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RESEARCH PAPER

The power of strength-oriented feedback enlightened by self-determination theory: a positive technology-based intervention

Marc-Antoine Gradito Dubord[1] · Jacques Forest[2] · Lina Marija Balčiūnaitė[3] · Evamaria Rauen[3] · Tomas Jungert[3]

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Abstract

Strength interventions at work have been shown to influence workers' optimal functioning and well-being. To increase the accessibility of these interventions in the workplace, relying on digital platforms would be a realistic idea. Akin to the Character Strengths 360-degree feedback activity, a smartphone (and computer) application allows users to send or receive anonymous strength-oriented descriptive feedback to/from colleagues, hence disseminating the identification and use of each other's signature strengths associated with their enacted behaviors. Drawing on Self-Determination Theory, an intervention was developed to investigate if the use of the online platform may impact psychological well-being, by increasing psychological need satisfaction and autonomous motivation and decreasing need frustration and controlled motivation. A sample of full-time workers (n = 112) experienced the application, while participants who did not use the platform were assigned to the *a posteriori* control condition (n = 54). Data were collected before and after the 4-weeks intervention. Results showed (1) that participants from the experimental group reported significantly higher levels of strength use, need satisfaction, autonomous motivation, and psychological well-being compared to the *a posteriori* control group, and (2) that increases in the levels of need satisfaction reported by participants from the experimental group were related to increases in autonomous motivation, which in turn resulted in higher levels of well-being. Theoretical and practical implications are discussed.

Keywords Strength-oriented feedback · Strength interventions · Positive technology · Self-determination theory · Psychological well-being

✉ Marc-Antoine Gradito Dubord
gradito_dubord.marc-antoine@courrier.uqam.ca

[1] Department of Psychology, UQAM, Montreal, Canada

[2] ESG UQAM, Montreal, Canada

[3] Lund University, Lund, Sweden

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The emergence of positive psychology – the enhancement of well-being and happiness of the individual (or group) to simultaneously increase positive experiences and decrease negative experiences (Seligman & Csikszentmihalyi, 2000) – has significantly influenced the organizational behavior sciences over the past 20 years, especially by shaping innovative interventions that promote employees' strengths. *Strength* can be scientifically defined as "a natural ability to behave, think or feel in a way that allows for optimal functioning and performance in the pursuit of results" (Linley et al., 2006, p. 88). Strength interventions usually consist in identifying, using, and developing one's five predominant strengths, also known as signature strengths, using the Values in Action (VIA) questionnaire (Ruch et al., 2020) or 360-degree feedback (Niemiec, 2014). Research showed that strength interventions performed in a wide variety of contexts, especially those focusing on signature strengths, had positive effects on a broad range of positive outcomes, such as work performance (Dubreuil et al., 2016; Harzer & Ruch, 2016), meaning at work (Harzer & Ruch, 2012; Littman-Ovadia & Steger, 2010), one's calling (Harzer & Ruch, 2012, 2016), and prosocial behaviors (Kong & Ho, 2016). Above all, strength interventions positive effects on well-being are the most documented (Ghielen et al., 2018; Miglianico et al., 2019; Schutte & Malouff, 2018). Meta-analytic evidence suggests that, across nine studies, strength interventions had a positive impact on both subjective and psychological well-being (Shutte & Malouf, 2018). In sum, by using their strengths, employees experience positive emotions, personal growth, and find more meaning at work (Littman-Ovadia et al., 2017; Littman-Ovadia & Steger, 2010).

However, a criticism frequently addressed to strengths' interventions is that they usually require several "consumable" resources to operate (van Woerkom et al., 2021). For instance, they often involve psychometric tools, training, and private coaching sessions provided by positive psychology specialists (Meyers et al., 2015; van Woerkom et al., 2021), representing a substantial time and financial investment and, therefore, raising doubts in terms of these interventions' accessibility and sustainability (Boiler & Abello, 2014). Thus, research in positive psychology should design interventions that are "non-consumable", that is, implementing inexpensive practices that can be repeatedly used to benefit more people without being used up (Munoz, 2010; van Woerkom et al. 2021). In other words, the applied research of positive psychology in organizations must conceive innovative, inclusive, and evidence-based practices which extend the influence of strengths interventions to all employees, without restriction, instead of focusing on a small number of participants (van Woerkom et al. 2021). In this regard, the integration of positive psychology and technology, also known as positive technology, could be a promising avenue of research (Boiler & Abello, 2014; Riva et al., 2019; Sander, 2011).

1 Positive Technology: An Emergent Field of Research

The term Positive Technology (PT), proposed by Botella and colleagues (2012), refers to the scientific and applied approach focused on the study of the use of technology to improve the quality of personal experiences. This perspective seeks to promote the use of technology to foster personal growth and the development of strengths (Riva et al., 2012). At the theoretical level, PT aims to develop conceptual frameworks and models for understanding how technologies can be effectively used to help individuals achieve greater well-being. At

the methodological and applied level, PT is concerned with the design, development, and validation of digital experiences that promote positive change through pleasure, flow, meaning, competence, and positive relationships (Riva et al., 2019).

The literature on PT focuses primarily on experimental and quasi-experimental research exploring the potential benefits of mobile apps that promote happiness (e.g., Parks et al., 2013; Riva et al., 2019), gratitude (e.g., Runyan & Steinke, 2014), self-awareness (e.g., Morris et al., 2010; Runyan et al., 2013), and optimistic thinking (e.g., Plaza et al., 2013). For instance, a naturalistic pre-post research design has tested the Live Happy app – which allows users to practice eight different happiness building activities (e.g., savoring the moment, gratitude journal, remembering happy times) – and demonstrated that its utilization was associated with a greater increase in happiness (Parks et al., 2013). In a randomized control study, another paper has shown that users who received four gratitude reminders within a mobile app, throughout the day for 14 days, had more positive and stable moods compared to control group participants (Runyan et al., 2013). PT interventions might also be embedded with online-based social platforms (e.g., peer groups; McGonigal, 2011) to bring people together and disseminate ideas and interventions.

2 The Integration of Character Strengths Within a Digital Environment

Regarding the interaction of character strengths and technology, Harzer and Ruch (2016) have demonstrated the benefits (e.g., calling and life satisfaction) associated with a web-based training intervention on strengths. More recently, a mobile app (*Listen Léon*) was conceived to promote anonymous character strength-oriented feedback in organizations. The digital platform is akin to the Character Strengths 360° activity (see Niemiec, 2014), which is a prevalent practice in clinical situations involving the patient systematically collecting character strengths feedback from a variety of people in his or her life (Niemiec, 2014; 2019). The overall functioning of the app is similar, gathering and giving descriptive feedback on strengths while offering an anonymous platform to do so (more information about the functioning of the application can be found in the method section).

Descriptive feedback, also known as promotion-oriented feedback aims at confirming and reinforcing desirable behaviors (Carpentier & Mageau, 2013, 2016). Likewise, strengths-oriented feedback occurs when the object of the promotion-oriented feedback focuses precisely on the character strengths observed in a colleague/employee, for example, as described by the VIA classification (Niemiec, 2014, 2019; Peterson & Seligman, 2004). To our knowledge, the potential consequences of anonymous strength-oriented feedback disseminated by a digital platform have never yet been measured, tested, or directly observed. Considering employees' mental health being the most documented consequence of strength interventions (e.g., Ghielen et al., 2018; Schutte & Malouff, 2019; van Woerkom et al., 2021), could a digital platform that promotes anonymous strength-based feedback have a significant effect on employee's well-being?

Self-Determination Theory (SDT; Deci & Ryan, 2000) seems to be a suitable conceptual framework to answer this question since social relationships and feedback are both substantial antecedents of employees' need satisfaction, autonomous motivation and, indirectly, levels of psychological well-being (Carpentier & Mageau, 2016; Forest et al., 2022; Ling & Soon, 2019). Moreover, strength interventions would require more rigorous research into

the mechanisms underlying the effects of fostering character strengths identification (and use) in various life contexts (Lavy, 2020; van Woerkom et al., 2021). The positive activation model (Lyubomirsky & Layous, 2013) claims that positive interventions (such as sending/receiving strength-oriented feedback) may trigger positive emotions, need satisfaction, and motivation, which in turn, lead to a greater sense of overall well-being. Several studies have suggested that strength interventions' benefits are explained by an increase of positive emotions (e.g., Lavy & Littman-Ovadia, 2011; Meyers & Van Woerkom, 2017; Meyers et al., 2015). However, their potential implications on need satisfaction and human motivation remain insufficiently studied (Bakker & van Woerkom, 2018), and SDT could help scholars to fulfill this theoretical gap (Kong & Ho, 2016; Miglianico et al., 2019).

Drawing on SDT, this paper presents the results of an intervention exploring the potential benefits of using technology to promote strength-oriented feedback in organizations. We designed an intervention program where full-time employees were invited to experience the Listen Léon app for 4 weeks. This study establishes that research can rely on digital platforms (such as mobile applications) to promote anonymous 360-degree feedback on strengths. More precisely, it demonstrates that an affordable, scalable, and innovative intervention on strength feedback can significantly increase various dimensions of well-being. Extending the influence of strengths interventions to all employees, without restriction, instead of focussing on a small number of participants, could be the biggest challenge strength interventions are currently facing, and our paper directly addressed this issue (van Woerkom et al., 2021). Finally, our findings increase the theoretical understanding of strength interventions' benefits by relying on self-determination theory (Bakker et van Woerkom, 2018; Miglianico et al.2019).

3 Using Self Determination Theory to Explain Why a Strengths' Intervention Might Increase Employees' Levels of Well-Being

Self-determination theory (SDT) is a macro-theory of human motivation proposed by Deci and Ryan (1985) and claims that human beings have at least three psychological needs (Deci & Ryan, 2000). Needs are innate and universal psychological nutrients that are essential for ongoing psychological growth, integrity, and well-being (Deci & Ryan, 2000). These needs are autonomy (the need to act with volition and to feel self-ownership), competence (the need to do things efficiently and successfully), and relatedness (the need to feel closeness and belonging with others; Ryan & Deci, 2017). Research on SDT in the domain on work suggests that human resources' interventions should aim simultaneously at increasing employees' needs satisfaction and decreasing employees' needs frustration (Marescaux et al., 2013). In this paper, we argue that receiving or giving anonymous feedback on strengths within an app would increase satisfaction and decrease frustration of users' need for competence (i.e., through strength identification and use; Bakker & van Woerkom, 2018), and autonomy (i.e., through anonymous communicational mechanisms which ensure freedom to choose when and how often to use the app; Kagan et al., 2006). Furthermore, research has shown that prosocial behavior (e.g., sending anonymous descriptive feedback) not only influences need for competence and autonomy, but it also significantly increases need for relatedness even without contact with the beneficiary (Martela & Ryan, 2016). Then, we

also suggest that giving or receiving anonymous feedback on strengths would increase satisfaction and decrease frustration of employees' need for relatedness.

Hypothesis 1 Participating in a digital and anonymous strength-oriented feedback intervention (i.e., using *Listen Léon* for 4 weeks) leads to increases in need satisfaction.

Hypothesis 2 Participating in a digital and anonymous strength-oriented feedback intervention (i.e., using *Listen Léon* for 4 weeks) leads to decreases in need frustration.

Basic psychological needs are also key elements to understand people's motivation quality. Need satisfaction leads to autonomous motivation, which is when people are engaged in an activity because it is enjoyable or interesting and/or because it is believed to be important (Ryan & Deci, 2017). Autonomously regulated activities might be intrinsically motivated, that is when people are motivated by the inherent pleasure and satisfaction of an activity. An external regulation activity might also arise from autonomous motivation, also known as identified regulation. Identified regulation occurs when one engages in an activity because she or he identifies with its value or meaning, notwithstanding if the activity is pleasant or not (Gagné et al., 2015). Therefore, we suggest that receiving and/or giving anonymous feedback on strengths within an app would help participants to perceive more meaning and feel more pleasure at work (autonomous motivation; Gagné & Deci, 2005).

Hypothesis 3 Participating in a digital and anonymous strength-oriented feedback intervention (i.e., using *Listen Léon* for 4 weeks) leads to increases in autonomous motivation.

On the other hand, need frustration might influence people to invest in externally regulated activities that are less or not at all self-determined, also known as controlled motivation. The latter most obvious expression is extrinsic motivation by external regulation which is when a behavior is mainly controlled by material or external social contingencies (i.e., material, or social rewards and punishments; Gagné & Deci, 2005). In the same vein, when one does an activity mostly not to feel guilty, anxious, or to prove his or her worth, that refers to introjected regulation (Gagné & Deci, 2005). Regarding the domain of work, when needs are satisfied and autonomous motivation is generated, it usually leads to greater psychological well-being and performance than need frustration and controlled motivation (Baard et al., 2004; Gagné & Deci, 2005; Olafsen et al., 2017; Ryan & Deci, 2017). That is why we proposed that receiving and/or giving anonymous feedback on strengths within an app would decrease participants' levels of controlled motivation.

Hypothesis 4 Participating in a digital and anonymous strength-oriented feedback intervention (i.e., using *Listen Léon* for 4 weeks) leads to decreases in controlled motivation.

As shown by past research (Olafsen et al., 2017; Trépanier et al., 2015), participants' levels of psychological well-being should benefit from having an autonomous motivation and less controlled motivation. More precisely, SDT would predict that an increase in autonomous motivation would have an indirect effect on the relation between the increase in need satisfaction and change in psychological well-being (Forest et al., *in press*, 2022).

Hypothesis 5: Participating in a digital and anonymous strength-oriented feedback intervention (i.e., using *Listen Léon* for 4 weeks) leads to increases in psychological well-being.

Hypothesis 6: Variations in need satisfaction would be positively associated with the variations in autonomous motivation, which would then be positively associated with well-being at the end of the intervention after controlling for initial levels of well-being.

Finally, as advanced by Niemiec (2014, 2018, 2019), an intervention focussing on strength-oriented feedback should favor strength use behaviors. For practical purposes, it would be interesting to know if *Listen Léon* indeed encourages employees to use more frequently and intensively their character strengths at work, as the platform claims to do.

Hypothesis 7 Participating in a digital and anonymous strength-oriented feedback intervention (i.e., using *Listen Léon* for 4 weeks) leads to higher level of strength use.

4 Method

4.1 Intervention

Listen Léon (available on Google Play, Apple Store, or any internet browser at www.listenleon.com) draws on the 24-strength classification VIA (Peterson & Seligman, 2004) and encourages employees to send anonymous strengths-oriented descriptive feedback to one another. Within this app, one can write a short anonymous text message to a colleague. The message needs to be 140 characters or longer (to elicit positive descriptive feedback) and then the sender needs to assign to this message one- to three-character strengths that he or she observed in the colleagues' behaviors. Listen Léon relies on artificial intelligence to monitor the quality of anonymous feedback sent within the platform: feedback must describe at least one character strength and negative comments are not allowed, otherwise the message won't be sent. Users also have access to their personal (and secret) profile which describes their top five signature strengths. The more one receives feedback from colleagues, the more reliable her or his 360° strength evaluation should be (Niemiec, 2014, 2018, 2019). Listen Léon does not collect any personal information other than the users' names and email addresses, as commanded by the General Data Protection Regulation (GDPR).

4.2 Participants

A convenience sample of 198 (44 males) working adults located in Canada and France were recruited at the beginning of this study. After 4-weeks, 164 participants completed the questionnaire at Time 2 (77,3% response rate). Among these, 112 respondents reported having sent or received strength-oriented feedback in the last month, while 52 participants did not. The former participants were included in the experimental group. Participants in the experimental group have sent or received on average 24,13 messages ($SD = 13.17$, Max = 112). The experimental group consisted of 112 (28 males) full-time workers located mainly in Canada and France. Most participants in the experimental group were between 25 and 44 years old (66%). Two-thirds of the participants have worked for less than a year or more than 5 years for their employer. Participants come from diverse industries (e.g., banking, retail, consult-

ing, HR, education), with the majority working in retail and banking (59%). Regarding the *a posteriori* control group, 52 full-time workers located mainly in Canada and France were selected. Most participants in the *a posteriori* control group were between 25 and 44 years old (77%). A large proportion of participants were working for less than a year for their current employer (44%). As for the experimental group, most participants in the *a posteriori* control group were working in banking and retail (53%). Table 1 shows that the proportions of participants by different demographic categories are quite similar in both groups.

4.3 Procedure

This research aims at investigating the potential scientific relevance to use *Listen Léon* in organizations. A convenience sampling method was used to select participants to conduct this research. Participating organizations were reached through a LinkedIn publication. To control for the influence of organization-related factors (e.g., Dorssen-Boog et al., 2021), organizations were chosen by sectors of activity. In total, five (5) industries were represented: retail, consulting, banking, human resources, and education. Potential participants were invited via email and the organizations' intranet where the intervention was advertised as a strength training based on mobile technology (i.e., *Listen Léon* was briefly described in the advertisement). We opted to recruit self-selected participants because prior research

Table 1 Characteristics of the participants

		Experimental group (n=112)		Control group (n=52)	
Items	Categories	Frequency	%	Frequency	%
Gender	Male	28	27%	15	28%
	Female	84	73%	37	72%
Age	18–24 years	11	10%	5	10%
	25–34 years	45	40%	22	42%
	35–44 years	29	26%	18	35%
	45–54 years	18	16%	4	8%
	55 years and more	9	8%	3	6%
Year(s) worked for current employer	0–1 year	39	36%	22	42%
	1–2 years	13	13%	8	15%
	2–3 years	13	10%	6	12%
	3–4 years	8	8%	0	0%
	4–5 years	4	3%	3	6%
	More than 5 years	34	30%	13	25%
Industry	Education	13	12%	1	2%
	Banking	27	23%	10	20%
	Consulting	18	16%	13	13%
	Retail	40	36%	17	33%
	Human resources	14	13%	11	11%

has shown that self-selection, which is related to positive expectations and motivation, increases the effectiveness of positive interventions (Sin & Lyubomirsky, 2009). While random assignment to conditions would have been preferred, it can lead to very high drop-out rates among working people who are less available than, for instance, students (e.g., see Meyers et al., 2015). All questionnaires were in French, and participants completed both questionnaires through a web-based platform.

At the beginning of the study, all participants completed a web-based questionnaire in which they reported their levels of need satisfaction, need frustration, autonomous motivation, controlled motivation, and well-being. Following the completion of this questionnaire, all participants were invited to participate in an online webinar on positive psychology, character strengths, Listen Léon, and the current research project. No groups were identified *a priori.* Participants were encouraged to use the app for 4 weeks, and even continue to do so after the intervention (i.e., they could use it whenever they wanted, either during or after our study). One month later, all participants were invited to complete the same questionnaire they had previously completed at the beginning of the study. Participants were also asked if they had used the app in the past month and if so, they were invited to report how many messages they had sent or received. All participants (who used the app) had access to their personal history on the app, which included the exact number of messages they have sent or received. Participants were advised to directly report the data from their personal profile on the app. Those who used the application during this period constituted the experimental group, while those who did not (but might eventually use it) represented the *a posteriori* control group. In short, since participants who did not use to app answered both questionnaires, were aware of the intervention, did not use the app, and were allowed to use it after the 4 weeks, the *a posteriori* control group has several similarities with a wait-list control group (Handley et al., 2018).

4.4 Scales

All measures were translated into French using a back-translation procedure (Vallerand, 1989), apart from the work motivation scale (MWMS) which is already validated in 26 languages (Gagné et al., 2015). Table 2 presents the means, standard deviations, and correlations of all scales used in this study for the experimental and the control group.

4.4.1 Basic Psychological Needs

The Balanced Measure of Psychological Needs Scale (BMPN; Sheldon & Hilpert, 2012) was used to measure need satisfaction (NS) and need frustration (NF). On a seven-point scale ranging from 0 (*totally disagree*) to 6 (*totally agree*), respondents reported how much they approved each statement. First, we adapted the need satisfaction subscale (9 items) to select 2 items for each psychological need satisfaction (competence = "I am good at the things I do in my job", autonomy= "I am free to do things my own way", relatedness = "At work, I feel part of a group"), resulting in a 6-items measure of need satisfaction ($\alpha = 0.76$ at Time 1 and $\alpha = 0.84$ at Time 2). Second, we also adapted the need frustration subscale (9 items) to select 2 items for each psychological need frustration (competence = "I experience some kind of failure, or was unable to do well at something"; autonomy = "I have to do things against my will", and relatedness = "I feel lonely"), resulting in a 6-items measure of

Table 2 Correlations among the study variables at two measurement occasions

Experimental			Control												
Variables	M	SD	M	SD	1	2	3	4	5	6	7	8	9	10	11
Need satisfaction 1	4.68	0.69	4.69	0.63	-										
Need satisfaction 2	4.94	0.76	4.58	0.72	0.21*	-									
Need frustration 1	3.51	1.02	3.67	1.05	−0.43**	−0.15	-								
Need frustration 2	3.40	1.14	3.25	0.93	−0.10	−0.45**	0.39**	-							
Autonomous Motivation 1	4.04	0.82	4.01	0.72	0.67**	0.13	−0.36**	−0.05	-						
Autonomous Motivation 2	4.31	0.67	4.08	0.68	0.29**	0.63**	−0.19	−0.29**	0.32**	-					
Controlled motivation 1	3.74	1.14	4.01	1.04	−0.03	−0.07	0.20*	0.17	0.08	−0.04	-				
Controlled motivation 2	3.96	1.15	4.08	1.12	−0.19	0.04	0.07	0.19	−0.08	−0.02	0.47**	-			
Well-being 1	5.61	0.81	5.46	0.87	0.61**	0.14	−0.56**	−0.13	0.53**	0.17	−0.07	−0.12	-		
Well-being 2	5.89	0.70	5.55	0.82	0.08	0.44**	−0.21*	−0.26**	0.07	0.48**	0.05	−0.02		-	
Strengths use 1	5.52	0.98	5.50	0.79	0.71**	0.09	−0.43**	0.05	0.57**	0.22*	0.03	−0.01		0.09	-
Strengths use 2	5.90	0.81	5.39	0.96	0.29**	0.58**	−0.25*	−0.39**	0.23*	0.62**	−0.02	0.09		0.52**	0.25**

Notes: Correlations below the diagonal: Experimental group; correlations above the diagonal: Control group. * $p < .05$; ** $p < .01$. Because of varying sample sizes, significance levels differ

need frustration ($\alpha = 0.79$ at Time 1 and $\alpha = 0.81$ at Time 2). Prior research has validated that only 6 items could be sufficient to assess adequately the latent construct of need satisfaction or need frustration (Eriksson & Boman, 2018).

4.4.2 Quality of Work Motivation

Quality of work motivation was measured using the Multidimensional Work Motivation Scale (MWMS; Gagné et al., 2015). This scale consists of 19 items measuring types of motivation in which participants reported their principal motives for doing their job on a seven-point scale ranging from 0 (*not at all for this reason*) to 6 (*exactly for this reason*). For a matter of internal reliability, 12 items were retained to create four construct variables : external regulation (3 items; study 1 $\alpha = 0.74$; study 2 $\alpha = 0.76$; e.g., "Because others will reward me financially only if I put enough effort in my job"), introjected regulation (3 items; time 1 $\alpha = 0.71$; time 2 $\alpha = 0.79$ e.g., "Because I have to prove to myself that I can"), identified regulation (3 items; time 1 $\alpha = 0.82$; time 2 $\alpha = 0.72$ e.g., "Because putting efforts in this job aligns with my values"), and intrinsic motivation (3 items; time 1 $\alpha = 0.96$; time 2 $\alpha = 0.82$; e.g. "Because my work is stimulating"). We followed the same procedure as Trépanier et al. (2015). In both studies, the latent construct of autonomous motivation was calculated using mean scores of the intrinsic motivation and identified regulation, and the latent construct of controlled motivation was assessed using mean scores of the introjected and external regulation subscales.

4.4.3 Psychological Well-Being

Participants' psychological well-being was measured with a short 6-item scale adapted from the Psychological Well-Being Scale (PWB; Ryff, 1989; Ryff & Keyes, 1995). We selected items from three subscales: self-acceptance ("I made some mistakes in the past, but I feel that all in all everything has worked out for the best"), purpose in life ("I enjoy making plans for the future and working to make them a reality"), and personal growth ("I have the sense that I have developed a lot as a person over time"). Only these three subscales were used in the present study since prior research demonstrated that the other three subscales of the PWB Scale are too similar to basic psychological needs for autonomy, competence, and relatedness (Miquelon & Vallerand, 2008). The latent construct of psychological well-being was calculated by computing all 6 items ($\alpha = 0.91$ at Time 1 and $\alpha = 0.93$ at Time 2).

4.4.4 Strengths Use Behaviors

Strengths use behaviors (SUB) were measured with the Strengths Use and Deficit Correction Scale (SUDCO; van Woerkom et al., 2016). In this study, only the 7 items strength use subscale was used. On a seven-point scale ranging from 0 (*rarely*) to 6 (*almost always*), participants reported how they perceived to act on their strengths at work ("I capitalize on my strengths at work" $\alpha = 0.86$ at Time 1 and $\alpha = 0.84$ at Time 2). Prior research has validated the SUDCO scale as an appropriate measure of strengths use behaviors (e.g., Els et al., 2018; Meyers et al., 2019; Meyers & van Woerkom, 2017; van Woerkom et al., 2016).

5 Results

5.1 Preliminary Analysis

Prior to conducting the main analyses, data was examined for univariate normality, missing values, and confirmatory factorial analysis (CFA). First, analysis of normality concluded that all variables were reasonably normally distributed. Second, Little's MCAR test (Little, 1988) was performed to see if missing values (especially at Time 2) were completely missing at random, and the test was not significant (χ^2 = 48.46, df=184, p=.374). Third, two measurement models were built to examine if the observed variable load on their respective latent factor at Time 1 and Time 2. Both models presented appropriate fit indexes: Time 1 (χ^2 = 402,765, df=177; p<.001; CFI=0.91; IFI=0.92; RMSEA=0.079, [CL=0.070–0.090]; SRMR=0.0712) and Time 2 (χ^2 = 398.627, df=178; p<.001; CFI=0.92; TLI=0.91; RMSEA=0.077, [CL=0.59−0.088]; SRMR=0.067).

Second, to detect differences between participants who responded at both measurement points and those who did only at Time 1, we conducted multiple ANOVA tests on several demographic variables: age (F(1,196) = ,942 p=.333), gender (F(1, 196)=3.122, p=.091), work tenure (F(1,196)=1,574, p=.211), and industry (F(1,196) = ,678 p=.411). A MANOVA including all demographic variables also indicated no significant effects (F(1, 196)=2.197, p=.093). All tests were not significant. We also conducted several ANOVA tests on the variables included in our conceptual framework: need satisfaction (F(1,196)=2,363, p=.126), need frustration (F(1,196)=2,086, p=.150), autonomous motivation (F(1,196) = ,076, p=.789), controlled motivation (F(1,196)=1,196, p=.275), psychological well-being (F(1,196)=0,609, p=.436), and strengths use (F1,196)=0,211, p=.889) comparing participants who responded at both times and those who did only at Time 1. Again, a MANOVA including all continuous variables was executed, and no significant effects were found (F(1, 196)=1.847, p=.112). Thus, it was concluded that participants who did answer at both measurement times did not significantly differ from those who only respond at Time 1.

Third, regarding potential differences between the experimental group and the *a posteriori* control group at Time 1, several ANOVA tests were performed on several demographic variables: age (F(1,196)=2,450, p=.119), gender (F(1,196)=2,737, p=.110), work tenure (F(1,196) = ,218 p=.641), and industry (F(1,196) = ,066, p=.798). A MANOVA including all demographic variables also indicated no significant effects (F(1,196)=1.97, p=.102). Likewise, multiple ANOVA tests were operated on the continuous variables included in this study: need satisfaction (F(1,196) = ,004, p=.949), need frustration (F(1,196)=1,100, p=.296), autonomous motivation (F(1,196) = ,042 p=.837), controlled motivation (F(1,196)=2,932, p=.088), psychological well-being (F(1,196)=1,586, p=.209), and strengths use (F(1,196)=0.036, p =. 849). Again, a MANOVA including all continuous variables was performed, and no significant effects were found (F(1,196)=0.589, p=.771). Therefore, it was concluded that the experimental and the *a posteriori* control groups did not significantly differ from each other at Time 1.

Fourth, to observe the simple effects of the intervention program on the studied variables, a series of paired sample and independent sample t-tests were conducted to compare the mean scores of the experimental group after the intervention, with their average scores before it (paired samples), as well with the control group's answer at Time 2 (independent samples; see Table 3). For both conditions (Groups and Time), results show a sig-

nificant increase in need satisfaction, autonomous motivation, psychological well-being, and strengths use behaviors. However, since no statistical differences were found regarding need frustration and controlled motivation on two distinct experimental conditions (Time and Groups), the preliminary results invalidate hypotheses 2 and 4. For this reason, need frustration and controlled motivation were excluded of the main analyses. To validate our remaining hypotheses (i.e., those focusing on need satisfaction, autonomous motivation, psychological well-being, and strengths use), we explore possible interaction effects

Table 3 Intra-subject and inter-subject group comparisons for the experimental group at time

Variables	Experimental n=103			Control n=52					
Need satisfaction		M	SD	M	SD	T	Df	P	*d*
	Time 2	4.95	0.76	4.81	0.72	2.834	152	0.005	0.45
	Time 1	4.68	0.69	4.77	0.58				
	T	2.897							
	Df	101							
	p	0.005							
	d	0.57							
Need frustration	Time 2	3.4	0.97	3.25	1.05	0.821	152	0.42	
	Time 1	3.52	0.95	3.67	0.93				
	T	1.22							
	Df	101							
	p	0.25							
Autonomous Motivation	Time 2	4.31	0.67	4.09	0.68	2.041	153	0.04	0.33
	Time 1	4.03	0.82	4.07	0.73				
	T	3.236							
	Df	102							
	p	0.002							
	d	0.64							
Controlled motivation	Time 2	3.89	1.06	4.08	1.12	0.633	153	0.52	
	Time 1	3.76	0.98	4.01	1.03				
	T	1.637							
	DF	102							
	p	0.105							
Well-being	Time 2	5.92	0.7	5.54	0.82	2.749	153	0.007	0.44
	Time 1	5.61	0.81	5.61	0.8				
	T	3.11							
	DF	102							
	p	0.002							
	d	0.61							
Strengths use	Time 2	5.91	0.81	5.41	0.95	3.441	153	0.001	0.55
	Time 1	5.54	0.94	5.55	0.8				
	T	3.495							
	DF	102							
	p	0.001							
	d	0.69							

Note: All Levene's tests for equality of variance were not significant

between both experimental conditions (Time and Groups), which are presented in the next section.

5.2 Main Analysis

First, a between and within subjects repeated measures ANOVA, with Time (1, 2) as the within-subjects factor and Groups (Experimental, Control) as the between subjects' factor, was run separately for need satisfaction (hypothesis 1), autonomous motivation (hypothesis 3), psychological well-being (hypothesis 5), and strengths use (hypothesis 7). To validate these hypotheses, significant interaction (i.e., between time and group) effects are required. As proposed by Cohen (1988), the eta-square index reports the effect size of an interaction. An eta square index ($\eta 2$) around 0.01 is considered as a small effect, around 0.06 as a moderate effect, and around 0.14 as a large effect. The results revealed that there was a significant group by time interaction effect for all four variables: need satisfaction ($F(1, 152)=9.857$. $p=.005$, $\eta 2=0.06$), autonomous motivation ($F(1, 153)=3.736$. $p=.002$, $\eta 2=0.025$), psychological well-being ($F(1, 153)=4.935$. $p<.05$, $\eta 2=0.036$), strength use ($F(1, 153)=7.39$. $p=.003$, $\eta 2=0.05$). The effect sizes ranged from 0.025 to 0.06, showing that the intervention had a moderate effect on these variables (except for autonomous motivation). These results fully support hypotheses 1, 3, 5, and 7.

Second, structural equation modeling analyses were performed using the maximum likelihood estimation procedure in SPSS AMOS to perform a cross-lagged panel model. The model tested in the present study was composed of two observed variables (variations in need satisfaction and variations in autonomous motivation) as well as two latent variables (well-being at Times 1 and 2). Three paths were specified: one between well-being at Time 1 and well-being at Time 2; one between the variations in need satisfaction and variations in autonomous motivation; and one between the variations in autonomous motivation and well-being. The proposed model had a good fit to the data: $\chi^2 = 45.89$, df=19; $p<.001$; CFI=0.92; IFI=0.94; RMSEA=0.08, [CL=0.054–0.11]; SRMR=0.0611. Results showed that variations in need satisfaction were positively associated with variations in autonomous motivation ($\beta=0.638$), which in turn predicted change in psychological well-being ($\beta=0.531$). The standardized weights of the proposed model are presented in Fig. 1. Furthermore, an alternative model was also tested. Three paths were specified: one between well-being at Time 1 and well-being at Time 2; one between the variations in well-being and autonomous motivation, and one between the variations in autonomous motivation and variations in need satisfaction. The results did not indicate a satisfactory fit to the data $\chi^2 = 64.045$, df=19; CFI=0.84; IFI=0.85; RMSEA=0.11, [CL=0.08–0.14]; SRMR=0.095. Therefore, these results support the sequential structure proposed in this study.

Finally, to observe the indirect effect of autonomous motivation in the relationship between need satisfaction variations and psychological well-being, a 95% confidence interval was processed from 5 000 samples using the Bootstrap method (MacKinnon et al., 2004). To be significant, a standardized indirect effect (SIE) must be within a confidence interval (CI) that rejects zero (Byrne, 2016). The test results were significant (SIE=0.34; CI=0.248–0.433). Therefore, the present model demonstrated that after controlling for levels of well-being at Time 1, increases in need satisfaction stimulated increases in autonomous motivation, which significantly impact employees' levels of psychological well-being at the end of the intervention. These results support hypothesis 6.

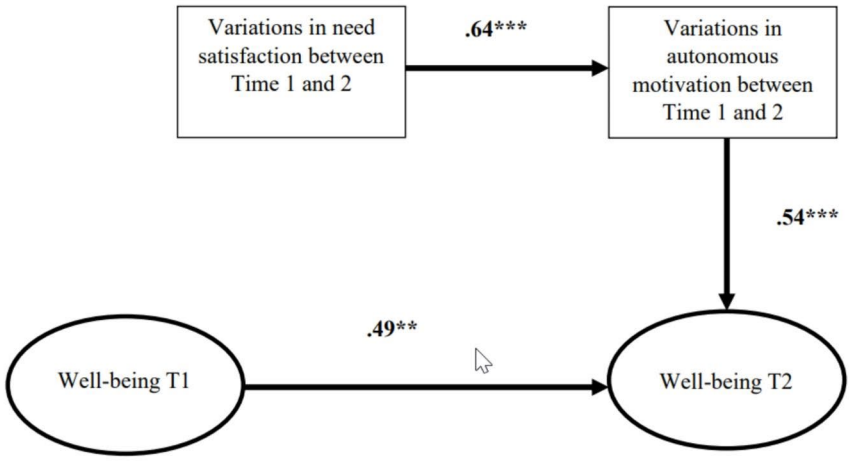

Fig. 1 Results of the cross-lag panel model: Experimental group (n=112). Note: **=p<.01; ***=p<.001

6 Discussion

6.1 Main Findings

The main purpose of the present research was to test an intervention in which participants were encouraged to send anonymous positive feedback using mobile technology and explore the potential influence of the intervention on several variables: strengths use, need satisfaction, autonomous motivation, and well-being. For that purpose, several full-time employees were recruited to follow a 4-week intervention and answer a questionnaire on two occasions. Past research has demonstrated that promoting signature strengths identification and use might favor employees' levels of psychological well-being and strengths use behaviors (e.g., Forest et al., 2012; Ghielen et al., 2018; Schutte & Malouff, 2018). Moreover, psychological needs and work motivation might be considered as two explanatory mechanisms justifying why strength interventions could improve employees' well-being (Bakker & van Woerkom, 2018; Kong & Ho, 2016; Miglianico et al., 2019). However, to the best of our knowledge, the potential effects of using mobile technology to promote signature strengths identification/use through anonymous 360-degree feedback have not yet been studied. Finding positive effects of a strength's intervention using mobile technology is highly important because it demonstrates how strength interventions might evolve into more accessible, sustainable, and communal practices (Boiler & Abello, 2014), which could be the biggest challenge strengths intervention are currently facing (van Woerkom et al., 2021). More precisely, our results demonstrate that a digital intervention on strengths feedback could be beneficial to as many employees as one could imagine since positive technology has no physical limits. Consequently, the present study also aimed to explore the impact of need satisfaction and work motivation that might explain the effect of strength interventions on well-being.

The results of the present research generally supported our hypotheses. Participants who used the online platform reported higher levels of strength use, need satisfaction, autonomous motivation, and psychological well-being after 4 weeks compared with those who did not use the application. However, the intervention did not have a significant effect on need frustration and controlled motivation. Figure 2 presents the significant Time by Groups interaction effects for the four variables in which a significant effect was found. Moreover, regarding the experimental group, the results supported the idea that changes in employees' well-being between Time 1 and Time 2 are potentially explained by variations in autonomous motivation and need satisfaction over time.

6.2 Theoretical Implications

First, because mobile applications do not need to be founded on evidence-based theory to be available on the digital market, scientific support demonstrating their impact on well-being is still lacking. However, those based on scientific theories tend to be more effective than

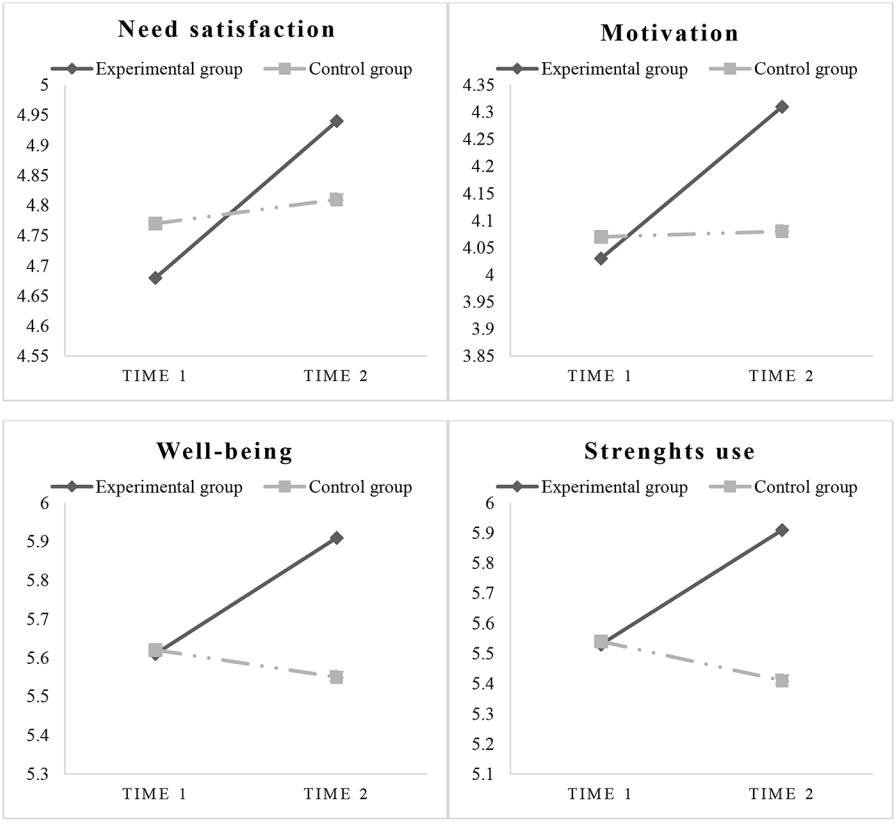

Fig. 2 Significant Time by Condition interaction effects for need satisfaction, autonomous motivation, psychological well-being, and strengths use

the ones which do not have any theoretical background (Bolier & Abello, 2014; Fieldmann, 2017). Therefore, this study contributes to the literature on positive technology by testing a mobile application built on an evidence-based theoretical framework, the VIA classification proposed by Peterson and Seligman (2004). It is the first study to demonstrate the scientific benefits of using technology to disseminate strength-oriented feedback at work. Like Harzer and Ruch (2016), our results will likely inspire others to use the technology to promote different strengths interventions.

Second, the present paper contributes to the theoretical knowledge on strengths and positive psychology at work. Drawing on SDT, we proposed a motivational framework to shed light on the underlying mechanisms of the strength-based approach. Since 2012, several systematic literature reviews have been carried out regarding the theoretical implications of the strength-based approach (Bakker et al. 2018; Ghielen et al. 2017; Miglianico et al., 2019; Quinlan et al., 2012). They all conclude by claiming that future research must develop a more refined theoretical framework for a wider understanding of its positive effects at work. Since the positive activation model (Lyubomirsky & Layous, 2013) predicts that positive interventions trigger positive mental experiences (e.g., positive emotions, need satisfaction, and motivation), but their potential implication on human motivation remains insufficiently studied (Bakker & van Woerkom, 2018), this research demonstrated the theoretical contributions of SDT to understand how strengths identification and promotion can enhance employees' psychological well-being (Kong & Ho, 2016; Miglianico et al., 2019). Our results support the following sequence validated by much research on SDT: contextual factors → need satisfaction → autonomous motivation → well-being. (e.g., Forest et al., *in press*, 2022; Olafsen et al., 2017; Ryan & Deci, 2017). In this paper, anonymous strengths-oriented descriptive feedback was presented as an antecedent of employees' basic psychological needs. We also investigated the potential effect of the intervention on need frustration and controlled motivation, but no significant effects were observed. Finally, we also tested an alternative model, which did not demonstrate a satisfactory fit to the data; hence lending support the sequential path presented in this study.

Third, the present study sheds light on the theoretical knowledge of feedback in organizations. Even if the principle of giving positive feedback (i.e., confirming and reinforcing employees' desirable behaviors) seems quite simple, understanding what is (or is not) quality feedback is much more complex (Carpentier & Mageau, 2013, 2016). This paper introduces strength-oriented descriptive feedback as a definite form of positive feedback in organizations (i.e., when the object of feedback focuses precisely on the character strengths observed in a colleague/employee; Niemiec, 2014, 2019), and demonstrates its impact on employees' optimal functioning. Our results could be explained by the fact that strength-oriented feedback affects the contextual aspects of day-to-day feedback, which results in changing the social experience and feedback environment (Steelman et al., 2004; Whitaker et al., 2007). In sum, our intervention had an impact on the quality and availability of feedback from different sources, thus helping employees to identify and use their character strengths.

6.3 Limitation and Future Research

Even though the present research tested the impact of an intervention and used a cross-lagged panel design, some limitations need to be addressed. First, all variables assessed

in this study were self-reported by participants and, therefore, they are subject to common method bias. However, it would have been challenging to assess several variables used in this study with other procedures (psychological experiences and states such as need satisfaction and psychological well-being), and perhaps less precise (Spector, 2006). We tried to minimize this bias by including a time lag, a comparison of intervention conditions, and running Harman's-factor test (Fuller et al. 2016), which suggested that common method bias was not an issue. Further research could, for example, examine whether the intervention put forward in this paper may also lead to positive organizational outcomes such as increasing performance ratings and financial returns.

A second limitation to our study is that the participants were not randomly assigned to the control and the experimental group, making our intervention a quasi-experimental study (i.e., the self-selection method). In other words, the experimental and the *a posteriori* control groups might not be equivalent at baseline and, therefore, the groups' differences observed might be due to chance, rather than to an inherent factor related to the intervention. For instance, there is still a chance that participants in the experimental groups were more familiar with technology and perhaps further enthusiastic about positive psychology than those in the control group. This means that causal inferences should therefore not be made based on this research. However, during the recruitment process, the intervention was labeled as a "positive psychology intervention supported by technology". Since all participants joined voluntarily, we can imagine that they all had a positive inclination or attitude about positive psychology and mobile applications. We also did not find any statistical differences between the experimental and the *a posteriori* control groups before the intervention on several variables (i.e., gender, age, organizational tenure, industry worked, as well as the variables included in our conceptual framework).

The self-selection method seems to be common in organizational intervention studies since several published studies present this form of quasi-experimental research design (e.g., Forest et al., 2012; Meyers & van Woerkom, 2017; Kuijpers et al., 2020). In this study, we opted for an *a posteriori* control group for three reasons. First, since the intervention could have influenced the social environment of the participants (Steelman et al., 2004), assigning a control group in advance would have possibly generated perceived organizational injustice among those who were deprived of using the online platform (Dries, 2013; Gelens et al., 2013; O'Connor & Crowley-Henry, 2019). Thus, this would have negatively influenced the responses of the control group at Time 2. Second, creating a post-intervention control group based on whether the app was used in the past month made it possible to accommodate participants' schedules. Because our research was conducted during the summer, some participants may not have used the app because they were on vacation or for other personal reasons. The present procedure allowed the participants to use the application when they were ready to do so, regardless of their time constraints. Third, participants who did not use the app also took part in the online webinar and were indirectly immersed in a strength-oriented work environment throughout the intervention. Therefore, since participants in the *a posteriori* control group received an intervention, it is possible to argue that potential changes in the experimental group over both measurement times are due to the use of the application and not to the attention that the participants received during the 4-weeks experiment (also known as the "Hawthorne effect"; Mayo, 1930). Although it is sometimes difficult to uphold the rudiments of the scientific method when research is applied to the work context, future research should try to replicate this study's findings using innovative

experimental and quasi-experimental research designs and, therefore, support the causal trajectory that we argued for in this paper.

A third limitation of this research is the short follow-up period. This is a shortcoming since delayed effects might be missed and, therefore, this study neglects that the intervention's possible effects might fade away. However, the opposite effect also remains possible. Since the intervention proposed in this research could influence employees' social environment, it could be argued that implementing strength-oriented feedback into an organization's culture should probably take longer than 4 weeks. For that reason, future research should collect data using a longitudinal research design to shed light on the possible impacts of the intervention described in this paper over a longer period.

Finally, although an effort has been made to select organizations that come from different working sectors (i.e., consulting, retail, banking, human resources, and education), our sample of participants remains not representative of the general working population. This raises doubts on the external validity of the results observed in this study and future research should thus demonstrate whether these findings can be generalized to other sectors and populations.

6.4 Practical Implications and Conclusion

Toward the democratization of strength interventions in organizations, the main practical contribution of this study was to demonstrate that an online platform such as an application could make positive psychology-based interventions available to any employee who has access to a smartphone or a computer. Therefore, by demonstrating that a mobile app (i.e., Listen Léon) could have a significant impact on employees' needs satisfaction, motivation, and psychological well-being, our results invite organizations to integrate evidence-based technology into their human resources practices to stimulate a positive, benevolent, and strengths-based culture.

Moreover, the current study's findings might also help managers in their day-to-day activities. Because managers are well placed to get to know their employees' strengths, they should encourage strengths-oriented feedback not only within the mobile app but also in most social interactions. With limited resources and increasing pressure to achieve organizational results, managers should invest in practices that are proven to meet employees' needs and stimulate employees' optimal functioning (Marescaux et al., 2013); that is, promoting strengths-oriented descriptive feedback.

Finally, our research guides employees on where to invest their time and energy at.

work. It highlights the idea that when an employee engages in activities that promote strength identification and use, he or she also favors need satisfaction and autonomous motivation and, therefore, enhances his or her optimal functioning at work. After all, the power of strength-oriented feedback possibly resides in the fact that the feedback not only influences the receiver, but also the social environment, which in turn favors needs satisfaction, work motivation, and, ultimately, the overall level of psychological well-being of many employees.

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Data Availability Statement The ethical approval obtained to conduct this study forbids any type of data sharing.

Disclosure Statement

Conflict of Interest No potential conflict of interest was reported by the authors. The authors received no financial compensation for conducting this study. Participation in the study was completely free.

Ethical Declaration The ethical committee of the *Université du Québec à Montréal* (CERPE UQAM)has approved the present research (approval number: 4377). All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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