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

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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.

59 **Abstract**

60 Social lockdowns associated with COVID-19 have led individuals to increasingly rely on

61 video conferencing and other technology-based interactions to fulfil social needs. The extent

62 to which these interactions, as well as traditional face-to-face interactions, satisfied

63 psychological needs and supported wellbeing during different periods of the COVID-19

64 pandemic is yet to be elucidated. OBJECTIVE: In this study, university students' social

65 interactions (both technology-based and face-to-face), psychological needs, and wellbeing

66 were assessed at six time points across four months of government-enforced restrictions in

67 Australia. DESIGN: Repeated survey assessment. MAIN OUTCOME MEASURES: Basic

68 psychological need satisfaction; general wellbeing. RESULTS: Results demonstrated that, at

69 the within-subjects level, relatedness satisfaction (feeling understood by, cared for, and

70 connected to others) significantly mediated the relationship between technology-based

71 interaction and wellbeing. Autonomy satisfaction (self-initiation and feeling ownership over

72 decisions and behaviors) mediated the relationship between face-to-face interactions and

73 wellbeing at the within-person level. CONCLUSION: Discussion is centred on the

74 importance of technology-based interactions for needs satisfaction and wellbeing during

75 periods of social isolation.

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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

109 pandemic, cross-sectional surveys have revealed that technology-based social interactions

110 may have mixed effects on wellbeing (e.g., Cauberghe, Van Wesenbeeck, De Jans, Hudders,

111 & Ponnet, 2020; Ellis, Dumas, & Forbes, 2020), but more research is needed—involving

112 different methodologies and populations—to improve our understanding of this issue. An

113 additional topic that requires attention is the role of face-to-face social interactions at

114 satisfying psychological needs and promoting wellbeing during various stages of the COVID-

115 19 pandemic. In Australia, even during the strictest periods of social lockdown, many

116 individuals were able to interact with members of their immediate family/household. Also,

117 Australia experienced various phases of social lockdown—some characterised by more

118 restrictions than others—meaning that, at times, face-to-face interactions were permitted

119 outside of household interactions. Little is known about the relative associations between

120 interactions, both face-to-face and technology-mediated, and wellbeing during various stages

121 of the COVID-19, and in this study, we address this gap.

122   In order to explore potential relationships between different types of social

123 interactions and wellbeing, it is useful to examine how these types of interactions are likely to

124 influence psychological needs. In self-determination theory, three basic psychological

125 needs—for autonomy (self-initiation and feeling ownership over decisions and behaviors),

126 competence (feeling proficient to successfully undertake pursuits), and relatedness (feeling

127 understood by, cared for, and connected to others)—are proposed to bear a significant

128 expression on human functioning (Ryan & Deci, 2000; Vansteenkiste, Ryan, & Soenens,

129 2020). Satisfaction of these basic needs is considered to promote a host of adaptive outcomes,

130 including psychological wellbeing (Vansteenkiste & Ryan, 2013). Positive social

131 interactions, which can be experienced in various forms, are likely to satisfy the need for

132 relatedness (e.g., Reis, Sheldon, Gable, Roscoe, & Ryan, 2000). However, the unusual social

133 lockdown periods associated with COVID-19 has raised an interesting possibility in relation

134   to autonomy. Specifically, against a backdrop of a controlled social lockdown period, any

135   opportunities to interact in a face-to-face format may satisfy the autonomy need to a greater

136   extent than would otherwise be expected. When individuals experience psychological need

137   deprivation or frustration, their desires to acquire missing experiences are heightened

138   (Sheldon & Gunz, 2009), and the weakening of government controls around face-to-face

139   social interaction is likely to be met with an increased sense of autonomy among community

140   members.

141   **The Present Study**

142   With the goal to capture information about individuals' social interactions,

143   psychological needs, and wellbeing at different stages of social lockdown, we employed a

144   design involving six surveys across a four-month period. The four-month period was

145   characterised by a gradual easing of social restrictions by the local state government. Our

146   repeated assessment design permitted an exploration of both within- and between-person

147   effects; that is, we were able to ascertain whether needs satisfaction and/or wellbeing was

148   higher on occasions when individuals experienced more social interactions, and also whether

149   need satisfaction and/or wellbeing was experienced more by people who typically engaged in

150   more social interaction. With respect to psychological needs, we focused on those discussed

151   within self-determination theory (Ryan & Deci, 2008)—autonomy, competence, and

152   relatedness. University students, many of whom experienced significant social, health,

153   academic, and financial change due to COVID-19 (Lyons, Wilcox, Leung, & Dearsley, 2020;

154   Zhao, An, Tan, & Li, 2020), comprised the sample.

155   Consistent with self-determination theory, it was hypothesised that, at both within-

156   and between-person levels, satisfaction of needs for autonomy, competence, and relatedness

157   would be positively associated with wellbeing. Competence satisfaction was not expected to

158   be associated with face-to-face or technology-mediated interactions at either within- or

159 between person levels. However, it was hypothesised that, at the within-person level,

160 satisfaction of the need for *relatedness* would significantly mediate a positive influence of

161 technology-based social interactions on wellbeing, and that *autonomy* satisfaction would

162 significantly mediate a positive influence of face-to-face interactions on wellbeing.

Method

164 **Participants**

165   A total of 127 students (24% male; 74% female; 2% non-binary) based in

166 Queensland, Australia, participated in the study. Participants were aged 18-53 ($M = 24.73$,

167 $Mdn = 20$, $SD = 8.96$), and the majority of the sample (83.47%) were of Australian

168 nationality. Forty-four percent of participants ($n = 57$) were full-time students, 37% ($n = 47$)

169 were working part-time, 6% ($n = 8$) worked full-time, and 12% ($n = 15$) were unemployed.

170 Students were recruited using a university participation scheme and received course credit for

171 their involvement in the study. The research outlined in this paper was part of data collection

172 for a broader study; other findings from the data can be found in [reference removed to

173 facilitate blind review]. The [reference removed to facilitate blind review] Human Research

174 Ethics Committee granted ethics approval (Approval number: H8074).

175 **Design and Procedure**

176   Participants were asked to complete a set of six surveys, each of which was separated

177 by a period of two weeks. In April, 2020—the time at which the first survey was

178 completed—participants had begun experiencing the strictest lockdown restrictions put in

179 place by the local government. Specifically, restrictions were placed on non-family members

180 entering households and strict boundaries were placed on travel (except for the essential

181 reasons of getting food, medical reasons, work, and exercise). The first easing of restrictions

182 took place on 26 April 2020, with bars, clubs, restaurants, and cafes permitted to reopen,

183 albeit under strict conditions, on 16 May 2020. In July 2020, the local government

184   implemented an easing of restrictions with borders reopening to travelers from other states

185   and territories (excluding one—Victoria) on 10 July 2020.

186   The questions on the first survey asked participants about their experiences prior to

187   any lifestyle changes due to COVID-19. The final (sixth) survey was completed in mid-July,

188   2020. The timing of the sixth survey corresponded with both the re-opening of state borders

189   and the resumption of numerous social events and activities (e.g., children's sport leagues).

190   Participants accessed the online questionnaires (hosted using Qualtrics) using direct web

191   links. Individuals read the participant information, gave their informed consent (indicated by

192   clicking 'yes' or 'no' on the online consent webpage), and created a unique, anonymous code

193   prior to completing the first questionnaire. This code was entered at the start of the

194   subsequent questionnaires, which were completed as a series of webpages. Following

195   completion of the final questionnaire, participants were thanked for their participation and

196   debriefed.

197   Aside from questions on demographic information (age, gender, nationality,

198   occupation and country of residence), which were included in the first survey only, all

199   surveys included the same questionnaire items. The Short Warwick Edinburgh Mental Well-

200   being Scale (Stewart-Brown et al., 2011; Stewart-Brown et al., 2009; Tennant et al., 2007)

201   was used to measure participant well-being. This scale score consists of the mean response of

202   seven positively-worded items that address well-being, which is measured as a

203   unidimensional construct. Participants were invited to consider their experiences over the

204   prior week, and responses were recorded on a 5-point Likert-type scale anchored by "*None of

205   the time*" and "*All of the time*". Cronbach's alpha for the scale varied between .85 and .92 in

206   the present study.

207   Satisfaction of needs for autonomy and relatedness were measured using the Basic

208   Psychological Needs Satisfaction and Frustration Scale (Chen et al., 2015). This scale

209   measures both need satisfaction and frustration in one's life. The scale consists of 24 items

210   and six subscales; however, given our interest in need satisfaction rather than need

211   frustration, only the competence, autonomy, and relatedness satisfaction (4 items each) were

212   relevant for the present study. Scores were calculated as the mean response to items in the

213   scale are made on a 5-point scale anchored by "*Not true at all*" and "*Completely true*".

214   Participants were encouraged to consider their experiences over the prior week when

215   completing the scale. Cronbach's alpha ranged from .88 to .95 for competence, .77 to .88 for

216   autonomy, and .88 to .95 for relatedness in the present study.

217   Social interactions were measured with a scale designed for the purposes of this study.

218   For face-to-face interactions, instructions read: "Please indicate the degree to which you have

219   had in-person, face-to-face social interaction with the following types of people over the past

220   week as compared to your usual week." Items were "Friends", "Family", 'Co-

221   workers/colleagues", "Other students", and "People not listed above". Response options were

222   "*Much less*", "*Somewhat less*", "*About the same*", "*Somewhat more*", and "*Much more*". The

223   items and response options were the same for the measure of technology-mediated social

224   interaction, although the stem of that scale read "Please indicate the degree to which you have

225   had technology-mediated social interaction (e.g., social media, video conferencing, etc.) with

226   the following types of people over the past week as compared to your usual week."

227   Cronbach's alpha ranged from .46 to .63 for face-to-face social interactions and from .59 to

228   .76 for technology-mediated social interactions in the present study. Given that these scales

229   are meant as a comprehensive aggregate of social interactions across a broad range of

230   sources, the relatively modest inter-item alpha values are expectedly lower than scales

231   targeting a single, narrow construct (see also Ponterotto & Ruckdeschel, 2007).

232   **Data Management & Analyses**

233   Intraclass correlations (ICCs) were used to evaluate degree of change in the

234   satisfaction of wellbeing, social interactions, and the basic psychological needs. The

235   hypotheses were tested using multilevel modelling, to account for nesting of data within-

236   person over the three time points, in the *lme4* (Bates et al., 2015; Bauer, Preacher, & Gil,

237   2006; Krull & MacKinnon, 2001) package of *R* version 3.6.2 (R Core Team, 2019).

238   Maximum likelihood estimation was used to account for missingness. First, wellbeing was

239   regressed onto satisfaction of the basic psychological needs of competence, autonomy, and

240   relatedness. The psychological needs variables were modelled as separate predictors to

241   simultaneously test for between- and within-person effects (Stone & Shiffman, 1994).

242   Between-person effects were tested with variables calculated as each individual's mean score

243   across all occasions (referred to throughout as *Overall* scores). Within-person effects were

244   tested with variables calculated as deviations from each individual's overall score per

245   occasion (referred to throughout as *Occasion-Specific* scores). Next, each basic needs

246   satisfaction variable was regressed onto Overall and Occasion-Specific face-to-face and

247   technology-based social interactions, as well as the other two psychological basic need

248   satisfaction variables (e.g., for the model with the dependent variable of satisfaction of

249   relatedness, the satisfaction of competence and autonomy were included as covariates). This

250   approach allows for the interpretation of the models to be whether social interactions are

251   linked to the independent variability of the basic psychological need satisfaction that is

252   unique from the other basic need satisfaction variables. To account for any potential time

253   effects, time (number of the survey assessment) was included as a covariate in all models.

254   Prior to model estimation, it was confirmed that there were no assumptions violated of non-

255   linearity, multicollinearity, or homoscedasticity. Mediation of basic needs satisfaction

256   between social interactions and wellbeing was investigated for all significant associations

257   found between social interactions and basic needs satisfaction. Mediation was tested using

258   the method of Krull & MacKinnon (2001) for evaluating direct, indirect, and total effects in

259   multilevel models with random effects. Indirect effects are calculated as the summation of the

260   random effects covariance and the estimated path between social interactions and satisfaction

261   of basic needs. Total direct effects are calculated as the indirect effect summed with the

262   estimate of the path between social interactions and wellbeing.

263   **Results**

264   **Sample Characteristics**

265   In total, there were there were 483 assessments from 127 participants. Most

266   participants completed 6 (n = 31, 24%) or 5 (n = 26, 21%) surveys, with 18 participants

267   (14%) completing 4, 11 (9%) completing 3, 21 completing 2 (17%), and 20 (16%)

268   completing 1 survey. Within the data, there were 13 cases of missing variables (3%). Study

269   variable descriptive statistics are shown in Table 1. The ICCs revealed that there was very

270   low stability in face-to-face social interactions—only 6% of variability was accounted for by

271   between-person differences. In contrast, 29% of variability in technology-based interactions

272   was at the between-person level, and more than half of variability was at the between-person

273   level for wellbeing and the satisfaction of the basic needs.

274   **Satisfaction of Basic Psychological Needs and Wellbeing**

275   The model testing the between- and within-person associations of satisfaction of

276   competence, autonomy, and relatedness with wellbeing is shown in Table 2. Wellbeing was

277   positively associated with all variables at both the between- and within-person levels,

278   demonstrating that people who overall had more satisfied psychological needs tended to have

279   better wellbeing. Also, on occasions when satisfaction of basic psychological needs was

280   particularly high, so was wellbeing.

281   **Satisfaction of Basic Psychological Needs and Social Interactions**

282   The results of the models testing the between- and within-person associations of face-

283   to-face and technology-based social interactions with satisfaction of competence, autonomy,

284   and relatedness are shown in Table 3. Competence satisfaction was not associated with face-

285   to-face or technology-based interactions at either the between- or within-person level.

286   Autonomy satisfaction was significantly and positively associated with occasion-specific

287   face-to-face interactions, such that on occasions when people interacted with more people

288   face-to-face than was usual for them, they experienced more satisfaction of their need for

289   autonomy. Relatedness satisfaction was significantly and positively associated with occasion-

290   specific technology-based interactions, such that on occasions when people interacted with

291   more people using technology than was usual for them, they experienced more satisfaction of

292   their need for relatedness.

293   Mediation analyses were conducted on those associations found to be significant

294   between basic needs satisfaction and social interactions: (1) occasion-specific autonomy

295   satisfaction as a mediator for the impact of face-to-face social interactions on wellbeing, and

296   (2) occasion-specific relatedness satisfaction as a mediator for the impact of technology-

297   based social interactions on wellbeing. The mediation analyses revealed that autonomy

298   satisfaction partially mediated the relation between occasion-specific face-to-face interactions

299   and wellbeing (Table 4, Figure 1). After accounting for covariance of random effects, the

300   indirect effect was calculated as 0.79 and the total effect as 1.59. Relatedness satisfaction

301   fully mediated the relation between occasion-specific technology-based interactions and

302   wellbeing (Table 5; Figure 2). After accounting for covariance of random effects, the indirect

303   effect was calculated as 0.53 and the total effect as 0.68.

Discussion

305   The aim of this study was to explore associations between social interactions—both

306   technology-based and face-to-face—and wellbeing. Satisfaction of the three basic

307 psychological needs were explored as potential mediators of relationships between

308 interactions and wellbeing. Results indicated that wellbeing was positively associated with

309 satisfaction of psychological needs at both within- and between-person levels. In other words,

310 individuals who typically experienced more satisfaction of psychological needs reported

311 more positive wellbeing, and on occasions when individuals reported greater need

312 satisfaction, they also reported more positive wellbeing. Consistent with hypotheses,

313 satisfaction of the need for autonomy mediated (albeit partially) a positive relationship

314 between face-to-face interaction and wellbeing at the within-person level, and satisfaction of

315 the need for relatedness fully mediated a positive relationship between technology-based

316 interaction and wellbeing at the within-person level.

317   Consistent with research on technology-based social interaction and wellbeing (see

318 e.g., Best et al., 2014; Noone et al., 2019), we found no significant between-person

319 associations between technology-mediated social interaction and need satisfaction. That is,

320 people who were more or less likely to socially interact with people via technology were not

321 more or less likely to have their basic psychological needs satisfied. In fact, our findings also

322 indicated that face-to-face interaction was not associated with need satisfaction at the

323 between-person level. Reasons for these non-significant relationships are speculative, but it is

324 possible that a circular relationship exists such that those low in need satisfaction seek more

325 social interaction (negative relationship), and that social interaction is need satisfying

326 (positive relationship). An examination of within-person effects provides a degree of support

327 to this possibility—individuals derived satisfaction of their need for autonomy on occasions

328 they had face-to-face interactions, and satisfied their need for relatedness on occasions they

329 had technology-mediated interactions.

330   The observed relationships between technology-mediated interaction, relatedness

331 satisfaction, and wellbeing were encouraging in light of individuals' increased reliance on

332   technology for social interactions during COVID-19. Although we did not test causality, our

333   data support the potential of technology-based interactions, such as video calls and social

334   media use, for improving wellbeing during periods of physical isolation. On the evidence of

335   these findings, such potential was realised during COVID-19, but it is also reassuring that

336   these technologies may be beneficial should other pandemics arise. Furthermore, for

337   individuals living in rural, regional, and remote areas, technologies represent an accessible,

338   easy-to-use, and low cost opportunity to develop and maintain relationships.

339   The results bring to light an interesting and important issue relating to need

340   satisfaction. Against a backdrop of social restrictions and controlling government mandates,

341   face-to-face interactions satisfied participants' need for autonomy. Our data were collected

342   across multiple months in 2020, and government-imposed social restrictions varied

343   considerably throughout this time. Although speculative, it is possible that individuals' needs

344   for autonomy were significantly compromised during the period of strictest social lockdown,

345   contributing to a greater sense of autonomy when the strictest lockdown period ended (and

346   more face-to-face interactions were permitted). There is evidence that deficits in basic

347   psychological need satisfaction arouse desires to acquire the missing experiences (Sheldon &

348   Gunz, 2009), so controlling government mandates around social interaction may have

349   sharpened individuals' desires for face-to-face interaction (i.e., as an exposition of

350   autonomy). It would be interesting to observe whether autonomy satisfaction occurs from

351   face-to-face interactions when social lockdowns are not salient in people's minds—our

352   expectation is that such relationships would not nearly be as strong. It is plausible that our

353   observed associations between face-to-face interactions and autonomy satisfaction are likely

354   to have arisen, at least in part, due to the backdrop of the COVID-19 pandemic.

355   The current study had a number of strengths, including a repeated assessment design

356   that captured participants' responses over a period that aligned with changing COVID-19

357   restrictions. The study was not without limitations, however, and it is important to consider

358   the findings in light of those limitations. First, the sample consisted of university students

359   from one area of Australia, and, as such, further research is needed to establish the

360   generalisability of the results. Second, although the data collection method (i.e., online

361   surveys) allowed for rapid and convenient responding, the entire periods between

362   assessments were not evaluated and participants were unable to qualify their responses.

363   Moreover, we acknowledge that our study design (i.e., repeated cross-sectional surveys)

364   provides limited insight into temporal issues; experimental or intervention designs are

365   therefore recommended to confirm the results in this study. Finally, our measures for social

366   interaction were focused on volume or frequency, and our hypotheses were based on the

367   assumption that most interactions were positive. It is possible that some interactions were

368   negative, however, and such interactions may compromise feelings of autonomy, relatedness,

369   and well-being (Deci & Ryan, 2000; Vansteenkiste et al., 2020). Finally, although our

370   findings provided some interesting insights into social interactions, need satisfaction, and

371   wellbeing during the COVID-19 lockdown period, we were surprised at the relatively weak

372   associations between face-to-face interactions and relatedness satisfaction, particularly at the

373   within-person level. Future work is required to explore possible reasons for those non-

374   significant effects.

375   Notwithstanding these limitations, the current study provides important insights into

376   the role of social interactions—both face-to-face and technology-mediated—on wellbeing

377   during various stages of the COVID-19 pandemic. Functional benefits of social interactions

378   were identified; interactions were predictive of satisfaction of basic needs for autonomy, in

379   the case of face-to-face interactions, and relatedness, in the case of technology-mediated

380   interactions. Need satisfaction (for autonomy, competence, and relatedness) was also found to

381   predict wellbeing. Social connections are a fundamental component of being human, and

382 government-imposed physical distancing measures have challenged individuals' abilities to

383 interact with others. It is comforting that technologies enabled individuals to experience

384 relatedness during the pandemic, and against a canvas of strict lockdowns, face-to-face

385 interactions provided a sense of volition and agency.

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474

475   Table 1. *Descriptive Statistics of Wellbeing, Social Interactions, and Basic Needs Satisfaction*

476   *of Competence, Autonomy, and Relatedness*

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

477   *Notes.* ICC: Intraclass Correlation

478   Table 2. *Multilevel Model Regression Estimates for Testing Between- and Within-Person*

479   *Associations of Wellbeing with Satisfaction of the Basic Psychological Needs of Competence,*

480   *Autonomy, and Relatedness.*

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

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

482

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.*

Dependent Variable: Basic Needs Satisfaction of:	Competence		Autonomy		Relatedness	
	b	95% Confidence Interval	b	95% Confidence Interval	b	95% Confidence Interval
Intercept	0.38*	0.06 to 0.70	1.05*	0.80 to 1.31	1.62	1.28 to 1.96
Overall Face-to-Face Interactions	0.05	-0.12 to 0.23	-0.01	-0.16 to 0.13	0.12	-0.09 to 0.33
Overall Technology-Based Interactions	0.09	-0.07 to 0.25	0.01	-0.12 to 0.14	0.03	-0.16 to 0.23
Occasion-Specific Face-to-Face Interactions	0.06	-0.00 to 0.12	0.11*	0.05 to 0.17	-0.01	-0.08 to 0.06
Occasion-Specific Technology-Based Interactions	-0.07	-0.14 to 0.01	0.04	-0.04 to 0.11	0.10*	0.01 to 0.19

Time	0.02	-0.01 to 0.05	-0.00	-0.03 to 0.02	-0.02	-0.05 to 0.01
Competence Satisfaction	--	--	0.12*	0.10 to 0.14	0.08*	0.05 to 0.10
Autonomy Satisfaction	0.15*	0.12 to 0.17	--	--	0.09*	0.06 to 0.12
Relatedness Satisfaction	0.06*	0.04 to 0.07	0.05*	0.04 to 0.07	--	--

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*

Dependent Variable: Wellbeing	b	95% Confidence Interval
Intercept	3.42*	3.30 to 3.53
Occasion-Specific Face-to-Face Social Interactions	0.23*	0.17 to 0.29
Dependent Variable: Satisfaction of Autonomy	b	95% Confidence Interval
Intercept	3.42*	3.30 to 3.54
Occasion-Specific Face-to-Face Social Interactions	0.28*	0.22 to 0.35
Dependent Variable: Wellbeing	b	95% Confidence Interval
Intercept	1.52*	1.27 to 1.76
Occasion-Specific Face-to-Face Social Interactions	0.07*	0.02 to 0.13
Satisfaction of Autonomy	0.55*	0.49 to 0.62

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*

Dependent Variable: Wellbeing	*b*	95% Confidence Interval
Intercept	3.41*	3.30 to 3.53
Occasion-Specific Technology-Based Social Interactions	0.12*	0.04 to 0.20
Dependent Variable: Satisfaction of Relatedness	*b*	95% Confidence Interval
Intercept	3.76*	3.62 to 3.90
Occasion-Specific Technology-Based Social Interactions	0.19*	0.09 to 0.29
Dependent Variable: Wellbeing	*b*	95% Confidence Interval
Intercept	1.73*	1.48 to 1.98
Occasion-Specific Technology-Based Social Interactions	0.03	-0.04 to 0.10
Satisfaction of Relatedness	0.11*	0.10 to 0.13

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.
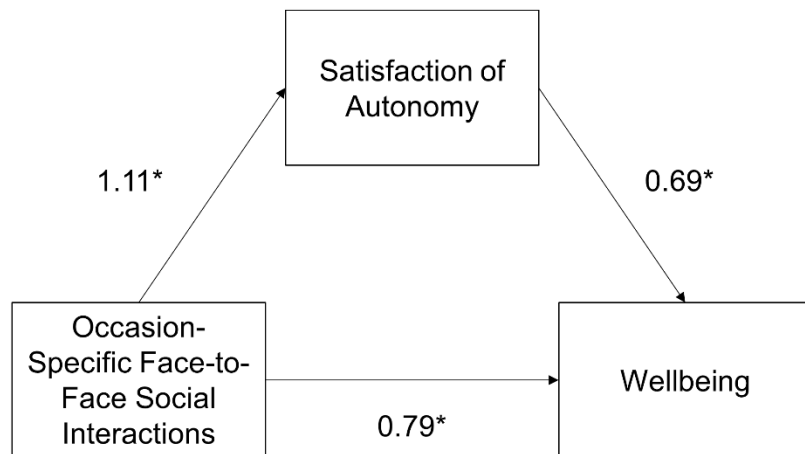

Figure 2. The mediation of satisfaction of relatedness on the relation between occasion-specific technology based social interactions and wellbeing. After taking into account the covariance of random effects = 0.03, the indirect effect was calculated as 0.53 and total effect was 0.69.