satisfaction by Changes in Relatedness and Changes in Meaning/Purpose.

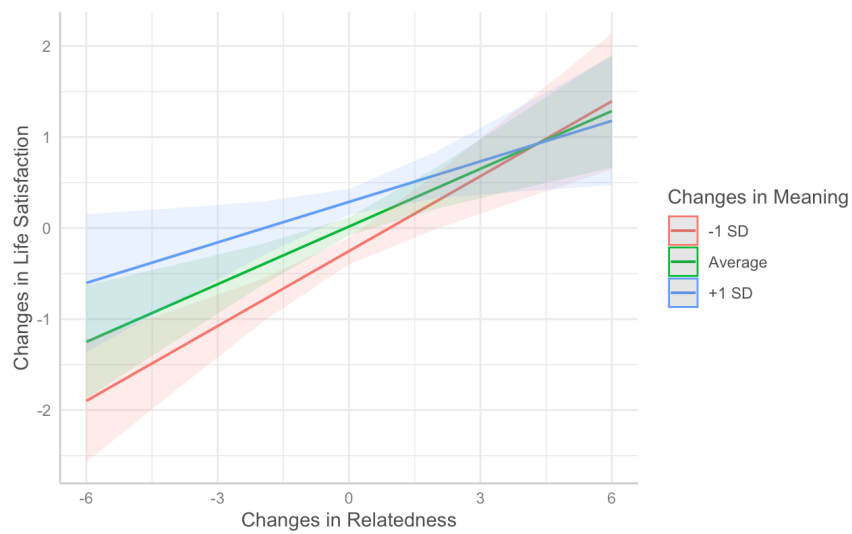


Figure 3. Predicted Changes in Life Satisfaction by Changes in Relatedness and Changes in Use of Skills.

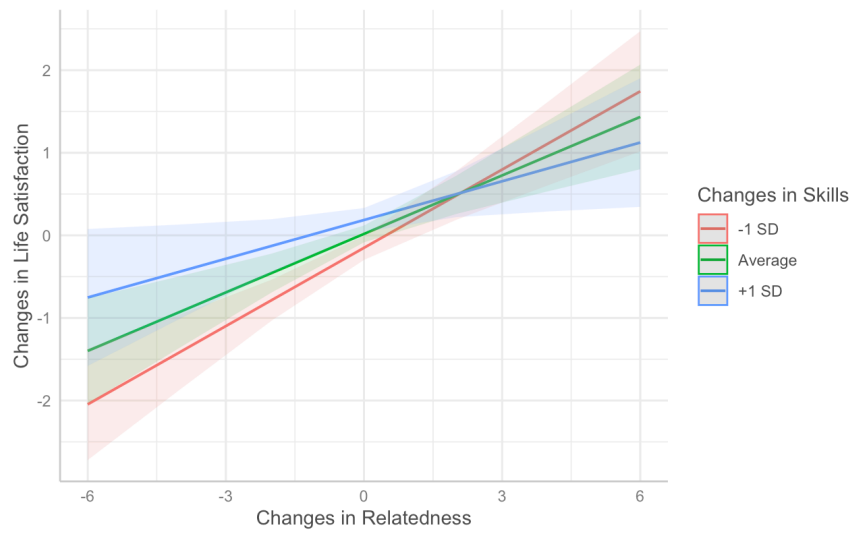


Figure 4. Predicted Changes in Life Satisfaction by Changes in Loneliness and Changes in Meaning/Purpose.

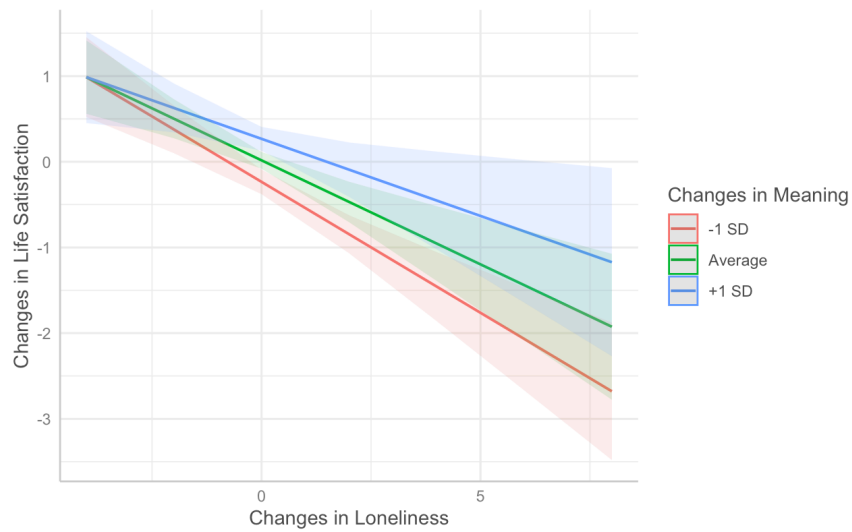


Figure 5. Predicted Changes in Life Satisfaction by Changes in Loneliness and Changes in Learning.

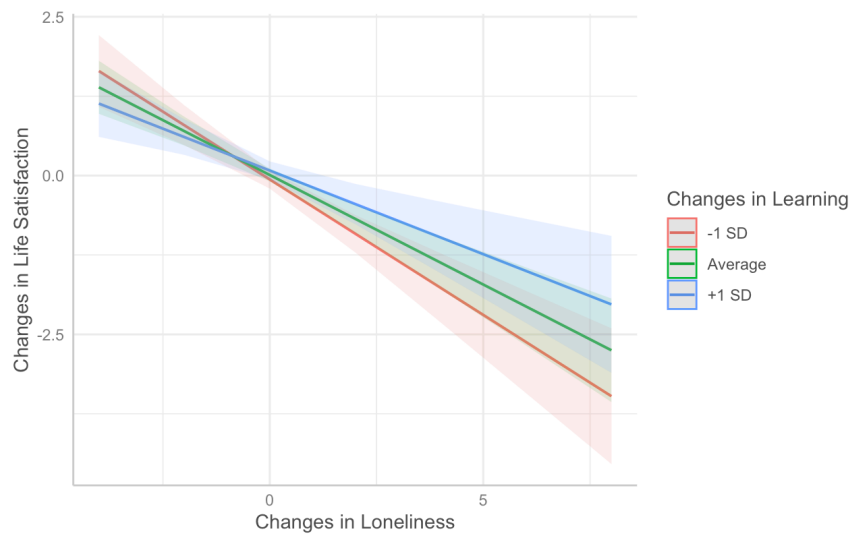
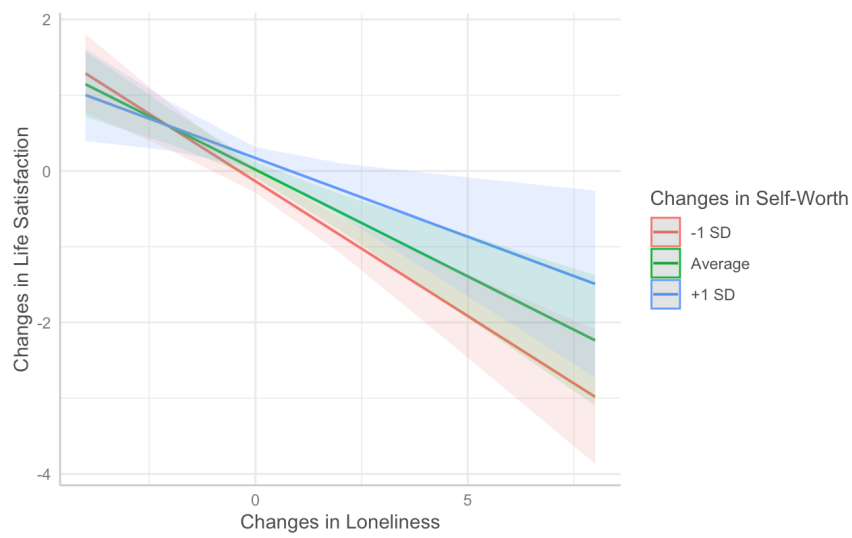


Figure 6. Predicted Changes in Life Satisfaction by Changes in Loneliness and Changes in Self-Worth.



## Supplementary Materials

Our primary constructs of interest were relatedness and loneliness. On a supplementary basis, we also assessed changes in belonging and support over time and how changes in belonging and support relate to changes in life satisfaction.

### *Measures*

#### *Belonging*

Participants completed the 3-item belonging subscale of the CIT (Su et al., 2014). Sample items include “I feel a sense of belonging in my community” and “I feel a sense of belonging my state or province,” rated on a 1 (*strongly disagree*) to 5 (*strongly agree*) Likert scale.

#### *Support*

Participants completed the 3-item support subscale of the CIT (Su et al., 2014). Sample items include “There are people I can depend on to help me” and “There are people who give me support and encouragement,” rated on a 1 (*strongly disagree*) to 5 (*strongly agree*) Likert scale.

### *Results*

#### *Changes in Belonging and Support*

A multilevel model indicated that from January/February 2020 to May 2020, participants felt significantly less belonging ( $\beta = 0.05, p = 0.02$ ; Table S1). Allowing trajectories to randomly vary did not improve model fit [ $\chi^2(2) = 2.13, p = 0.34$ ]. There were no significant changes in support over the same period ( $\beta = -0.03, p = 0.18$ ).

#### *Changes in Belonging and Support Predicting Changes in Well-Being*

Our two-stage least squares models showed that changes in belonging and support positively predicted changes in life satisfaction ( $\beta = 0.18, p = 0.001$ ;  $\beta = 0.19, p = <0.001$ , respectively; Table S2).



***Supplementary Discussion***

Our findings for belonging and support mirror our findings for our primary indicators of social connection (relatedness and loneliness). That is, sharper increases in belonging predicted sharper increases in life satisfaction, and sharper increases in support predicted sharper increases in life satisfaction. These supplementary findings offer further support for our observation that changes in social connection are impactful for well-being, and vice versa.

Table S1. Results of Multilevel Models Predicting Changes in Social Connection from Time (Fixed).

Effect	Belonging				Support			
	$\beta$	95% CI		$p$	$\beta$	95% CI		$p$
		LL	UL			LL	UL	
Intercept	-0.02	-0.11	0.07	0.71	-0.03	-0.12	0.06	0.54
Time (fixed)	-0.05	-0.09	-0.01	0.02	-0.03	-0.07	0.01	0.18
$\sigma^2_{ij}$	0.28	–	–	–	0.30	–	–	–
$\tau_{00}$	0.73	–	–	–	0.73	–	–	–

*Note.* CI = confidence interval; *LL* = lower limit; *UL* = upper limit

$\sigma^2_{ij}$  = Level-1 residual variance;  $\tau_{00}$  = Level-2 residual variance.

Table S2. Results of Two-Stage Least Squares Regression Models Predicting Changes in Life Satisfaction from Changes in Social Connection.

Effect	Belonging				Support			
	$\beta$	95% CI		$p$	$\beta$	95% CI		$p$
		LL	UL			LL	UL	
Intercept	0.00	-0.11	0.11	1.00	0.00	-0.11	0.11	1.00
$\Delta$ S.C.	0.18	0.08	0.29	0.001	0.19	0.09	0.30	<0.001

*Note.* CI = confidence interval; *LL* = lower limit; *UL* = upper limit;

$\Delta$  S.C. = Change in Social Connection.