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Relationships between social interactions, basic psychological needs, and wellbeing
during the COVID-19 pandemic

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Contributorship
AK and JD collaboratively developed the study, gained ethical approval, and conducted
participant recruitment. AK oversaw data collection; AR conducted the data analysis, with
input from JD, AK, and BJ. JD and AR drafted initial versions of the manuscript, with AK
and BJ offering later input. All authors collaborated to approve the final version of the
manuscript.

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research.

Data Statement
The Ethics approval for this project stated that participants would explicitly consent to the
possible re-use of their data by the researchers but it did not permit the sharing of the
collected data.
Abstract

Social lockdowns associated with COVID-19 have led individuals to increasingly rely on video conferencing and other technology-based interactions to fulfil social needs. The extent to which these interactions, as well as traditional face-to-face interactions, satisfied psychological needs and supported wellbeing during different periods of the COVID-19 pandemic is yet to be elucidated. OBJECTIVE: In this study, university students’ social interactions (both technology-based and face-to-face), psychological needs, and wellbeing were assessed at six time points across four months of government-enforced restrictions in Australia. DESIGN: Repeated survey assessment. MAIN OUTCOME MEASURES: Basic psychological need satisfaction; general wellbeing. RESULTS: Results demonstrated that, at the within-subjects level, relatedness satisfaction (feeling understood by, cared for, and connected to others) significantly mediated the relationship between technology-based interaction and wellbeing. Autonomy satisfaction (self-initiation and feeling ownership over decisions and behaviors) mediated the relationship between face-to-face interactions and wellbeing at the within-person level. CONCLUSION: Discussion is centred on the importance of technology-based interactions for needs satisfaction and wellbeing during periods of social isolation.

Keywords: technology; communication; social interaction, basic psychological needs; self-determination theory
Relationships between social interactions, basic psychological needs, and wellbeing
during the COVID-19 pandemic

Uncertainties, fears, and lifestyle changes associated with the COVID-19 pandemic have led to alarming rises in anxiety, depression, post-traumatic stress disorder, psychological distress, and stress (Salari et al., 2020; Xiong et al., 2020). Among the most challenging lifestyle changes that individuals have been required to make has been that of physical distancing from friends, family, colleagues, and other social networks. Community-wide physical distancing has been enforced by governments to mitigate the spread of the virus, and such physical distancing has led individuals to search for creative—and often technology-based—methods to maintain social connections. In March, 2020, Australia experienced a significant mobile phone network strain caused by social lockdowns (Fookes & Condon, 2020), and a BBC report indicated that the use of Zoom software increased 30-fold in April, 2020 (Sherman, 2020), when many of the world’s governments enforced strict lockdown measures.

Despite the increased use of technologies to maintain social connections during the COVID-19 pandemic (Fookes & Condon, 2020; Sherman, 2020), little is known about the effects of these interactions on wellbeing during this period. Prior to COVID-19, most research indicated that digitally-based social interactions had little impact on wellbeing, although scholars often pointed to the need for more research in the area. In a systematic review, for example, Best and colleagues (2014) concluded that online social technologies had little effect on adolescent wellbeing, although the authors also noted the absence of robust causal research on the topic. A similar conclusion was made in a separate review—this time on the effects of video calls on wellbeing for older people (Noone et al., 2020). Specifically, Noone and colleagues (2020) reported inconclusive results from a limited body of research and called for further research in the area. Since the beginning of the COVID-19
pandemic, cross-sectional surveys have revealed that technology-based social interactions may have mixed effects on wellbeing (e.g., Cauberghe, Van Wesenbeeck, De Jans, Hudders, & Ponnet, 2020; Ellis, Dumas, & Forbes, 2020), but more research is needed—involving different methodologies and populations—to improve our understanding of this issue. An additional topic that requires attention is the role of face-to-face social interactions at satisfying psychological needs and promoting wellbeing during various stages of the COVID-19 pandemic. In Australia, even during the strictest periods of social lockdown, many individuals were able to interact with members of their immediate family/household. Also, Australia experienced various phases of social lockdown—some characterised by more restrictions than others—meaning that, at times, face-to-face interactions were permitted outside of household interactions. Little is known about the relative associations between interactions, both face-to-face and technology-mediated, and wellbeing during various stages of the COVID-19, and in this study, we address this gap.

In order to explore potential relationships between different types of social interactions and wellbeing, it is useful to examine how these types of interactions are likely to influence psychological needs. In self-determination theory, three basic psychological needs—for autonomy (self-initiation and feeling ownership over decisions and behaviors), competence (feeling proficient to successfully undertake pursuits), and relatedness (feeling understood by, cared for, and connected to others)—are proposed to bear a significant expression on human functioning (Ryan & Deci, 2000; Vansteenkiste, Ryan, & Soenens, 2020). Satisfaction of these basic needs is considered to promote a host of adaptive outcomes, including psychological wellbeing (Vansteenkiste & Ryan, 2013). Positive social interactions, which can be experienced in various forms, are likely to satisfy the need for relatedness (e.g., Reis, Sheldon, Gable, Roscoe, & Ryan, 2000). However, the unusual social lockdown periods associated with COVID-19 has raised an interesting possibility in relation
to autonomy. Specifically, against a backdrop of a controlled social lockdown period, any opportunities to interact in a face-to-face format may satisfy the autonomy need to a greater extent than would otherwise be expected. When individuals experience psychological need deprivation or frustration, their desires to acquire missing experiences are heightened (Sheldon & Gunz, 2009), and the weakening of government controls around face-to-face social interaction is likely to be met with an increased sense of autonomy among community members.

**The Present Study**

With the goal to capture information about individuals’ social interactions, psychological needs, and wellbeing at different stages of social lockdown, we employed a design involving six surveys across a four-month period. The four-month period was characterised by a gradual easing of social restrictions by the local state government. Our repeated assessment design permitted an exploration of both within- and between-person effects; that is, we were able to ascertain whether needs satisfaction and/or wellbeing was higher on occasions when individuals experienced more social interactions, and also whether need satisfaction and/or wellbeing was experienced more by people who typically engaged in more social interaction. With respect to psychological needs, we focused on those discussed within self-determination theory (Ryan & Deci, 2008)—autonomy, competence, and relatedness. University students, many of whom experienced significant social, health, academic, and financial change due to COVID-19 (Lyons, Wilcox, Leung, & Dearsley, 2020; Zhao, An, Tan, & Li, 2020), comprised the sample.

Consistent with self-determination theory, it was hypothesised that, at both within- and between-person levels, satisfaction of needs for autonomy, competence, and relatedness would be positively associated with wellbeing. Competence satisfaction was not expected to be associated with face-to-face or technology-mediated interactions at either within- or
between person levels. However, it was hypothesised that, at the within-person level, satisfaction of the need for relatedness would significantly mediate a positive influence of technology-based social interactions on wellbeing, and that autonomy satisfaction would significantly mediate a positive influence of face-to-face interactions on wellbeing.

Method

Participants

A total of 127 students (24% male; 74% female; 2% non-binary) based in Queensland, Australia, participated in the study. Participants were aged 18-53 ($M = 24.73$, $Mdn = 20$, $SD = 8.96$), and the majority of the sample (83.47%) were of Australian nationality. Forty-four percent of participants ($n = 57$) were full-time students, 37% ($n = 47$) were working part-time, 6% ($n = 8$) worked full-time, and 12% ($n = 15$) were unemployed. Students were recruited using a university participation scheme and received course credit for their involvement in the study. The research outlined in this paper was part of data collection for a broader study; other findings from the data can be found in [reference removed to facilitate blind review]. The [reference removed to facilitate blind review] Human Research Ethics Committee granted ethics approval (Approval number: H8074).

Design and Procedure

Participants were asked to complete a set of six surveys, each of which was separated by a period of two weeks. In April, 2020—the time at which the first survey was completed—participants had begun experiencing the strictest lockdown restrictions put in place by the local government. Specifically, restrictions were placed on non-family members entering households and strict boundaries were placed on travel (except for the essential reasons of getting food, medical reasons, work, and exercise). The first easing of restrictions took place on 26 April 2020, with bars, clubs, restaurants, and cafes permitted to reopen, albeit under strict conditions, on 16 May 2020. In July 2020, the local government
implemented an easing of restrictions with borders reopening to travelers from other states
and territories (excluding one—Victoria) on 10 July 2020.

The questions on the first survey asked participants about their experiences prior to
any lifestyle changes due to COVID-19. The final (sixth) survey was completed in mid-July,
2020. The timing of the sixth survey corresponded with both the re-opening of state borders
and the resumption of numerous social events and activities (e.g., children’s sport leagues).
Participants accessed the online questionnaires (hosted using Qualtrics) using direct web
links. Individuals read the participant information, gave their informed consent (indicated by
clicking ‘yes’ or ‘no’ on the online consent webpage), and created a unique, anonymous code
prior to completing the first questionnaire. This code was entered at the start of the
subsequent questionnaires, which were completed as a series of webpages. Following
completion of the final questionnaire, participants were thanked for their participation and
debriefed.

Aside from questions on demographic information (age, gender, nationality,
occupation and country of residence), which were included in the first survey only, all
surveys included the same questionnaire items. The Short Warwick Edinburgh Mental Well-
being Scale (Stewart-Brown et al., 2011; Stewart-Brown et al., 2009; Tennant et al., 2007)
was used to measure participant well-being. This scale score consists of the mean response of
seven positively-worded items that address well-being, which is measured as a
unidimensional construct. Participants were invited to consider their experiences over the
prior week, and responses were recorded on a 5-point Likert-type scale anchored by “None of
the time” and “All of the time”. Cronbach’s alpha for the scale varied between .85 and .92 in
the present study.

Satisfaction of needs for autonomy and relatedness were measured using the Basic
Psychological Needs Satisfaction and Frustration Scale (Chen et al., 2015). This scale
measures both need satisfaction and frustration in one’s life. The scale consists of 24 items and six subscales; however, given our interest in need satisfaction rather than need frustration, only the competence, autonomy, and relatedness satisfaction (4 items each) were relevant for the present study. Scores were calculated as the mean response to items in the scale are made on a 5-point scale anchored by “Not true at all” and “Completely true”.

Participants were encouraged to consider their experiences over the prior week when completing the scale. Cronbach’s alpha ranged from .88 to .95 for competence, .77 to .88 for autonomy, and .88 to .95 for relatedness in the present study.

Social interactions were measured with a scale designed for the purposes of this study. For face-to-face interactions, instructions read: “Please indicate the degree to which you have had in-person, face-to-face social interaction with the following types of people over the past week as compared to your usual week.” Items were “Friends”, “Family”, “Co-workers/colleagues”, “Other students”, and “People not listed above”. Response options were “Much less”, “Somewhat less”, “About the same”, “Somewhat more”, and “Much more”. The items and response options were the same for the measure of technology-mediated social interaction, although the stem of that scale read “Please indicate the degree to which you have had technology-mediated social interaction (e.g., social media, video conferencing, etc.) with the following types of people over the past week as compared to your usual week.”

Cronbach’s alpha ranged from .46 to .63 for face-to-face social interactions and from .59 to .76 for technology-mediated social interactions in the present study. Given that these scales are meant as a comprehensive aggregate of social interactions across a broad range of sources, the relatively modest inter-item alpha values are expectedly lower than scales targeting a single, narrow construct (see also Ponterotto & Ruckdeschel, 2007).

**Data Management & Analyses**
Intraclass correlations (ICCs) were used to evaluate degree of change in the satisfaction of wellbeing, social interactions, and the basic psychological needs. The hypotheses were tested using multilevel modelling, to account for nesting of data within-person over the three time points, in the lme4 (Bates et al., 2015; Bauer, Preacher, & Gil, 2006; Krull & MacKinnon, 2001) package of R version 3.6.2 (R Core Team, 2019). Maximum likelihood estimation was used to account for missingness. First, wellbeing was regressed onto satisfaction of the basic psychological needs of competence, autonomy, and relatedness. The psychological needs variables were modelled as separate predictors to simultaneously test for between- and within-person effects (Stone & Shiffman, 1994). Between-person effects were tested with variables calculated as each individual’s mean score across all occasions (referred to throughout as Overall scores). Within-person effects were tested with variables calculated as deviations from each individual’s overall score per occasion (referred to throughout as Occasion-Specific scores). Next, each basic needs satisfaction variable was regressed onto Overall and Occasion-Specific face-to-face and technology-based social interactions, as well as the other two psychological basic need satisfaction variables (e.g., for the model with the dependent variable of satisfaction of relatedness, the satisfaction of competence and autonomy were included as covariates). This approach allows for the interpretation of the models to be whether social interactions are linked to the independent variability of the basic psychological need satisfaction that is unique from the other basic need satisfaction variables. To account for any potential time effects, time (number of the survey assessment) was included as a covariate in all models. Prior to model estimation, it was confirmed that there were no assumptions violated of non-linearity, multicollinearity, or homoscedasticity. Mediation of basic needs satisfaction between social interactions and wellbeing was investigated for all significant associations found between social interactions and basic needs satisfaction. Mediation was tested using
the method of Krull & MacKinnon (2001) for evaluating direct, indirect, and total effects in multilevel models with random effects. Indirect effects are calculated as the summation of the random effects covariance and the estimated path between social interactions and satisfaction of basic needs. Total direct effects are calculated as the indirect effect summed with the estimate of the path between social interactions and wellbeing.

Results

Sample Characteristics

In total, there were 483 assessments from 127 participants. Most participants completed 6 (n = 31, 24%) or 5 (n = 26, 21%) surveys, with 18 participants (14%) completing 4, 11 (9%) completing 3, 21 completing 2 (17%), and 20 (16%) completing 1 survey. Within the data, there were 13 cases of missing variables (3%). Study variable descriptive statistics are shown in Table 1. The ICCs revealed that there was very low stability in face-to-face social interactions—only 6% of variability was accounted for by between-person differences. In contrast, 29% of variability in technology-based interactions was at the between-person level, and more than half of variability was at the between-person level for wellbeing and the satisfaction of the basic needs.

Satisfaction of Basic Psychological Needs and Wellbeing

The model testing the between- and within-person associations of satisfaction of competence, autonomy, and relatedness with wellbeing is shown in Table 2. Wellbeing was positively associated with all variables at both the between- and within-person levels, demonstrating that people who overall had more satisfied psychological needs tended to have better wellbeing. Also, on occasions when satisfaction of basic psychological needs was particularly high, so was wellbeing.

Satisfaction of Basic Psychological Needs and Social Interactions
The results of the models testing the between- and within-person associations of face-to-face and technology-based social interactions with satisfaction of competence, autonomy, and relatedness are shown in Table 3. Competence satisfaction was not associated with face-to-face or technology-based interactions at either the between- or within-person level.

Autonomy satisfaction was significantly and positively associated with occasion-specific face-to-face interactions, such that on occasions when people interacted with more people face-to-face than was usual for them, they experienced more satisfaction of their need for autonomy. Relatedness satisfaction was significantly and positively associated with occasion-specific technology-based interactions, such that on occasions when people interacted with more people using technology than was usual for them, they experienced more satisfaction of their need for relatedness.

Mediation analyses were conducted on those associations found to be significant between basic needs satisfaction and social interactions: (1) occasion-specific autonomy satisfaction as a mediator for the impact of face-to-face social interactions on wellbeing, and (2) occasion-specific relatedness satisfaction as a mediator for the impact of technology-based social interactions on wellbeing. The mediation analyses revealed that autonomy satisfaction partially mediated the relation between occasion-specific face-to-face interactions and wellbeing (Table 4, Figure 1). After accounting for covariance of random effects, the indirect effect was calculated as 0.79 and the total effect as 1.59. Relatedness satisfaction fully mediated the relation between occasion-specific technology-based interactions and wellbeing (Table 5; Figure 2). After accounting for covariance of random effects, the indirect effect was calculated as 0.53 and the total effect as 0.68.

**Discussion**

The aim of this study was to explore associations between social interactions—both technology-based and face-to-face—and wellbeing. Satisfaction of the three basic
psychological needs were explored as potential mediators of relationships between interactions and wellbeing. Results indicated that wellbeing was positively associated with satisfaction of psychological needs at both within- and between-person levels. In other words, individuals who typically experienced more satisfaction of psychological needs reported more positive wellbeing, and on occasions when individuals reported greater need satisfaction, they also reported more positive wellbeing. Consistent with hypotheses, satisfaction of the need for autonomy mediated (albeit partially) a positive relationship between face-to-face interaction and wellbeing at the within-person level, and satisfaction of the need for relatedness fully mediated a positive relationship between technology-based interaction and wellbeing at the within-person level.

Consistent with research on technology-based social interaction and wellbeing (see e.g., Best et al., 2014; Noone et al., 2019), we found no significant between-person associations between technology-mediated social interaction and need satisfaction. That is, people who were more or less likely to socially interact with people via technology were not more or less likely to have their basic psychological needs satisfied. In fact, our findings also indicated that face-to-face interaction was not associated with need satisfaction at the between-person level. Reasons for these non-significant relationships are speculative, but it is possible that a circular relationship exists such that those low in need satisfaction seek more social interaction (negative relationship), and that social interaction is need satisfying (positive relationship). An examination of within-person effects provides a degree of support to this possibility—individuals derived satisfaction of their need for autonomy on occasions they had face-to-face interactions, and satisfied their need for relatedness on occasions they had technology-mediated interactions.

The observed relationships between technology-mediated interaction, relatedness satisfaction, and wellbeing were encouraging in light of individuals’ increased reliance on
technology for social interactions during COVID-19. Although we did not test causality, our
data support the potential of technology-based interactions, such as video calls and social
media use, for improving wellbeing during periods of physical isolation. On the evidence of
these findings, such potential was realised during COVID-19, but it is also reassuring that
these technologies may be beneficial should other pandemics arise. Furthermore, for
individuals living in rural, regional, and remote areas, technologies represent an accessible,
easy-to-use, and low cost opportunity to develop and maintain relationships.

The results bring to light an interesting and important issue relating to need
satisfaction. Against a backdrop of social restrictions and controlling government mandates,
face-to-face interactions satisfied participants’ need for autonomy. Our data were collected
across multiple months in 2020, and government-imposed social restrictions varied
considerably throughout this time. Although speculative, it is possible that individuals’ needs
for autonomy were significantly compromised during the period of strictest social lockdown,
contributing to a greater sense of autonomy when the strictest lockdown period ended (and
more face-to-face interactions were permitted). There is evidence that deficits in basic
psychological need satisfaction arouse desires to acquire the missing experiences (Sheldon &
Gunz, 2009), so controlling government mandates around social interaction may have
sharpened individuals’ desires for face-to-face interaction (i.e., as an exposition of
autonomy). It would be interesting to observe whether autonomy satisfaction occurs from
face-to-face interactions when social lockdowns are not salient in people’s minds—our
expectation is that such relationships would not nearly be as strong. It is plausible that our
observed associations between face-to-face interactions and autonomy satisfaction are likely
to have arisen, at least in part, due to the backdrop of the COVID-19 pandemic.

The current study had a number of strengths, including a repeated assessment design
that captured participants’ responses over a period that aligned with changing COVID-19
restrictions. The study was not without limitations, however, and it is important to consider
the findings in light of those limitations. First, the sample consisted of university students
from one area of Australia, and, as such, further research is needed to establish the
generalisability of the results. Second, although the data collection method (i.e., online
surveys) allowed for rapid and convenient responding, the entire periods between
assessments were not evaluated and participants were unable to qualify their responses.
Moreover, we acknowledge that our study design (i.e., repeated cross-sectional surveys)
provides limited insight into temporal issues; experimental or intervention designs are
therefore recommended to confirm the results in this study. Finally, our measures for social
interaction were focused on volume or frequency, and our hypotheses were based on the
assumption that most interactions were positive. It is possible that some interactions were
negative, however, and such interactions may compromise feelings of autonomy, relatedness,
and well-being (Deci & Ryan, 2000; Vansteenkiste et al., 2020). Finally, although our
findings provided some interesting insights into social interactions, need satisfaction, and
wellbeing during the COVID-19 lockdown period, we were surprised at the relatively weak
associations between face-to-face interactions and relatedness satisfaction, particularly at the
within-person level. Future work is required to explore possible reasons for those non-
significant effects.

Notwithstanding these limitations, the current study provides important insights into
the role of social interactions—both face-to-face and technology-mediated—on wellbeing
during various stages of the COVID-19 pandemic. Functional benefits of social interactions
were identified; interactions were predictive of satisfaction of basic needs for autonomy, in
the case of face-to-face interactions, and relatedness, in the case of technology-mediated
interactions. Need satisfaction (for autonomy, competence, and relatedness) was also found to
predict wellbeing. Social connections are a fundamental component of being human, and
government-imposed physical distancing measures have challenged individuals’ abilities to interact with others. It is comforting that technologies enabled individuals to experience relatedness during the pandemic, and against a canvas of strict lockdowns, face-to-face interactions provided a sense of volition and agency.
References


### Table 1. Descriptive Statistics of Wellbeing, Social Interactions, and Basic Needs Satisfaction of Competence, Autonomy, and Relatedness

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
<th>Range</th>
<th>ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Wellbeing</td>
<td>3.40 (0.79)</td>
<td>1 to 5</td>
<td>.57</td>
</tr>
<tr>
<td>2. Face-to-Face Social Interactions</td>
<td>2.50 (0.90)</td>
<td>1 to 5</td>
<td>.06</td>
</tr>
<tr>
<td>3. Technology-Based Social Interactions</td>
<td>2.85 (0.80)</td>
<td>1 to 5</td>
<td>.29</td>
</tr>
<tr>
<td>4. Satisfaction of Competence</td>
<td>3.29 (0.96)</td>
<td>1 to 5</td>
<td>.59</td>
</tr>
<tr>
<td>5. Satisfaction of Autonomy</td>
<td>3.39 (0.83)</td>
<td>1 to 5</td>
<td>.50</td>
</tr>
<tr>
<td>6. Satisfaction of Relatedness</td>
<td>3.75 (0.96)</td>
<td>1 to 5</td>
<td>.56</td>
</tr>
</tbody>
</table>

**Notes.** ICC: Intraclass Correlation
Table 2. Multilevel Model Regression Estimates for Testing Between- and Within-Person Associations of Wellbeing with Satisfaction of the Basic Psychological Needs of Competence, Autonomy, and Relatedness.

<table>
<thead>
<tr>
<th>Dependent Variable: Wellbeing</th>
<th>b</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.64*</td>
<td>0.34 to 0.94</td>
</tr>
<tr>
<td>Overall Competence Satisfaction</td>
<td>0.15*</td>
<td>0.02 to 0.28</td>
</tr>
<tr>
<td>Overall Autonomy Satisfaction</td>
<td>0.12*</td>
<td>0.01 to 0.23</td>
</tr>
<tr>
<td>Overall Relatedness Satisfaction</td>
<td>0.14*</td>
<td>0.03 to 0.24</td>
</tr>
<tr>
<td>Occasion-Specific Competence Satisfaction</td>
<td>0.08*</td>
<td>0.06 to 0.10</td>
</tr>
<tr>
<td>Occasion-Specific Autonomy Satisfaction</td>
<td>0.06*</td>
<td>0.04 to 0.09</td>
</tr>
<tr>
<td>Occasion-Specific Relatedness Satisfaction</td>
<td>0.03*</td>
<td>0.01 to 0.05</td>
</tr>
<tr>
<td>Time</td>
<td>-0.02</td>
<td>-0.04 to 0.00</td>
</tr>
</tbody>
</table>

Notes. 470 observations from $N = 127$, *$p < .05$
Table 3. *Multilevel Model Regression Estimates for Testing Between- and Within-Person Associations of Satisfaction of the Basic Psychological Needs of Competence, Autonomy, and Relatedness with Face-to-Face and Technology-Based Social Interactions.*

<table>
<thead>
<tr>
<th>Dependent Variable: Basic Needs Satisfaction of:</th>
<th>Competence</th>
<th>Autonomy</th>
<th>Relatedness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(b)</td>
<td>95% Confidence Interval</td>
<td>(b)</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.38*</td>
<td>0.06 to 0.70</td>
<td>1.05*</td>
</tr>
<tr>
<td>Overall Face-to-Face Interactions</td>
<td>0.05</td>
<td>-0.12 to 0.23</td>
<td>-0.01</td>
</tr>
<tr>
<td>Overall Technology-Based Interactions</td>
<td>0.09</td>
<td>-0.07 to 0.25</td>
<td>0.01</td>
</tr>
<tr>
<td>Occasion-Specific Face-to-Face Interactions</td>
<td>0.06</td>
<td>-0.00 to 0.12</td>
<td>0.11*</td>
</tr>
<tr>
<td>Occasion-Specific Technology-Based Interactions</td>
<td>-0.07</td>
<td>-0.14 to 0.01</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td>Competence Satisfaction</td>
<td>Autonomy Satisfaction</td>
</tr>
<tr>
<td>--------------------</td>
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<td>-------------------------</td>
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</tr>
<tr>
<td></td>
<td>0.02 *</td>
<td>--</td>
<td>0.12*</td>
</tr>
<tr>
<td></td>
<td>-0.01 to 0.05</td>
<td>-0.00</td>
<td>0.10 to 0.14</td>
</tr>
<tr>
<td></td>
<td>-0.00</td>
<td>0.12*</td>
<td>0.08*</td>
</tr>
<tr>
<td></td>
<td>-0.03 to 0.02</td>
<td>0.05*</td>
<td>0.09*</td>
</tr>
<tr>
<td></td>
<td>-0.02</td>
<td>--</td>
<td>0.09*</td>
</tr>
<tr>
<td></td>
<td>-0.05 to 0.01</td>
<td>0.06*</td>
<td>0.06 to 0.12</td>
</tr>
</tbody>
</table>

Notes. 465 observations from $N = 126$, *$p < .05$
Table 4. *Mediation Models for Satisfaction of Autonomy on Association between Wellbeing and Occasion-Specific Face-to-Face Social Interactions*

<table>
<thead>
<tr>
<th>Dependent Variable: Wellbeing</th>
<th>$b$</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>3.42*</td>
<td>3.30 to 3.53</td>
</tr>
<tr>
<td>Occasion-Specific Face-to-Face Social Interactions</td>
<td>0.23*</td>
<td>0.17 to 0.29</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent Variable: Satisfaction of Autonomy</th>
<th>$b$</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>3.42*</td>
<td>3.30 to 3.54</td>
</tr>
<tr>
<td>Occasion-Specific Face-to-Face Social Interactions</td>
<td>0.28*</td>
<td>0.22 to 0.35</td>
</tr>
</tbody>
</table>

Notes. 470 observations from $N = 127$, *$p < .05$
Table 5. Mediation Models for Satisfaction of Relatedness on Association between Wellbeing and Occasion-Specific Technology-Based Social Interactions

<table>
<thead>
<tr>
<th>Dependent Variable: Wellbeing</th>
<th>$b$</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>3.41*</td>
<td>3.30 to 3.53</td>
</tr>
<tr>
<td>Occasion-Specific Technology-Based</td>
<td>0.12*</td>
<td>0.04 to 0.20</td>
</tr>
</tbody>
</table>

Social Interactions

<table>
<thead>
<tr>
<th>Dependent Variable: Satisfaction of Relatedness</th>
<th>$b$</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>3.76*</td>
<td>3.62 to 3.90</td>
</tr>
<tr>
<td>Occasion-Specific Technology-Based</td>
<td>0.19*</td>
<td>0.09 to 0.29</td>
</tr>
</tbody>
</table>

Social Interactions

<table>
<thead>
<tr>
<th>Dependent Variable: Wellbeing</th>
<th>$b$</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.73*</td>
<td>1.48 to 1.98</td>
</tr>
<tr>
<td>Occasion-Specific Technology-Based</td>
<td>0.03</td>
<td>-0.04 to 0.10</td>
</tr>
</tbody>
</table>

Social Interactions

<table>
<thead>
<tr>
<th>Satisfaction of Relatedness</th>
<th>$b$</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.11*</td>
<td>0.10 to 0.13</td>
</tr>
</tbody>
</table>

Notes. 470 observations from $N = 127$, $*p < .05$
**Figure Captions**

Figure 1. The mediation of satisfaction of autonomy on the relation between occasion-specific face-to-face social interactions and wellbeing. After taking into account the covariance of random effects = 0.03, the indirect effect was calculated as 0.79 and total effect was 1.59.

Figure 2. The mediation of satisfaction of relatedness on the relation between occasion-specific technology based social interactions and wellbeing. After taking into account the covariance of random effects = 0.03, the indirect effect was calculated as 0.53 and total effect was 0.69.