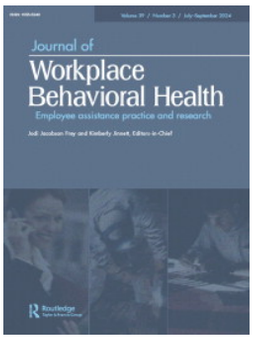

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Boosting workplace well-being: Unveiling the impact of digital tools

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ABSTRACT

Well-being at work has become as much a challenge for organizations as a public health issue. The development of new technologies has enabled the emergence of solutions to support employee well-being (e.g., positive technology). The aim of this study is to verify the effects of using a digital application designed to support employees in their well-being. French speaking workers have been included in a longitudinal study ($N = 77$). The longitudinal study lasted 6 months, including 3 measurement periods (one every 3 months). Our results showed that workers who had access to the digital application had a greater level of work well-being, a better psychological needs satisfaction and less burnout. The results will be discussed in the light of the consequences for the employee and the limits to the use of these positive technologies.

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Well-being at work; digital application; occupational psychology; positive technology

Introduction

The World Health Organization (WHO) defines the mental health as "*a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community*" (World Health Organization, 2018). Importantly, the WHO also emphasize that mental health is more than the absence of disorder and promotes well-being.

Enhancing psychological well-being at work has emerged as one of the most pressing dilemmas of contemporary times, with many global institutions identifying mental health and stress-induced problems as being among the most frequent work-related diseases (Dewa et al., 2007). In work context, mental health and well-being is a broad concept focused primarily on the health of employees, which can consequently determine good or poor outcomes in the workplace (Waddell et al., 2023). Employee ill-health is associated with work overload, interpersonal conflicts, negative

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feedback, and low levels of social support, autonomy, and job satisfaction (Carlotto & Câmara, 2019; Molero et al., 2018). This ill-health has a significant negative impact on work performance (Sanderson & Andrews, 2006), workplace safety, absenteeism, and early retirement (Sanderson et al., 2008). On the opposite, well-being at work promotes performance and better health (Hamar et al., 2015) and generally contributes to a better quality of life (Chari et al., 2018).

Apart from the psychological ramifications of ill-health, such as work-related stress, the economic costs remain substantial (Hassard et al., 2018). In the UK, poor mental health in businesses costs between £33 and £42 billion annually (Deloitte, 2017), while in France, the social cost of workplace stress is estimated at €1.9 to €3 billion per year (INRS, 2010).

Consequently, companies are investing in various measures to promote occupational health or mitigate stress and burnout (Grawitch et al., 2015; Tetrick & Winslow, 2015). To survive and innovate, organizations must therefore invest in the well-being of their employees. Corporate health programs are an argument to attract and retain talent. According to a recent Institut Français des Opinion Publique (IFOP) survey (2021), two thirds of the employees questioned (65%) said that the way their company takes their psychological health into account has an impact on their desire to stay or join the company. Aware of this responsibility, organizations are increasingly developing so-called CSR (corporate social responsibility) practices (Singh et al., 2019).

To meet the challenge of employee well-being, some organizations react. During the last decades, companies have invested in interventions to promote well-being with mental health programs through stress management group discussion, mental health consulting, CBT programs, or even telephone screening (Deloitte, 2017). At the same time, new information and communication technologies (ICT) offer convenient solutions (Wind et al., 2020) to companies (e.g., email interventions, Deloitte, 2017).

The ICT create a new way of interventions. These technologies are based on positive psychology theories. Positive psychology focuses on human strengths and who to promote these strengths to allow individuals, communities, and societies to flourish. This discipline departs from other currents, which only took suffering into account and only wanted to treat the individual for his or her illness, without really promoting well-being but only the absence of illness (Riva et al., 2012). This combination of positive psychology and ICT has generated new digital tools called: "positive technologies" (PT, Botella et al., 2012; Grossi et al., 2020).

The aim of such PT is to exploit technology for improving the quality of personal experience with the goal of increasing wellness, and generating strengths and resilience in individuals, organizations, and society

(Grossi et al., 2020; Riva et al., 2012). PT facilitate novel intervention approaches for employee well-being within organizations. PT leverage ICT to enhance personal experiences with the objective of promoting wellness, fostering strengths, and building resilience in individuals, organizations, and society (Riva et al., 2012). PT adopt a person-centered and holistic approach, to promote well-being, addressing three primary spheres: physical and cognitive, emotional and affective, and social.

In the workplace domain, PT have been utilized to enhance well-being and mental health. PT-based interventions can operate at various levels, employing diverse means of action. Well-being improvements can be achieved through implementing applications for feedback (Gradito Dubord et al., 2022), virtual reality interventions for relaxation (Adhyaru & Kemp, 2022), emotional artificial intelligence (Mantello et al., 2023), or by focusing on employees' mental health (Carrouel et al., 2022). These digital application-based interventions have the potential to effectively alleviate symptoms of certain mental disorders (Hwang et al., 2021), enhance well-being and life satisfaction (Gál et al., 2021; Gradito Dubord et al., 2022), increase need satisfaction (Gradito Dubord et al., 2022), reduce loneliness and depressive symptoms (Shapira et al., 2021) and enhance emotional management effectiveness (Bakker et al., 2016; Eisenstadt et al., 2021). Despite the benefits that such technologies can bring, we did not forget that the consequences can be more negative than expected. On the contrary, the use of new technology can increase ostracism and stress among employees (Mantello & Ho, 2024). It is therefore essential to be able to verify the consequences of the use of such technologies on employees.

Aim of the study

The aim of our study is to evaluate the impact of an internet intervention in the form of a digital application on employees' well-being, stress, burnout, and basic psychological needs satisfaction. To our knowledge, few studies have examined the effect of such interventions (e.g., mental health applications) on the well-being and health of workers. Gradito Dubord et al. (2022) demonstrated a positive effect of a feedback application on well-being and need satisfaction. However, this application solely utilizes feedback to enhance employee well-being. In our study, we use a holistic application addressing various aspects of workers' life (e.g., emotional management, social relationship, work organization). To confirm the effects on workers, we compare two groups of participants (users vs. non-users) over a 6-month period. We hypothesize that the use of well-being applications in the workplace increase well-being level and satisfaction of needs (Deci & Ryan, 2008) while reducing burnout and stress. Our study will enable us to

observe the medium to long-term effects of using a digital application in promoting well-being and health at work.

Method

Intervention

Moodwork is a web and mobile application whose aim is to support employees in their mental health and well-being at work. It has been developed since 2017 by the Moodwalk company. The application is available to employees of client companies. Each employee can create an account freely and confidentially. There, they can measure their level of well-being at work *via* a questionnaire including various risk and protection factors. This questionnaire has been created and validated by Bebiroglu et al. (2021) based on the Job Demands-Resources (JD-R) model (Demerouti et al., 2001). Each factor included in this questionnaire is significantly linked with burnout (Bebiroglu et al., 2021).

Users can also read articles and watch videos on a wide range of topics (e.g., motivation, emotion management, work atmosphere). In all, resources are available with unlimited access. Each resource is created and verified by experts in the field of psychology (psychologists or doctors in psychology). The included elements and proposed advice are based on scientifically supported theories (e.g., coping strategies, organizational engagement, self-efficacy). Resources can be consulted freely by users according to their needs and expectations, but they are also recommended and highlighted following their questionnaire results. These recommendations present themes that can be worked on by the user to improve their well-being in relation to the factors of well-being and ill-being identified by their questionnaire. These recommendations are made automatically, but there is no obligation to use them.

Finally, users can book appointments with "specialists", mainly psychologists, to discuss work-related issues. These appointments, made by videoconference or by phone, are unlimited and at no cost to the user. All actions carried out on the application are confidential as commanded by the General Data Protection Regulation (GDPR).

Participants

At Time 1 (baseline), the sample consisted of 217 participants (12% of men) located in France. The age of respondents ranged from 26 to 67 years ($M = 46.4$, $SD = 8.8$). Fifty six percent of participants had a master's or more degree, 35% of participants had a bachelor's degree and 9% had a high school diploma. Twenty four percent of participants were senior

executive, 36% were middle manager, 32% were employees and 8% were independents. Most of them (89%) had a permanent contract with their company.

At Time 2 (Time 1 + 3 months), the sample consisted of 119 participants (13% of men). The age of respondents ranged from 26 to 67 years ($M = 46$, $SD = 8.7$). Fifty six percent of participants had a master's or more degree, 35% of participants had a bachelor's degree and 9% had a high school diploma. Twenty eight percent of participants were senior executive, 39% were middle manager, 30% were employees and 3% were independents. Most of them (90%) had a permanent contract with their company.

At Time 3 (Time 1 + 6 months), the sample consisted of 77 participants (13% of men). The age of respondents ranged from 27 to 67 years ($M = 46.8$, $SD = 8.7$). Fifty five percent of participants had a master's or more degree, 38% of participants had a bachelor's degree and 7% had a high school diploma. Twenty six percent of participants were senior executive, 46% were middle manager and 26% were employees. Most of them (95%) had a permanent contract with their company.

Procedure

This research aims at investigating the potential effects of *Moodwork* on workers' mental health. The study was performed between April and October 2023. Data were collected at baseline (Time 1), at 3 months (Time 2) and at 6 months (Time 3).

Participants were recruited *via* mailing and social networks (e.g., LinkedIn). After completing an initial online questionnaire through the platform *Alchemer*, including a consent according to GDPR recommendations, approximately half of participants ($n = 93$) were randomly proposed to participate in an online conference about the application. During this conference, we described the use of the application and gave the terms of access. They were then free to use the application for the duration of the study (6 months).

Three months after the first questionnaire and access to the application for the experimental group, a second questionnaire was sent to all participants who had completed the first questionnaire. Finally, 3 months after the second phase, a final questionnaire (identical to the first two) was sent to the 119 people who had completed the first two phases. Seventy-seven participants completed this third phase including 27 in the experimental group.

Measures

In addition to socio-demographic questions, we measured job burnout, workplace well-being, stress, and basic psychological needs related to work.

Reliability for all measures was estimated using Cronbach's alpha as presented in Table 1. All measures had good internal consistency.

Workplace well-being

Workplace well-being was assessed through the positive scale of well-being at the workplace (EPBET in French) from Biétry and Creusier (2013) who created and validated a scale in the French work context. This scale consisted of 12 items using a Likert scale ranging from 0 = totally disagree to 7 = totally agree. In accordance with the structure suggested by Biétry and Creusier (2013), our analysis revealed a 4-factors design with good reliability: relations with colleagues (e.g., "I have good relationships with my colleagues."), relations with manager (e.g., "My needs and expectations are taken into account."), relations with work times (e.g., "My working hours are reasonable."), and relation with work environment (e.g., "My work station is appropriated for my needs."). The four factors can be added to form a global score (Biétry & Creusier, 2013).

Burnout dimensions

The level of burnout was measured *via* the "Inventaire Français d'Epuisement Professionnel" (IFEP) created and validated with French workers (Poirier et al., 2023). This scale is composed by two factors: interpersonal tension (e.g., "I feel resentment toward my colleagues.", "I am on edge in my work relationships.") and exhaustion (e.g., "My work exhausts me so much that I can't think anymore.", "Thinking about my work exhausts me."). The 15 items are scored on a scale from 0 = never to 6 = every day.

Need satisfaction and frustration at work

The basic psychological needs at work scale proposed by Schultz et al. (2015) adapted from the BPNS-R (Chen & Bozeman, 2013) was used. According to Vallerand's recommendation (1989), translation and back translation were used to adapt the scale to French workers. The scale assesses both the satisfaction need and the frustration need as separate constructs. The three needs (autonomy, competence, and relatedness) were assessed in work context. This scale consisted of 24 items using a Likert scale ranging from 1 = totally disagree to 5 = totally agree according to Chevrier and Lannegrand (2022). The 24 items were divided in six factors including four items each: satisfaction of autonomy (e.g., "I feel my choices on my job express who I really am."), satisfaction of competence (e.g., "When I am at work, I feel competent to achieve my goals."), satisfaction

Table 1. Mean values, standard deviation, intercorrelations, and internal coherence (Cronbach's alpha) of variables in time 1 ($N = 217$).

	Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11
Workplace well-being													
1.WWB	43.2	12.3	*.83*										
Burnout dimensions													
2.Interpersonal Tension	2.2	1.5	−0.65***	*.92*									
3.Exhaustion	2.4	1.7	−0.63***	.78***	*.95*								
Need satisfaction and frustration at work													
4.Frustration Autonomy	11.8	4.5	−0.62***	.61***	.68***	*.89*							
5.Frustration Competence	9.1	3.9	−0.30***	.45***	.48***	.34***	*.82*						
6.Frustration relatedness	8.9	3.9	−0.61***	.59***	.47***	.45***	.34***	*.87*					
7.Satisfaction Autonomy	12.5	4.0	.61***	−0.53***	−0.51***	−0.70***	−0.39***	−0.51***	*.87*				
8.Satisfaction Competence	15.2	3.4	.30***	−0.32***	−0.44***	−0.34***	−0.75***	−0.29***	.45***	*.84*			
9.Satisfaction relatedness	14.5	3.8	.53***	−0.41***	−0.28***	−0.26***	−0.19**	−0.64***	.51***	.27***	*.87*		
Perceived Stress Scale													
10.Perceived helplessness	12.2	5.1	−0.58***	.71***	.73***	.56***	.45***	.43***	−0.43***	−0.38***	−0.24***	*.82*	
11.Perceived self-efficacy	5.9	3.3	−0.58***	.71***	.64***	.59***	.52***	.51***	−0.61***	−0.43***	−0.35***	.71***	*.81*

Note: In italic: Cronbach's alpha, $^{**}p < .01$, $^{***}p < .001$.

of relatedness (e.g., "I feel connected with people who care for me at work, and for whom I care at work."), frustration of autonomy (e.g., "I feel pressured to do too many things on my job."), frustration of competence (e.g., "I feel insecure about my abilities on my job."), and frustration of relatedness (e.g., "I feel excluded from the group I want to belong to at work.").

Perceived helplessness and perceived self-efficacy

Perceived helplessness was measured *via* the perceived helplessness scale of the Perceived Stress Scale-10 items (PSS 10; Cohen et al., 1983), validated in French (Bellinghausen et al., 2009). The six items are scored on a scale from 1 = never to 5 = often (e.g., "During the past month, have you felt nervous or stressed at work?").

Perceived self-efficacy was measured *via* the perceived self-efficacy scale also included in the Perceived Stress Scale 10 items (PSS 10; Cohen et al., 1983; adapted in French by Bellinghausen et al., 2009). The four items are scored on a scale from 1 = never to 5 = often (e.g., "During the past month, have you felt capable of taking charge of your work-related issues?").

Results

Confirmatory factorial analyses of measures

Prior to conducting the main analyses, data was examined to confirm the factorial structure of each measure on the baseline sample ($N = 217$). Several confirmatory analyses (CFA) were performed. Several goodness-of-fit measures were used to determine the acceptability of the models. The Root Mean Square Error of Approximation (RMSEA), the Standardized Root Mean Square Residual (SRMR), the Comparative Fit Index (CFI), and the Tucker-Lewis Index (TLI) were used. Values close to or >.95 for CFI and TLI, and <.08 for SRMR and RMSEA are acceptable (Hu & Bentler, 1999; Steiger, 2007). The measure of workplace well-being was theoretically composed of four dimensions (Biétry & Creusier, 2013) including one second-order factor (Biétry & Creusier, 2015). In accordance with prior research, we conducted a second-order CFA.

The four factors of workplace well-being are grouped in one second-order factor. The fit indices showed acceptable values: (χ^2 (50, 217) = 82.7, $p < .01$; CFI = .95; TLI= .94; SRMR = .07; RMSEA = .068, 90%C.I. [.037, .096]. To respect the nature of our data and the theoretical and empirical construct of workplace well-being (Biétry & Creusier, 2013, 2015), we used the second-order factor.

The burnout was assessed through the IFEP composed of two dimensions (Poirier et al., 2023). We test this factorial structure with CFA, and

the results showed a good fit: χ^2 (89, 217) = 181.7, $p < .001$; CFI = .97; TLI = .96; SRMR = .040; RMSEA = .069; 90%C.I. [.055, .084]. We conserved the two-dimension structures for subsequent analysis according to previous study (Poirier et al., 2023): interpersonal tension and exhaustion.

The satisfaction and frustration of basic psychological needs at work is measured with an adaptation of the Basic Psychological Needs Satisfaction and Frustration (BPNSF) scale (Schultz et al., 2015) including six factors (three for frustration and three for satisfaction). We test the six factors structure according to prior research in the French context (Chevrier & Lannegrand, 2022). The CFA results showed an accepted fit: χ^2 (237, 217) = 445.23; $p < .001$; CFI = .93; TLI = .92; SRMR = .06; RMSEA = .064; 90%C.I. [.054, .073]. We used the six factors in our subsequent analysis.

Finally, the perceived stress was apprehended through two dimensions of the PSS scale (Cohen et al., 1983; adapted in French by Bellinghausen et al., 2009). The CFA confirm these two dimensions with a good fit: χ^2 (34, 217) = 57.9; $p < .01$; CFI = .98; TLI = .97; SRMR = .043; RMSEA = .057; 90%C.I. [.030, .081]. We conserved these two dimensions (perceived helplessness and perceived self-efficacy) for our main analysis.

Differences between full and partial participants

Second, to identify differences between participants who completed all three questionnaires (full participants) and those who completed only one or two of them (partial participants), we carried out several ANOVA and χ^2 tests on the socio-demographic variables. In total, 77 participants responded to all three questionnaires and 140 did not. Analyses did not show differences between these participants for age (F(1, 215) = 0.037, p = .848), gender (χ^2(1, 217) = 0.545, p = .761), diploma (χ^2(2, 217) = 0.71, p = .703) or contract type (χ^2(4, 217) = 4.1, p = .393). However, our analyses showed that middle managers drop out less than other work categories (χ^2(3, 217) = 12.4, $p < .01$).

We also used several ANOVA tests to identify these differences on the psychological variables included at Time 1: workplace well-being (F(1, 215) = 0.017, p = .644), interpersonal tension (F(1, 215) = 0.425, p = .515), exhaustion (F(1, 215) = 0.293, p = .589), satisfaction of autonomy (F(1, 215) = 0.056, p = .814), satisfaction of competence (F(1, 215) = 0.64, p = .425), satisfaction of relatedness (F(1, 215) = 2.21, p = .139), frustration of autonomy (F(1, 215) = 0.946, p = .332), frustration of competence (F(1, 215) = 0.147, p = .702), frustration of relatedness (F(1, 215) = 0.201, p = .654), perceived helplessness (F(1, 215) = 0.397, p = .529) and perceived self-efficacy (F(1, 215) = 0.477, p = .49). The overall analysis concluded that there were no differences between the groups. The participants who

completed all three questionnaires and those who did not were similar regarding the variables in our study.

Differences between groups (experimental vs. control)

Third, regarding potential differences between the experimental group and the control group for the full participants at Time 3 ($N = 77$), several ANOVA and χ^2 tests were conducted on demographic variables: age ($F(1, 75) = 0.215$, $p = .644$), gender ($\chi^2(1, 77) = 0.998$, $p = .318$), diploma ($\chi^2(2, 77) = 3.72$, $p = .59$), contract type ($\chi^2(4, 77) = 1.6$, $p = .444$) or work categories ($\chi^2(3, 77) = 2.9$, $p = .395$).

In addition, we conducted multiple ANOVA tests to compare these participants ($N = 77$) in function of their group (experimental and control) on the variables included in this study measuring at Time 1: workplace well-being ($F(1, 75) = 0.22$, $p = .634$), interpersonal tension ($F(1, 75) = 1.93$, $p = .169$), exhaustion ($F(1, 75) = 0.42$, $p = .518$), satisfaction of autonomy ($F(1, 75) = 0.04$, $p = .846$), satisfaction of competence ($F(1, 75) = 0.70$, $p = .406$), satisfaction of relatedness ($F(1, 75) = 0.94$, $p = .337$), frustration of autonomy ($F(1, 75) = 0.09$, $p = .762$), frustration of competence ($F(1, 75) = 0.00$, $p = .995$), frustration of relatedness ($F(1, 75) = 1.34$, $p = .252$), perceived helplessness ($F(1, 75) = 0.06$, $p = .806$) and perceived self-efficacy ($F(1, 75) = 1.93$, $p = .169$). The overall analysis concluded that there were no differences between the groups.

Finally, we observed the use of the application by our participants. Participants in the experimental group ($n = 27$) used the application from once (to take the well-being test) to over 200 times (including reading content and booking appointments) with a mean at 110 activities ($SD = 61$). Our results showed no differences in application use according to the level of workplace well-being ($t(25, 27) = -0.99$, $p = .327$), interpersonal tension ($t(25, 27) = 0.0002$, $p = .993$), exhaustion ($t(25, 27) = 0.01$, $p = .645$), satisfaction of autonomy ($t(25, 27) = 0.12$, $p = .131$), satisfaction of competence ($t(25, 27)) = 0.05$, $p = .312$), satisfaction of relatedness ($t(25, 27) = 0.07$, $p = .352$), frustration of autonomy ($t(25, 27) = -0.07$, $p = .382$), frustration of competence ($t(25, 27) = -0.06$, $p = .377$), frustration of relatedness ($t(25, 27) = -0.03$, $p = .367$), perceived helplessness ($t(25, 27) = -0.03$, $p = .724$) and perceived self-efficacy ($t(25, 27) = -0.02$, $p = .705$).

Main analyses

Our main analysis consisted of several repeated measures ANOVA tests with Time (1, 2, and 3) as the within-subjects' factors and Groups

Table 2. Means and standard deviation by group and time, and results of analyses for each variable ($N = 77$).

	Experimental group ($n = 27$)			Control group ($n = 50$)			ANOVA (repeated measures)		
	Means T1(SD)	Means T2(SD)	Means T3(SD)	Means T1(SD)	Means T2(SD)	Means T3(SD)	Groupe	Time	Groupe*time
Workplace well-being									
1. WWB	42.56 (10.01)	45.33 (10.59)	46.56 (11.70)	43.80 (11.58)	42.22 (13.21)	42.52 (13.67)	$F = 0.56$ $p = .46$	$F = 0.91$ $p = .41$	$F = 4.56$ $p = .012$
Burnout dimensions									
2. Interpersonal Tension	2.17 (1.53)	1.66 (1.20)	1.77 (1.23)	2.02 (1.41)	2.06 (1.53)	2.15 (1.61)	$F = 0.33$ $p = .57$	$F = 1.54$ $p = .22$	$F = 3.19$ $p = .04$
3. Exhaustion	2.11 (1.42)	1.76 (1.23)	1.90 (1.50)	2.35 (1.67)	2.34 (1.60)	2.26 (1.78)	$F = 1.34$ $p = .25$	$F = 0.99$ $p = .34$	$F = 0.80$ $p = .44$
Need satisfaction and frustration at work									
4. Frustration autonomy	11.04 (3.86)	11.37 (4.33)	11.89 (4.15)	11.36 (4.72)	11.14 (4.33)	11.94 (4.86)	$F = 0.03$ $p = .96$	$F = 2.62$ $p = .08$	$F = 0.41$ $p = .67$
5. Frustration competence	8.82 (3.15)	7.63 (3.48)	8.33 (3.41)	8.82 (3.89)	8.32 (3.59)	9.2 (4.22)	$F = 0.14$ $p = .71$	$F = 4.40$ $p = .01$	$F = 0.85$ $p = .43$
6. Frustration relatedness	9.89 (4.34)	8.22 (3.18)	8.52 (3.73)	8.68 (4.41)	8.92 (4.63)	8.96 (4.38	$F = 0.02$ $p = .89$	$F = 2.49$ $p = .09$	$F = 3.91$ $p = .026$
7. Satisfaction autonomy	12.30 (3.75)	12.48 (3.47)	12.48 (3.78)	12.48 (4.06)	12.20 (3.54)	12.30 (3.56)	$F = 0.01$ $p = .92$	$F = 0.01$ $p = .99$	$F = 0.18$ $p = .83$
8. Satisfaction competence	15.93 (2.43)	16.11 (3.19)	15.04 (2.78)	15.36 (3.03)	15.08 (3.19)	14.74 (3.24)	$F = 0.67$ $p = .41$	$F = 4.72$ $p = .01$	$F = 0.63$ $p = .53$
9. Satisfaction relatedness	13.44 (3.52)	14.19 (4.29)	15.22 (3.41)	14.36 (4.18)	13.90 (4.09)	13.82 (3.84)	$F = 0.07$ $p = .79$	$F = 1.87$ $p = .16$	$F = 5.85$ $p = .004$
Perceived stress at work									
10. Perceived helplessness	6.44 (2.94)	5.15 (3.30)	5.59 (3.51)	5.40 (3.25)	5.86 (3.25)	5.80 (3.94)	$F = 0.61$ $p = .44$	$F = 3.63$ $p = .03$	$F = 2.66$ $p = .08$
11. Perceived self-efficacy	11.78 (3.86)	9.37 (4.07)	11.22 (4.49)	12.06 (5.23)	11.52 (4.46)	10.96 (5.22)	$F = 0.43$ $p = .62$	$F = 0.15$ $p = .81$	$F = 3.36$ $p = .011$

(Experimental, Control) as the between subjects' factor. We conducted separate ANOVA for each variable. To confirm the effect of our intervention, significant interaction effects are required. The eta-square (η^2) index reports the effect size of an interaction, according to Cohen (1988), an eta-square 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 of our ANOVA tests revealed significant interaction effects between group and time for several variables (all results are presented in Table 2): workplace well-being ($F(2, 150) = 4.56$, $p < .05$, $\eta^2_g = .010$), interpersonal tension ($F(2, 150) = 3.19$, $p < 0.05$, $\eta^2_g = .010$), satisfaction of relatedness ($F(2, 150) = 5.85$, $p < .01$, $\eta^2_g = 0.013$), frustration of relatedness ($F(2, 150) = 3.91$, $p < .05$, $\eta^2_g = .010$), and perceived self-efficacy ($F(2, 150) = 3.35$, $p < .05$, $\eta^2_g = .011$).

To observe the evolution of these variables between each time for both groups, we used post-hoc analysis (pairwise t-tests with Bonferroni adjustment). The results showed significant differences for workplace well-being scores uniquely for the experimental group between T1 and T2 ($t(26) = 2.38$, $p < .05$) and T1 and T3 ($t(26) = -2.09$, $p < .05$). This pattern is also observed for the level of interpersonal tension for T1-T2 ($t(26) = -2.19$, $p < .05$) differences and T1-T3 differences ($t(26) = 2.71$, $p < .05$). We also observed differences in the experimental group between T1 and T2 for the levels of frustration of relatedness ($t(26) = 2.47$, $p < .05$) and perceived self-efficacy ($t(26) = 2.19$, $p < .05$). And the scores of satisfaction of relatedness evolved significantly for the experimental group between T1 and T3 ($t(26) = -3.14$, $p < .01$).

To go further in our analyses, we observed the effect of the number of activities on the application by the application on our variables. A multivariate analysis of variance (MANOVA) revealed only an effect on the dimension of perceived self-efficacy (one of the PSS dimensions). The more activity participants have on the application, the less stress they feel about their ability to act (ß = − 0.03, t (25, 27) = −2.6, $p < .05$, $R^2 = .15$).

Discussion

The enhancement of well-being and mental health in recent decades has emerged as a significant concern for both companies and society. Legislation and regulations now incorporate provisions mandating companies to implement measures ensuring favorable working conditions (Cefaliello, 2022; Leka et al., 2017).

The emergence of novel technologies has facilitated the development of innovative tools that respond to individual needs while adopting a holistic

approach. These positive technologies (Grossi et al., 2020) serve as new levers for companies to promote workplace well-being.

Various studies have highlighted the positive effects of PT on well-being and mental health in the workplace (Adhyaru & Kemp, 2022; Gradito Dubord et al., 2022; Johnson et al., 2020; Mantello et al., 2023). However, not all these technologies are equally effective (Carrouel et al., 2023), and it is important to be able to verify the consequences of their use.

The aim of our study was to evaluate the impact of a digital application on employees' well-being (*Moodwork*). This application is part of a long-term intervention, granting employees unrestricted access over extended periods to utilize it at their discretion. It is based on scientific theories (e.g., JD-R model (Demerouti et al., 2001) and includes scientifically validated assessment tools (Bebiroglu et al., 2021; Poirier et al., 2021, 2023). However, the efficacy of this application had not been proven on employees' well-being and mental health.

After 6 months, our study provides valuable insights into the effectiveness of digital applications in promoting workplace well-being, addressing burnout and stress, and meeting basic psychological needs. Repeated measures analyses conducted enabled the identification of several effects consistent with our hypotheses. Indeed, all significant results demonstrate that using the application enhances workers' well-being (increase well-being and decrease ill-being).

Findings reveal a significant interaction between the experimental group (those utilizing the application) and time concerning workplace well-being. This result suggests that the digital intervention had a tangible positive effect on employees' overall well-being within the workplace context. Access to the application enables the employee to work on their work environment over time, involving both colleagues, their manager, and their organization (Biétry & Creusier, 2013). Through this outcome, *Moodwork* emerges as an application whose person-centered approach fosters an overall improvement in well-being within the work environment. The conceptualization of the measure of well-being used is also defined in terms of the relationship with the work environment (Biétry & Creusier, 2013). Indeed, the effects of using this application seem to be significant in terms of the employees' relationships can have with their colleagues and, more broadly, their work environment. Thus, users appear to be more positive about their relationships.

Furthermore, the study highlights the impact of the digital application on reducing interpersonal tension and frustration, particularly in relation to the relatedness need and interpersonal tensions related to burnout syndrome (Poirier et al., 2023). By providing resources and support tailored to these needs, digital interventions have the potential to mitigate workplace

stressors and enhance interpersonal dynamics. Both in terms of satisfying needs and reducing burnout, the variables affected by this use are those of interpersonal relations. These elements demonstrate the importance of taking an interest in relationships in the professional context. Recent health crises (i.e., COVID-19) have highlighted the need for relationships, and the importance they represent even in the professional world. ICT is one of the levers to create good relations and reduce isolation and depression (Shapira et al., 2021). Conversely, the non-significant results are above all linked to the feelings of individuals or their work organization, with less involvement of the environment, particularly the human environment at work. This application seems to be able to support employees in managing interactions, but less so in organizing their work and not so much with the work itself.

In addition, in an increasingly technological working environment, the use and mastery of new technologies can be a source of stress (Moreira-Fontán et al., 2019). Giving employees access to a digital tool enabling them to develop their skills and workplace well-being could be a way of reducing stress. Our results point in this direction as the utilization of the application appears to reduce stress related to the perception of self-efficacy (Bellinghausen et al., 2009). We can suppose that the use of the application has improved the need for mastery of new technologies, thus increasing self-efficacy (Bandura, 2002). This improvement in mastery, while guaranteeing a form of autonomy, would thus lead to an overall reduction in stress and increase job engagement (Moreira-Fontán et al., 2019). So, the effect of positive technologies could be as much the result of an increased sense of mastery of the technologies as the content of those technologies themselves.

Finally, the longitudinal design of our study made it possible to observe the participants' development over an extended period (6 months), indicating a lasting effect of the intervention. These effects indicate the potential for long-term benefits associated with digital well-being interventions (Hamar et al., 2015). The use of the application has shown an impact that has not diminished over time. It tended either to increase again compared to T1 or to stabilize compared to T2. This finding suggests PT could be useful in primary prevention.

These applications could play a preventive role by supporting employees over the long term, guarding against the emergence of risks.

In addition, our study had observed the use of the application, contrary to other studies (e.g. Gradito Dubord et al., 2022), we recorded the number of uses made by participants throughout the study period. We observed a wide variety of uses (from 1 to 200 times). However, use of the application does not appear to have a significant impact on the variability of employee

well-being and mental health. Only the level of stress related to their ability appeared to be linked to application used. The more participants used the application, the less stress they felt. These results tell us that while repetitive use and the implementation of several sessions of use will reduce stress, knowing that we have access and go on the application even sporadically may also have an effect. A free and unrestricted access to PT will increase employees' well-being in the long term.

The results of this study demonstrate once again that the use of new technologies can help improve employee well-being. PTs are tools that can take on different aspects, but which appear to be relevant in today's work contexts. Whether it's feedback tools (Gradito Dubord et al., 2022), artificial intelligence-based management aids (Mantello et al., 2023) or virtual reality tools (Adhyaru & Kemp, 2022), PTs are solutions to be considered in managing and supporting employees in their day-to-day work.

However, our results also show that the effects remain weak. Indeed, the use of an application can reinforce certain individual resources, but not all factors. The JD-R model (Demerouti et al., 2001) shows that there are many different types of resources available to cope with different demands. The use of PT may be one of these resources, but it is not the only one. Indeed, to use these technologies, basic conditions are necessary, such as access to IT tools and Internet networks, as well as the ability to use and be trained in the use of these tools (Adhyaru & Kemp, 2022). In addition, some profiles may be more sensitive to this type of technology. We've observed a higher level of abandonment on the part of middle managers. These professions may have less time to devote to individual tools or may not find the elements adapted to their daily lives. Better personalization of these technologies could increase user engagement. So, although PTs appear to be relevant and useful tools in the daily lives of employees, they cannot replace other interventions and support for workers.

Limitations

While the results are promising, several challenges and opportunities for future research emerge. Firstly, the study primarily focused on subjective self-report measures, which may be susceptible to biases such as social desirability and response distortions. Future research could incorporate objective measures, such as physiological indicators of stress (McEwen & Stellar, 1993), to provide a more comprehensive understanding of the intervention's impact.

Additionally, the study predominantly recruited participants from France, limiting the generalizability of the findings to other cultural and organizational contexts. Indeed, cultural context can play a role in the

apprehension of this type of intervention. Decades of studies have shown people in collectivist cultures are more likely to conform to their group's expectations compared to those in individualist cultures (Mantello et al., 2023). At the opposite, in Western culture, people were more concerned about self-autonomy and privacy than in East Asia (Whitman, 1985). The use and the effect of an individual application, such as *Moodwork,* could depend on the cultural context. Cross-cultural studies examining the efficacy of digital well-being interventions in diverse settings would help elucidate the universality of these effects and identify potential cultural moderators.

Furthermore, we can observe an overrepresentation of women within our sample (13% of men) that does not reflect the repartition observed in the country of work of our participants. Indeed, according to the International Labor Office and "*Institut National de la Statistique et des Etudes Economiques*" (Insee Références, 2020), women would only represent between 46 and 50% of the working population in Europe. In the same way, the percentage of participants dropping out is not the same for each position. The overrepresentation of such work positions (e.g., manager) could bias the results. Regarding these repartitions, further studies should be carried out on a wider range of populations to verify our results.

Finally, a limitation that may also have an impact on the effects observed is linked to participants' expectations. The fact that effects were mainly observed between T1 and T2, and not between T2 and T3, may call into question the methodology used. Indeed, participants in the experimental group had access to an application that could be compared to individual coaching. This specific support could have created a bias (e.g., Hawthorne effect). To overcome this potential bias, all participants (experimental and control) should have access to an application, one related to workplace well-being, the other unrelated.

Conclusion

In conclusion, the integration of digital applications is promising as a viable strategy for promoting workplace well-being and mitigating the adverse effects of stress and burnout (Botella et al., 2012; Grossi et al., 2020). By leveraging technology to deliver personalized interventions tailored to employees' needs, organizations can cultivate a supportive work environment conducive to optimal performance and employee satisfaction. In addition, these applications could have an impact on the manager's role promoting self-management and self-leadership (Le Vaillant & Dumas, 2023). However, the effects of PT and workplace well-being seem complex and understanding the relationships between the various sources of well-

being and ill-being at work (Demerouti et al., 2001) regarding the emergence of new technologies appears necessary to propose tools adapted to employees' daily lives, while avoiding potential deleterious consequences. To go further, we need to validate these findings across diverse populations and settings, while also addressing the manager's role.

Disclosure statement

The authors of the study are employees of the MOODWALK company, owner of the Moodwork application.

Data availability statement

https://osf.io/x8n5u/?view_only=c17284cfe2604c159f32e83bcb38b5f8.

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