European Journal of Work and Organizational Psychology

ISSN: 1359-432X (Print) 1464-0643 (Online) Journal homepage: www.tandfonline.com/journals/pewo20

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To cite this article: Marc-Antoine Gradito Dubord, Marylène Gagné, Philippe Dubreuil & Jacques Forest (30 Sep 2025): Finding your Totem: unveiling the effects of a positive technology intervention on employees' well-being and perceived team effectiveness with self-determination theory, European Journal of Work and Organizational Psychology, DOI: 10.1080/1359432X.2025.2566811

To link to this article: https://doi.org/10.1080/1359432X.2025.2566811

EUROPEAN JOURNAL OF WORK AND ORGANIZATIONAL PSYCHOLOGY
https://doi.org/10.1080/1359432X.2025.2566811

Finding your Totem: unveiling the effects of a positive technology intervention on employees' well-being and perceived team effectiveness with self-determination theory

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ABSTRACT

Virtual work presents numerous benefits in contemporary workplaces yet concurrently might pose substantial challenges, notably impacting employees' well-being and team dynamics. This study investigated the Totem activity, a digital gamified team exercise designed to promote employees' strengths. Drawing on Self-Determination Theory (SDT), it is proposed that the intervention positively influences employees' well-being and perceived team effectiveness by enhancing need satisfaction and autonomous motivation. Using an experimental design, our study examined the impact of the activity on 58 teams ($n = 395$) and compared it with a wait-list control group of seven teams ($n = 67$). The data were gathered pre- and post-intervention for both groups, with the experimental group answering a third questionnaire 3 weeks post-intervention ($n = 202$). Multilevel analyses revealed that the experimental group displayed notable increases in all the studied variables post-intervention compared to the control group. Longitudinal analyses using a latent change score model showed that variations in need satisfaction during the Totem activity predicted changes in work motivation, psychological well-being, and team effectiveness across 3 weeks. This study shows that a digital strengths-based team intervention like Totem is an affordable, scalable, and self-directed way to support employees' psychological needs and, thus, overcome challenges associated with virtual work.

ARTICLE HISTORY
Received 27 November 2024
Accepted 22 September 2025

KEYWORDS
Strengths interventions; positive technology; self-determination theory; psychological well-being; perceived team effectiveness

Introduction

Virtual work, which allows employees to collaborate across geographical and temporal boundaries using technology, can leverage diverse expertise, improve work–life balance, and reduce organizational costs (Raghuram et al., 2019; Rudolph et al., 2021), but it can also impact employees' well-being (Rudolph et al., 2021; Standaert et al., 2023; Tarafdar & Stich, 2021) by decreasing informal interactions, increasing the frequency of technology-mediated interruptions while impairing effective communication, and limiting feedback and career support (Cooper & Kurland, 2002; Coyne et al., 2017; Stich, 2020). These issues can exacerbate other existing job challenges, leading to increased job stress (Standaert et al., 2023; Stich et al., 2019), reduced job satisfaction (Orhan et al., 2016), and decreased satisfaction with supervisors (Mulki & Jaramillo, 2011; Pinsonneault & Boisvert, 2001). Another concern is the impact of virtual teamwork – collaborative work facilitated by communication technologies – on team effectiveness (Mai et al., 2020; Maynard et al., 2019; Rudolph et al., 2021). Risk factors include a heightened need for trust, increased potential for conflict, reduced managerial support, feedback delays, and technological challenges (Breuer et al., 2016; Hoch & Kozlowski, 2014; Maynard et al., 2019).

Recent discussions in I/O psychology emphasize the need for digital interventions to mitigate the impact of virtual work on individual and group dynamics (Mai et al., 2020; Rudolph et al., 2021; van Woerkom et al., 2021). These interventions offer easy access, automation, and scalability, making them particularly suitable for virtual teams. However, the rigorous testing of digital tools has not kept pace with technological advancements, with only 2.08% of platforms supported by research (Lau et al., 2020). For instance, a review of workplace digital interventions for health and safety revealed major validation gaps, with only 13 of 37 platforms being theory-based and just two scientifically validated (Karlsen et al., 2022). While this gap is concerning, positive technology (PT) – which integrates psychological theory with digital innovation – shows promise. PT

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seeks to design and evaluate digital platforms that foster positive experiences (Riva et al., 2019), and studies suggest digital tools can enhance well-being, gratitude, and optimism (Parks et al., 2013; Runyan et al., 2013).

The present study examined Totem (https://app.Totemteam.com/), a digital team-based activity grounded in two theoretical frameworks. Through this gamified platform, team members identify and recognize each other's strengths using symbolic Totems. Unlike most digital workplace interventions that lack theory (Karlsen et al., 2022), Totem draws on the Character Strengths 360° feedback method (Niemiec, 2014; Peterson & Seligman, 2004). Recent workplace research suggests that strength-oriented feedback can effectively promote psychological well-being (Gradito Dubord et al., 2022). Totem's second theoretical foundation lies in its structured feedback format, which prompts employees to describe colleagues' strengths with specific behavioural examples. This approach aligns with research on descriptive and promotion-oriented feedback, shown to enhance motivation (Carpentier & Mageau, 2013) and virtual team effectiveness (Handke et al., 2022). Given the challenges of virtual work and the lack of theory-driven digital interventions, this study investigates Totem as a tool for enhancing employee well-being and perceived team effectiveness. To explain these effects, we draw on Self-Determination Theory (SDT; Ryan & Deci, 2017), which clarifies how strength-based feedback may satisfy basic psychological needs and foster autonomous motivation, thereby improving both individual well-being and perceptions of team effectiveness. Although team effectiveness can be conceptualized at the group level, we assess it here at the individual level, focusing on members' personal evaluations of team functioning and goal achievement.

Theoretically, this study enriches the literature on positive technology within the field of organizational psychology (Gradito Dubord et al., 2022; Harzer & Ruch, 2016; van Woerkom et al., 2021), illuminating an underexplored area as most digital platforms lack empirical foundations (Karlsen et al., 2022; Lau et al., 2020). It also contributes to the literature on positive psychology interventions, which are often criticized for lacking robust theoretical foundations (van Zyl et al., 2024), by integrating SDT to support their potential benefits. Additionally, it makes a substantial contribution to SDT by examining how team-based interventions can influence individual-level outcomes, including need satisfaction, autonomous motivation, and perceived team effectiveness. Recent theoretical developments in self-determination theory suggest that team-level autonomous motivation may enhance collective effectiveness (Grenier et al., 2024), yet empirical evidence supporting these propositions remains scarce. Although focused on individual-level perceptions, this study advances our understanding of team effectiveness by examining how a strength-based digital intervention influences need satisfaction, autonomous motivation, and perceived team effectiveness, thereby providing initial empirical support for these theoretical propositions. While prior research has shown that team-based SDT interventions can enhance individual need satisfaction and motivation (e.g., Jungert et al., 2018), this study extends previous work by examining how these improvements influence individuals' perceptions of team effectiveness and by testing these relationships in virtual collaboration contexts, providing support for SDT's applicability in remote and hybrid team settings. Practically, it helps practitioners and organizations by presenting empirical evidence regarding a digital intervention that has been developed by the private sector. Moreover, it provides an accessible and scalable solution to address the challenges of virtual work on employees' well-being and team effectiveness. In the following sections, we review the literature on strength-based interventions in the workplace and examine the key factors that contribute to their effectiveness.

Strengths-based interventions in the workplace

A character strength is defined as "a natural capacity for optimal functioning and performance stemming from particular ways of thinking, feeling, or behaving" (Linley et al., 2006, p. 88). Typical strengths-based interventions involve assessing, harnessing, and developing an individual's top five strengths, often termed "signature strengths," via tools like the Values in Action (VIA) questionnaire (Ruch et al., 2020) or through 360-degree feedback mechanisms (Niemiec, 2014). Meta-analytic evidence highlights that strengths-based interventions primarily enhance psychological well-being (Schutte & Malouff, 2018), with benefits lasting weeks or months (Bu & Duan, 2019; Carr et al., 2024; Duan et al., 2019). Empirical studies indicate positive outcomes in the workplace (Miglianico et al., 2019) including improved work performance (Peláez et al., 2020), realization of one's "calling" (Harzer & Ruch, 2016), increased psychological capital (Meyers & van Woerkom, 2017), enhanced self-efficacy (van Woerkom & Meyers, 2019), and work engagement (Bakker & van Wingerden, 2021).

There is a recognized need to assess whether these benefits extend to team dynamics and effectiveness (van Woerkom et al., 2021). Applying strengths-based interventions in team settings could offer significant

advantages. For example, individuals who identify and embrace their strengths before joining a team are more likely to contribute effectively and boost creativity through increased social value and better information sharing (Lee et al., 2016). A diverse representation of character strengths and team roles significantly improves both individual and team performance (Gander et al., 2020), while specific team roles lead to more job satisfaction by influencing the use of character strengths (Ruch et al., 2018). This body of research underscores the importance of embedding strengths-based practices within team dynamics to enhance overall team effectiveness.

Despite these benefits, strengths-based interventions face criticism. Practically, their reliance on financial investments in psychometric assessments, expert consultations, and specialized training reduces access and sustainability (Bolier & Abello, 2014; Peláez et al., 2020; van Woerkom et al., 2021). Theoretically, a primary criticism is the lack of solid theoretical grounding and conceptual clarity (van Zyl et al., 2024) that create concerns around the framing, investigation, and implementation of these interventions (Brown et al., 2013); research on strengths-based interventions in organizational settings should rely on robust conceptual models grounded in theory to effectively demonstrate their impact (Bakker & van Woerkom, 2018; Littman-Ovadia et al., 2021; Miglianico et al., 2019). To address this, our study's hypotheses are based on Self-Determination Theory (SDT) to investigate the effectiveness of strengths-based interventions in workplace settings.

Using self-determination theory to study a positive technology intervention

A recurrent suggestion among calls to develop a theoretical based around is the SDT framework because it can highlight the psychological and motivational mechanisms underlying their benefits (Bakker & van Woerkom, 2018; Ghielen et al., 2018; Miglianico et al., 2019; Quinlan et al., 2012; van Woerkom et al., 2021). SDT is a macro-theory of human motivation that proposes humans have three fundamental psychological needs that are crucial for continuous psychological growth, engagement, and well-being (Deci & Ryan, 2000). The needs include autonomy (feeling volitional), competence (mastering one's environment and working competently), and relatedness (the longing for connection and belongingness) (Ryan & Deci, 2017). Within the workplace, SDT research shows that all three needs are important to work outcomes (Van den Broeck et al., 2016).

SDT posits that satisfying psychological needs promotes the internalization of the value of an activity, operationalized as motivations behind individual engagement. These range from amotivation (lack of motivation) to extrinsic motivations with varying degrees of internalization: external regulation (non-internalized, driven by rewards or punishment avoidance), introjected regulation (partially internalized, motivated by ego involvement), and identified regulation (more internalized, reflecting personal meaning). Intrinsic motivation arises from genuine interest and enjoyment. Motivations are classified as controlled (external, introjected) or autonomous (identified, intrinsic), with research showing that autonomous motivation, supported by need satisfaction, leads to better work outcomes (Van den Broeck et al., 2016, 2021).

Studies have shown that interventions helping employees identify and utilize their strengths contribute to fulfilling their psychological needs (Linley et al., 2010; Moore et al., 2023), including single-session interventions (Gradito Dubord et al., 2022; Moore et al., 2023). Strength-oriented feedback might foster autonomy by aligning work tasks with personal values, thereby enhancing self-direction and empowerment (Dubreuil et al., 2016). It may also bolster competence by promoting mastery and emphasizing desirable behaviours (Bakker & van Woerkom, 2018). Additionally, strengths-oriented feedback enhances relatedness by strengthening relationships between senders and recipients (Gradito Dubord et al., 2022). Research indicates that the act of giving, such as giving strength-oriented feedback, significantly satisfies the need for social connection for both the giver and receiver (Martela & Ryan, 2016). Moreover, strengths-based interventions can enhance intrinsic motivation by aligning tasks with individuals' skills and interests, fostering enjoyment and fulfilment (Littman-Ovadia et al., 2017), and identified motivation by highlighting the significance of leveraging one's strengths, encouraging engagement in tasks for their meaningfulness rather than immediate pleasure (Harzer & Ruch, 2016).

Research in positive psychology has consistently shown that employing strengths enhances psychological well-being (Bakker & van Woerkom, 2018; Ghielen et al., 2018; Miglianico et al., 2019; Quinlan et al., 2012; van Woerkom et al., 2021). A meta-analysis of 14 studies found that strengths-based interventions significantly improve mental health, resulting in moderate to large effects on positive affect, reduced depression, and overall life satisfaction (Schutte & Malouff, 2018), with benefits lasting for weeks (Bu & Duan, 2019; Duan et al., 2019). These results can be explained by the fact that strengths interventions promote positive emotions and life

satisfaction, which align with the hedonic aspect of well-being (Miglianico et al., 2019). They also foster a sense of purpose and fulfilment, which aligns with the eudaimonic aspect of well-being (Harzer & Ruch, 2016). Experimental research indicates that strengths-oriented feedback significantly enhances psychological well-being over time (Gradito Dubord et al., 2022).

Only one previous quasi-experimental study of a Positive Technology called *Listen Léon* demonstrated a direct relationship between strengths-oriented feedback and need satisfaction, autonomous motivation, and well-being (Gradito Dubord et al., 2022), but this platform was not game-based and focused solely on individual employees, rather than employees working within team contexts. We argue that the strengths-oriented feedback provided during the Totem intervention will directly satisfy participants' basic psychological needs through the game experience itself. Consistent with SDT's theoretical framework, this enhanced need satisfaction experienced during the intervention should promote autonomous motivation development over time. When employees act out of autonomous motivation, they experience immediate pleasure because activities align with their interests, while also gaining lasting satisfaction from pursuing goals they genuinely value (Ryan & Deci, 2017). Therefore, we formulated the following hypotheses (see Figure 1).

Hypothesis 1: Participants engaging in the Totem activity will report increased levels of need satisfaction after the activity compared to those in a control group, with these effects persisting 3 weeks post-activity.

Hypothesis 2: Participants involved in the Totem activity **(a)** will report increased levels of autonomous motivation after the activity compared to participants in a control group, with these effects lasting 3 weeks post-activity **(b)** via increased need satisfaction.

Hypothesis 3: Participants engaged in the Totem activity **(a)** will report enhanced psychological well-being after the activity, compared to those in a control group, with these effects persisting 3 weeks post-activity **(b)** via increased need satisfaction and autonomous motivation.

Virtual work environments pose challenges to team effectiveness, such as feelings of isolation, diminished trust, reduced feedback, and weakened team identity (Breuer et al., 2016; Hoch & Kozlowski, 2014; Maynard et al., 2019). Research indicates that strengths-based interventions can enhance individuals' contributions to their teams by increasing creativity, fostering positive roles, and improving information sharing (Gander et al., 2020; Lee et al., 2016; Ruch et al., 2018). The Totem activity is designed to provide employees with structured opportunities to describe their colleagues' strengths through the VIA classification framework, using specific behavioural examples from their work interactions. This approach aligns with research on "descriptive feedback" and "promotion-oriented feedback," which has demonstrated positive effects on team effectiveness (Carpentier & Mageau, 2013). A review of 59 studies on feedback characteristics found that providing feedback anchored in work-related actions and insights into psychological states related to tasks, such as strengths, significantly enhances how individuals perceive and contribute to their virtual team's functioning team effectiveness (Handke et al., 2022). Thus, we propose that participation in Totem will significantly influence perceived team effectiveness,

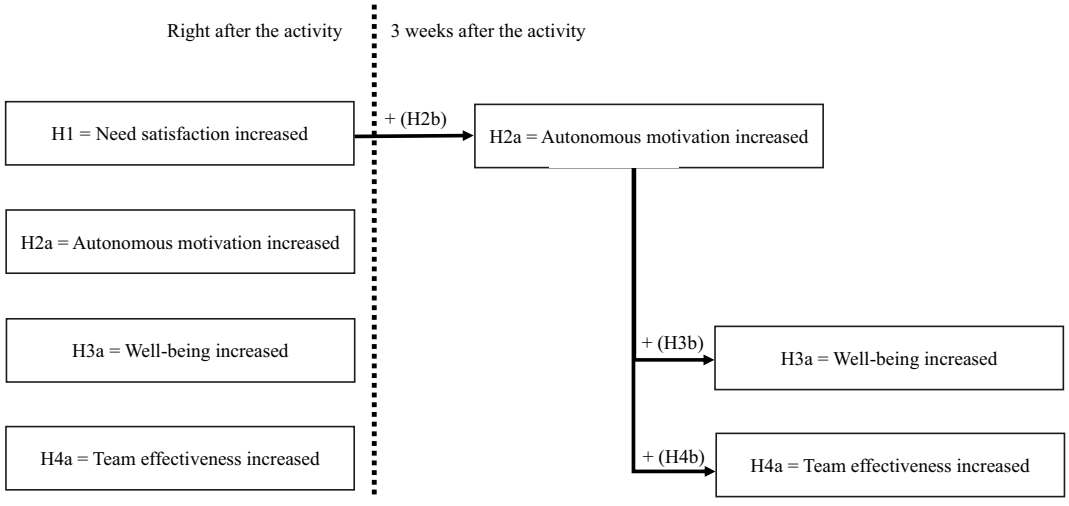

Figure 1. Conceptual framework of this study grounded in self-determination theory.

with effects sustained for 3 weeks post-activity (Hastings et al., 2018; Marasi, 2019). Recent theoretical propositions have applied SDT to team dynamics, emphasizing the importance of supporting team members' psychological needs to foster identification, autonomous motivation, and, ultimately, improved team effectiveness (Grenier et al., 2024). Our study represents a first step towards empirically examining this proposed relationship by approaching it from an individual-level perspective. Specifically, we investigate how individuals' experiences of need satisfaction foster autonomous motivation, which in turn may shape their perceptions of team effectiveness. This perspective is consistent with Grenier et al. (2024), who note that, at the individual level, autonomous motivation is associated with greater information sharing and more persistent goal pursuit (Gagné et al., 2019; Koestner et al., 1999; Sheldon & Elliot, 1998), both of which are likely to influence how individuals evaluate the effectiveness of their team. These considerations inform the development of our final hypotheses.

Hypothesis 4: Participants engaged in the Totem activity **(a)** will report enhanced perceived team effectiveness after the activity, compared to those in a control group, with these effects persisting 3 weeks post-activity **(b)** via increased need satisfaction and autonomous motivation.

Method

Intervention: the Totem activity

Totem is accessible in both English and French at app.Totemteam.com. The number of participants in a Totem game can range from four to nine, with the duration of the game depending on this number. Each participant adds approximately 20 min to the game's length (e.g., a team of six would result in a game lasting about 2 hr). Each game session starts with an introductory instructional video detailing the gameplay mechanics. The core gameplay unfolds over three distinct phases.

During the Animal Card Allocation phase, each player is privately given a set of animal cards that symbolize character strengths (e.g., the camel card represents perseverance). Subsequently, players distribute one animal card to each team member, representing the most important strength they perceive in them. However, the cards newly allocated to each player remain undisclosed at this point.

During the Quality Card Allocation phase, each player privately receives a second set of cards, each representing distinct qualities such as meticulousness, self-assurance, and insightfulness. Players then distribute these cards among their team members based on how well they believe the qualities correspond to each individual.

In the final phase, Totem Revelation, each player reviews the cards they received. Guided by the game, they choose one animal and one quality card that best matches their self-view. Each participant then reveals their chosen Totem to the group. The card assigners explain their choices, providing examples from work when relevant that represent the animals and qualities they assigned to teammates. At this stage, each participant verbally shares and receives feedback based on the choices and explanations provided during the Totem reveal. After all Totem revelations and feedback, the game session concludes.

At the end, participants receive an email with a guide and tools to help integrate their personal Totem into the workplace, such as customized digital wallpapers for team meetings. This initiative aims at positive ongoing awareness and strength use beyond the activity. Figure 2 outlines all the steps of the Totem activity and includes a graphical example of a Totem.

Participants

All study activities were conducted online following ethical approval from the first author's institution. In July 2023, recruitment occurred through a LinkedIn campaign directed at team managers interested in team-building activities. The research team conducted 15-min onboarding sessions with each participating manager to explain the study's purpose, verify inclusion criteria, and outline participation requirements (three surveys and one Totem game session). Managers who consented then invited their teams to participate. The recruitment materials clearly stated that participation involved both research components (surveys) and an interactive team activity (the Totem game). Participants received full details about the study's research purpose, data handling procedures, and voluntary nature of participation through the informed consent form prior to any data collection.

This process yielded a convenience sample of 462 working adults from 22 organizations in Canada and the U.S., encompassing 65 teams with an average size of eight members (minimum = 4, maximum = 12). Since the maximum number of participants allowed in a Totem game is nine, teams with more than nine members were split into two groups. These subgroups conducted the experiment at the exact same time but were treated as part of the same working team in our analyses. All teams enrolled in this study operated virtually. The sample included 236 women, primarily

Step 1 ➔ Teams are created
Step 2 ➔ Virtual animal cards are distributed
Step 3 ➔ Virtual animal cards are chosen
Step 4 ➔ Virtual animal cards are given, and descriptive (i.e. promotion-oriented) feedback is given
Step 5 ➔ Virtual quality cards are distributed
Step 6 ➔ Virtual quality cards are chosen
Step 7 ➔ Virtual quality cards are given, and descriptive (i.e. promotion-oriented) feedback is given
Step 8 ➔ Final TOTEM (constituted by a quality and an animal) is given and celebrated

Figure 2. Graphical display of an example of Totem given to a participant.

French speakers, with 64% aged 25–44 years. About 87% were employed in the service sector or governmental entities, sectors known for their collaborative professional roles that require team-based work and exhibit a significant degree of interdependence for effective task performance.

Procedure

Following enrolment, the teams underwent a randomized assignment, either to an experimental group receiving the Totem activity or an active control group receiving an alternate form of training on character strengths. For all characteristics examined (see Table 1), the proportions reported within each sociodemographic category were comparable between the groups.

Given that the goal of the research was to determine whether there are differences between the short- and long-term effects of the intervention, the control group added value by enabling short-term results comparisons. For this reason, the control group's procedure mirrored the procedure of the experimental group, aligning the first and second surveys right before and after training to maintain comparable procedures. The third measurement time was conducted only in the experimental group, as the study's long-term focus was on analysing longitudinal changes in the intervention group, while the control group served primarily to establish short-term comparative effects.

Table 1. Characteristics of the participants.

		Experimental group ($n = 395$)		Control group ($n = 67$)	
Items	Categories	Frequency	%	Frequency	%
Gender	Male	160	41%	17	25%
	Female	235	69%	50	75%
Age	18–24 years	22	6%	4	6%
	25–34 years	131	33%	20	30%
	35–44 years	127	32%	20	30%
	45–54 years	71	18%	12	17%
	55 years and more	44	11%	12	17%
Year(s) worked on current team	0–1 year	128	32%	17	25%
	1–2 years	91	23%	17	25%
	2–3 years	45	11%	11	16%
	3–4 years	33	8%	5	7%
	4–5 years	24	6%	3	5%
	More than 5 years	74	19%	14	22%
Industry	Private sector services	203	51%	49	73%
	Manufacturing and production	47	11%	6	9%
	Public administration	135	34%	12	18%
	Arts, entertainment, culture	9	2%	0	0%

Note. Composite reliability (CR) indices are reported along the diagonal of the matrix.
*$p < .05$.**$p < .01$.

Given the study's focus on individual-level effects, power analyses and randomization strategy were conducted at the individual level while accounting for the nested structure of participants within teams. We conducted a comprehensive power analysis to determine the optimal sample size for our longitudinal analyses. Based on both previous literature (e.g., Schulz et al., 2021) and Monte Carlo simulations (Zhang & Liu, 2018), we estimated that 400 participants would provide ideal statistical power for our analyses. Subsequently, Monte Carlo simulations (1,000 iterations) were performed in R to determine the minimum control group size needed (ranging from 20 to 100 participants) while maintaining a fixed experimental group size ($n = 400$) to detect a moderate effect size for between group comparisons. Results indicated that 50 control participants would achieve adequate statistical power (0.90). Teams were randomly assigned to either the experimental (58 teams, $n = 395$) or control condition (7 teams, $n = 67$), representing an 11% allocation ratio for team random assignment.

The intervention was conducted between August and September 2023. Each participating team in the experimental condition was required to coordinate with the research team to schedule their Totem activity, ensuring that a pre-intervention questionnaire was sent to them 1 week prior to their activity date. Initially, 58 teams comprising a total of 395 participants ($n = 395$) were enrolled in the experimental group. Post-activity, an immediate survey captured the responses of 273 participants, and a follow-up survey dispatched 3 weeks post-intervention captured the responses of 202 participants, enabling the assessment of the intervention's impact over time. Only teams that completed the Totem activity were included in the post-intervention and follow-up surveys. Our analyses of team-level participation revealed that 4 out of 58 teams (6.9%) had complete non-response at T2, meaning no team members completed the second survey. Thus, attrition primarily occurred at the individual level within teams, rather than entire teams dropping out. The issue of non-response bias is thoroughly addressed in the results section. This relatively low team-level attrition can be attributed to our study design, where the post-intervention survey was automatically triggered upon completion of the Totem activity, ensuring both immediate data collection and that responses reflected participants' complete intervention experience.

Seven teams in the control group participated in an online activity focused on positive psychology and work motivation. This included a 30-min seminar on the strengths-based approach and SDT, followed by a 30-min interactive session encouraging participants to discuss practical applications of their strengths. To ensure a structured intervention, teams scheduled training with the research team weeks in advance, allowing the distribution of a pre-intervention questionnaire 1 week prior, completed by all participants ($n = 67$). A post-activity survey was administered immediately afterwards, completed by 61 participants. All seven teams finished the training, with attrition occurring at the individual level. Finally, control group teams received complimentary access to the Totem game but did not complete the 3-week follow-up survey due to variability in engagement post-second survey.

Scales

The instruments were made available in both French and English. The survey items, excluding those from the Multidimensional Work Motivation Scale (MWMS), which was already validated in both languages, underwent a rigorous back-translation procedure as delineated by Vallerand (1989). Table 2 provides a detailed breakdown of the means and standard deviations for all utilized scales, differentiating between the experimental and control groups, and reporting the correlations for the experimental group only.

Need satisfaction

The Psychological Need States at Work Scale (PNSW-S; Huyghebaert-Zouaghi et al., 2021) was employed to evaluate need satisfaction (NS) on a 1 (*totally disagree*) to 7 (*totally agree*) Likert scale. For this study, we utilized a shortened version of the need satisfaction subscale (Eriksson & Boman, 2018), with two items for each psychological need: competence (e.g., "I am proficient in my job tasks"), autonomy (e.g., "I can approach tasks in my preferred manner"), and relatedness (e.g., "I feel integrated within my work group"). Composite reliabilities of the need satisfaction construct were adequate at all three time points (CR1 = .86, CR2 = .89, and CR3 = .91, respectively).

Autonomous motivation

Autonomous motivation was assessed using the Identified Regulation and Intrinsic Motivation subscales of the MWMS (Gagné et al., 2015). Participants indicate why they put effort into their job on a 1 (*not for this reason*) to 7 (*precisely for this reason*) Likert scale. This six-item subset (e.g., "Because I personally consider it important to put effort into this job" and "Because the work I do is interesting") demonstrated robust composite reliabilities across the three assessments (CR1 = .88, CR2 = .81, and CR3 = .85, respectively).

Table 2. Means, standard deviations, internal consistencies, and correlations.

Experimental			Control													
Variables	M	SD	M	SD	1	2	3	4	5	6	7	8	9	10	11	12
Need satisfaction 1	5.01	0.70	4.79	0.77	(.86)											
Need satisfaction 2	5.34	0.66	4.84	0.73	.55**	(.89)										
Need satisfaction 3	5.37	0.65	–	–	.52**	.48**	(.91)									
Motivation 1	4.99	0.79	4.97	0.89	.39**	.42**	.46**	(.88)								
Motivation 2	5.15	0.81	5.04	0.91	.46**	.45**	.50**	.54**	(.81)							
Motivation 3	5.22	0.75	–	–	.34**	.34**	.39**	.46**	.39**	(.85)						
Well-being 1	4.98	0.91	4.91	0.88	.37**	.43**	.43**	.41**	.52**	.33*	(.81)					
Well-being 2	5.16	0.85	4.99	0.94	.50**	.42**	.51**	.53**	.41**	.49**	.52**	(.77)				
Well-being 3	5.23	0.95	–	–	.39*	.39**	.33**	.48**	.48**	.55**	.49**	.52**	(.86)			
Team effectiveness 1	4.42	1.01	3.98	0.79	.44**	.36**	.29**	.29**	.38**	.31**	.27*	.29**	.33*	(.78)		
Team effectiveness 2	4.78	0.99	4.02	1.01	.42**	.38*	.42**	.43**	.51**	.44**	.31**	.44**	.34*	.55**	(.86)	
Team effectiveness 3	4.87	1.03	–	–	.37*	.38**	.53**	.32**	.32**	.49**	.21*	.29*	.39**	.41**	.49**	(.85)

T1 = time 1; T2 = time 2; T3 = time3. Figures in parentheses are Cronbach's alphas. For simplicity, only correlations of the experimental group are displayed **$p \leq .01$ *$p \leq .05$.

Psychological well-being

Participants' psychological well-being was assessed using a shortened four-item version of the Psychological Well-Being (PWB) scale (Ryff & Keyes, 1995) on a 1 (*totally disagree*) to 7 (*totally agree*) Likert scale. Items were chosen from three specific subscales: self-acceptance (e.g., "While I acknowledge past mistakes, overall, I feel things have turned out well"), purpose in life (e.g., "I take pleasure in setting future goals and striving to achieve them"), and personal growth (e.g., "I feel I have evolved significantly as an individual over time"). For this study, only these three subscales were employed, based on prior findings suggesting that the remaining subscales of the PWB scale closely mirror the basic psychological needs of autonomy, competence, and relatedness (Miquelon & Vallerand, 2008). The resulting construct exhibited adequate composite reliabilities across three time points (CR1 = .81, CR2 = .79, and CR3 = .86, respectively).

Perceived team effectiveness

Perceived team effectiveness was assessed with four items from the Bohn (2010) organizational efficacy scale emphasizing a sense of collective capability using a 1 (*totally disagree*) to 7 (*totally agree*) Likert scale. Consistent with prior research (Hu & Liden, 2015; Shin et al., 2017), we modified the phrasing from "this organization" to "this team" to better encapsulate perceptions within the team, leading to statements like, "In this team, everyone works together very effectively." Composite reliabilities were adequate at the three time points (CR1 = .81, CR2 = .88, and CR3 = .86, respectively). This scale measures individual-level perceptions of team effectiveness.

Analytical strategy

Our analytical approach was designed to address two primary objectives. First, we examined the intervention's effectiveness through between-group comparisons immediately post-intervention and evaluated sustained effects at 3-weeks follow-up within the experimental group. Second, we investigated how changes in need satisfaction during the Totem activity predicted changes in outcomes (autonomous motivation, well-being, and perceived team effectiveness).

Given the nested structure of participants within teams, we first assessed the necessity of accounting for team-level effects by examining intraclass correlation coefficients (ICC[1], ICC[2]) for all variables across measurement occasions (Klein et al., 2000). ICC(1) values for need satisfaction, autonomous motivation, and psychological well-being (ranging from 0.02 to 0.09) indicated minimal between-team variance. However, perceived team effectiveness demonstrated substantial team-level effects (ICC[1]: T1 = 0.19, T2 = 0.25, T3 = 0.21). Similarly, ICC(2) values were low for need satisfaction, autonomous motivation, and psychological well-being (0.22–0.34) but moderate for team effectiveness (T1 = 0.66, T2 = 0.71, T3 = 0.68).

From a theoretical perspective, we were interested in perceived team effectiveness at the individual level to examine each member's unique assessment of how well their team functions. While ICC values indicated significant team-level variance that needed to be controlled for, perceived team effectiveness was analysed as an individual level variable reflecting each member's personal evaluation of their team's ability to achieve its goals. Given the presence of team-level effects indicated by ICC values, we implemented analytical procedures that account for the nested structure of the data rather than aggregating the data at level 2. Specifically, we employed: (1) hierarchical linear modelling for analysing initial intervention effects and group comparisons and (2) latent change score modelling with clustering adjustments for examining longitudinal change trajectories within the experimental group. This dual analytical approach enabled us to assess both intervention effects and change mechanisms while appropriately controlling for team-level variance.

Initial intervention effects and group comparisons

To examine the effects of the Totem activity on four continuous outcome variables (need satisfaction, autonomous motivation, psychological well-being, and perceived team effectiveness), we conducted two sets of analyses using hierarchical linear modelling (HLM) in SPSS, both employing a three-level data structure with measurement occasions nested within individuals, who were nested within teams. First, to test between-group comparisons, we analysed 796 observations across two time points (T1: $n = 462$, T2: $n = 334$) nested within 462 participants from 65 teams (395 participants in 58 experimental teams; 67 participants in 7 control teams). We examined experimental group × Time 2 interaction effects. Second, to investigate sustained effects over time, we conducted additional analyses focusing solely on the experimental group ($n = 395$ participants in 58 teams), examining changes across three time points (T1: $n = 395$, T2: $n = 273$, T3: $n = 202$). In both analyses, we controlled for sociodemographic variables (age, gender, team tenure, and industry).

Longitudinal analysis

For the longitudinal examination of our hypothesized model within the experimental group (395 participants in 58 teams), we employed latent change score modelling (LCSM; MacKinnon, 2008) using R (Version 4.3.0; R Core Team, 2023) with the lavaan package (Version 0.16–15; Rosseel, 2012). LCSM was selected over cross-lagged panel modelling due to its ability to model change as a function of variations in other variables (McArdle, 2009; Selig & Preacher, 2009). This approach quantifies change by contrasting adjacent data points while accounting for measurement error. Following Selig and Preacher's (2009) recommendations, we constrained the path from the factor's initial to subsequent measurement and from the latent difference to the secondary measurement to 1, while setting the second measurement's variance to 0. This methodology enabled precise quantification of proportional change between measurement points (Eschleman & LaHuis, 2014).

To address missing data, common in longitudinal studies (Ohly et al., 2010), we employed full information maximum likelihood (FIML) estimation (Enders, 2011). Preliminary analyses showed no systematic dropout patterns, supporting the use of FIML. Prior to hypothesis testing, we conducted confirmatory factor analyses (CFA) to verify measurement structures, using conventional fit criteria (CFI/TLI > .90, RMSEA/SRMR < .08; Byrne, 2016). The use of cluster-robust standard errors specifically addresses the higher ICC values observed in team effectiveness by adjusting standard error estimates to account for the non-independence of observations within teams, thus providing more conservative tests of intervention effects while maintaining the ability to examine individual-level processes (Matusik et al., 2021). The coefficient of variation of cluster sizes (0.19) fell below the problematic threshold of 0.23 (M et al., 2006), supporting this approach.

Results

Preliminary analyses

Prior to conducting the main analyses, the data were examined for multivariate normality using Mardia's test. The results confirmed that the assumptions of multivariate normality were satisfactorily met. Also, Little's (1988) MCAR test was performed to see if missing values, especially at T2 and T3, were completely missing at random. The tests were not significant, T2: $\chi^2 = 48.46$, df = 67, $p = .974$, and T3: $\chi^2 = 56.46$, df = 80, $p = .374$. Thus, using FIML estimation to handle missing data seemed appropriate since the data were missing at random.

In our approach to examining the construct validity, a CFA was implemented. Initially, the analysis of T1 items pinpointed a structure with four interlinked factors: need satisfaction, autonomous motivation, well-being, and perceived team effectiveness. This configuration exhibited an apt fit, $\chi2 = 216.241$, df = 113, $p < .001$; CFI = .94; TFI = .93; RMSEA = .06; SRMR = .05. Replicated analyses for T2 and T3 echoed these findings, T2: $\chi2 = 177.360$, df = 113, $p < .001$; CFI = .97; TFI = .95; RMSEA = .06; SRMR = .04, and T3: $\chi2 = 192.570$, df = 113, $p < .001$; CFI = .96; TFI = .97; RMSEA = .06; SRMR = .04. To assess potential common method bias (CMB), we employed the CFA Harman single-factor (CFA HSF) technique at each measurement time (Podsakoff et al., 2024). The fit indices indicated a poorer fit compared to the four-construct CFA: specifically, at T1: $\chi^2 = 1125.24$, df = 236, $p < .001$; CFI = .85; TFI = .87; RMSEA = .09; SRMR = .07; at T2: $\chi^2 = 2594.74$, df = 236, $p < .001$; CFI = .81; TFI = .82; RMSEA = .07; SRMR = .09; similarly, at T3: $\chi^2 = 13658.57$, df = 236, $p < .001$; CFI = .79; TFI = .81; RMSEA = .08; SRMR = .09. Thus, these results suggested that CMB was not a significant concern, as the one-factor model did not provide a good fit to the data.

Subsequently, we aimed to establish if the identified factors maintained their structural and conceptual coherence across the three time points (see Table 3). Temporal invariance was probed for each construct by examining a continuum of models: from configural invariance (i.e., equal form with free loadings) through metric invariance (equal factor loadings), to strict invariance (equal factor variances). For consistency, item measurement errors were permitted to correlate within respective time points. Our stringent invariance testing suggested a consistent factor representation across the time frames. A comprehensive four-factor representation with strict invariance presented a commendable fit, $\chi2 = 1283.557$, df = 936, $p < .001$; CFI = .92; RMSEA = .05; SRMR = .06. Following the approach of McArdle (2009), we conducted hypothesis testing by constraining factor loadings to ensure metric invariance.

To assess the discriminant validity of our constructs – need satisfaction, autonomous motivation, well-being, and perceived team effectiveness – using the Fornell-Larcker criterion, the square roots of the average variance extracted (AVE) for each construct at all three measurement times were analysed (Henseler et al., 2015). Specifically, the square roots of the AVE for need satisfaction were 0.82, 0.75, and 0.77; for autonomous motivation, they were 0.85, 0.70, and 0.77; for well-being, they were 0.81, 0.82, and 0.67; and for perceived team

Table 3. Fit indices of measurement models to assess time invariance.

Factor and model	χ2	*df*	χ2 differences	*df* difference	χ2 difference test	RMSEA	CFI	SRMR
Needs satisfaction								
Free factor loading	206.95	51				.05	.95	.04
Equal factor loading	215.92	57	8.97	6	$p = .175$	.05	.94	.04
Equal factor variance	219.34	59	3.42	2	$p = .189$	.06	.95	.05
Autonomous motivation								
Free factor loading	73.24	24				.06	.98	.03
Equal factor loading	76.23	28	3.28	4	$p = .180$	.06	.98	.04
Equal factor variance	82.14	30	5.83	2	$p = .092$	.06	.97	.04
Psychological well-being								
Free factor loading	169.32	88				.07	.94	.06
Equal factor loading	176.38	93	7.06	5	$p = .088$	.08	.94	.06
Equal factor variance	181.12	96	4.74	3	$p = .121$	.08	.93	.07
Team effectiveness								
Free factor loading	68.47	24						
Equal factor loading	70.35	28	1.88	4	$p = .752$	.05	.96	.06
Equal factor variance	71.68	29	1.35	1	$p = .133$	.06	.97	.04

Note. RMSEA = root mean square error of approximation; CFI = comparative fit index; SRMR = standardized root mean square residual.

effectiveness, they were 0.70, 0.77, and 0.66. These AVE values consistently exceeded the highest correlations with any other construct at each measurement time, confirming robust discriminant validity.

Moreover, given the relatively high correlations among the four variables at each of the three measurement times, we examined the variance inflation factors (VIFs) separately for each time point to determine if multicollinearity might pose an issue for our model. The VIF statistics for all four predictors at each time ranged from 1.5 to 4.3, indicating that multicollinearity was not a concern at any measurement time. It is generally accepted that VIF values greater than 10 suggest significant multicollinearity problems, although a more conservative threshold of over 5 is sometimes recommended (see Cohen, 2013; Dormann et al., 2013).

In the experimental group, we assessed potential differences between participants based on their response patterns across three measurement points, comparing those who answered surveys at T1, T1 and T2, and at all three times. Utilizing a multivariate analysis of variance (MANOVA), we examined variables central to our theoretical framework, including need satisfaction, autonomous motivation, well-being, and perceived team effectiveness. The analysis revealed no significant differences between the groups, $F(4, 390) = 1.970$, $p = .098$. Therefore, consistent participation across all measurement points did not yield different responses compared to partial participation at earlier times. This suggests that the loss of participants over the course of the study could be attributed to attrition rather than to any specific characteristics of the individuals or their responses.

Finally, to assess baseline differences between the experimental and control groups at T1, a MANOVA encompassing all continuous variables was conducted. While the analysis yielded a significant result, $F(4, 446) = 4.231$, $p = .002$, post-hoc analyses revealed that these differences were in perceived team effectiveness ($F(1, 449) = 10.960$, $p = .001$, $\eta^2 = .022$) and need satisfaction ($F(1, 449) = 3.140$, $p = .077$, $\eta^2 = .007$). Several important considerations suggest these baseline differences do not warrant statistical control in our main analyses. First, baseline differences in randomized controlled trials should not be considered on their statistical significance, but rather on the potential meaningful impact of the variables on outcomes (de Boer et al., 2015; Senn, 1994). In other words, the statistical significance of baseline differences becomes irrelevant if there are no practical implications for the intervention's effects. The small effect sizes indicate minimal practical relevance of these differences. Second, visual inspection of the means across time points (see Figure 3) indicates distinct temporal patterns between groups, with changes in the experimental group appearing independent of initial values. Finally, controlling for these minor baseline differences would add unnecessary complexity to our models, potentially creating convergence issues while violating the principle of parsimony (Vandekerckhove et al., 2015). This approach aligns with current methodological recommendations that discourage adjustment for baseline differences in randomized trials unless they demonstrate substantial practical impact on outcomes (de Boer et al., 2015; Senn, 1994).

Main analyses

Initial intervention effects and group comparisons

Multilevel analyses revealed significant experimental group × Time 2 interaction effects across all primary variables (see Table 4), which supports post-intervention comparisons between the experimental and control groups. Specifically, the intervention showed positive effects on need satisfaction ($B = 0.25$, $SE = 0.07$, $p < .01$), autonomous motivation ($B = 0.16$, $SE = 0.06$, $p < .05$),

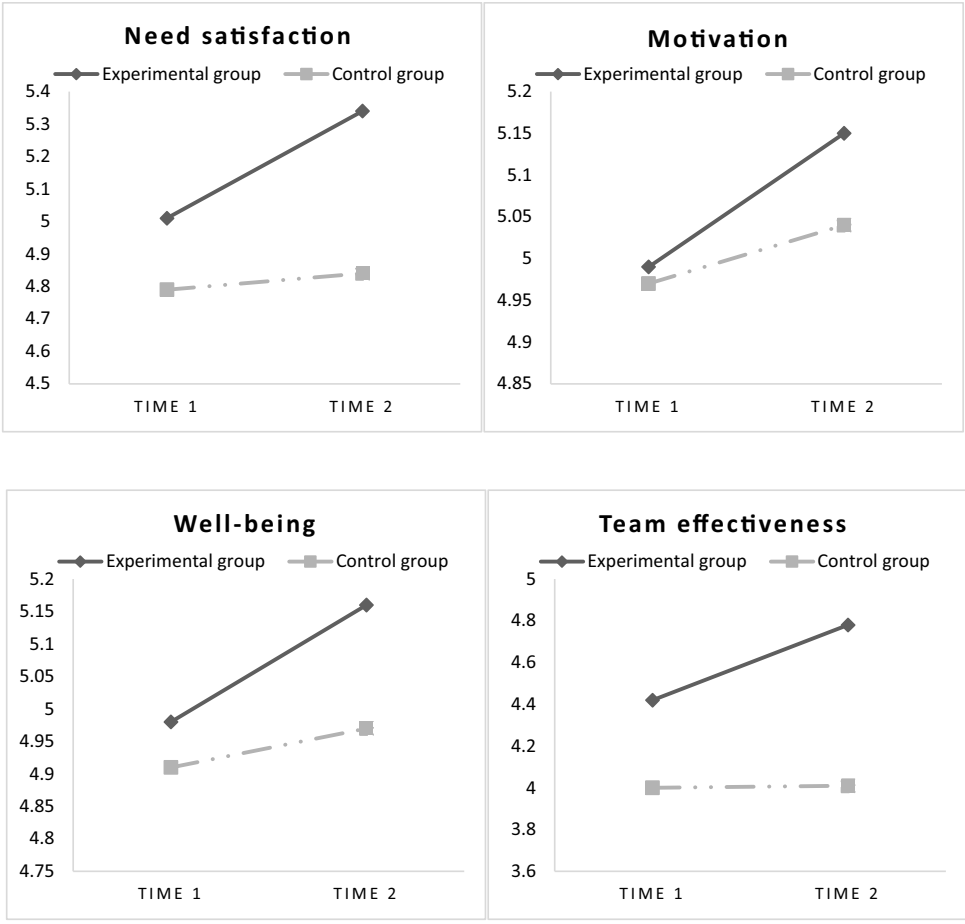

Figure 3. Time by condition effects for need satisfaction, autonomous motivation, well-being, and perceived team effectiveness.

psychological well-being (B = 0.17, SE = 0.13, $p < .05$), and perceived team effectiveness (B = 0.27, SE = 0.11, $p < .05$).

Additional analyses focusing on the experimental group only showed that follow-up data collected at Time 3 (see Table 5) revealed sustained improvements from baseline: need satisfaction (B = 0.25, SE = 0.05, $p < .01$), autonomous motivation (B = 0.19, SE = 0.04, $p < .01$), well-being (B = 0.21, SE = 0.05, $p < .01$), and perceived team effectiveness (B = 0.27, SE = 0.06, $p < .01$). Together, these findings supported hypotheses 1, 2a, 3a, and 4a, demonstrating both immediate intervention effects (compared to control group) and sustained benefits within the experimental group.

Longitudinal analysis

To examine how changes in our variables were related across the three measurement points, we employed Latent Change Score Modeling (LCSM) using structural equation modelling (SEM). Following Selig and Preacher's (2009) methodology, we created latent change scores by constraining the path from the initial to subsequent measurement to 1, and the path from the latent difference to the second measurement to 1, while setting the variance of the second measurement to 0. This specification allowed us to precisely quantify the proportional change between measurements while accounting for measurement error (Eschleman & LaHuis, 2014). We applied this methodology to create change scores for need satisfaction (T2-T1), autonomous motivation (T3-T1), well-being (T3-T1), and team effectiveness (T3-T1). We then systematically tested three nested models, with data clustered by teams to account for non-independence.

To identify the best fitting model that accurately represents our data while maintaining theoretical coherence, we followed a systematic model comparison approach (Anderson & Burnham, 2004). Starting with the most parsimonious model, we progressively added theoretically justified paths until reaching optimal model fit. Model 1 (M1) tested our basic hypothesized sequence: changes in need satisfaction (T2-T1) predicting changes in autonomous motivation (T3-T1), which in turn predicted changes in both well-being and team effectiveness (T3-T1). However, this model showed poor fit: $\chi^2 = 3448.832$, df = 276; TLI = .82; CFI = .81; RMSEA = .09; SRMR = .11. Model 2 (M2) is built upon M1 by adding direct paths from changes in need satisfaction

Table 4. Multilevel analysis of pre–post intervention effects across groups.

	Need satisfaction		Autonomous motivation		Well-being		Perceived team effectiveness	
Variable	B	SE	B	SE	B	SE	B	SE
Intercept	5.28**	0.18	5.65**	0.17	5.74**	0.18	4.51**	0.25
Age	−.01	0.03	0.04	0.03	0.02	0.03	0.04	0.04
Gender	0.19*	0.04	0.1*	0.05	0.12**	0.04	0.24**	0.06
Years on current Team	0.02	0.01	0.02	0.02	0.05	0.01	0.02	0.02
Industry	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Experimental group	0.19*	0.09	0.02	0.11	0.07	0.16	0.34*	0.19
Time 2	0.02	0.06	−0.05	0.06	−0.05	0.12	0.06	0.10
Expertimental group ×Time 2	0.25**	0.07	0.16*	0.06	0.17*	0.13	0.27*	0.11
Variance components								
Team	0.056		0.077		0.010		0.156	
Individual	0.283		0.395		0.298		0.380	
Occasion	0.181		0.168		0.207		0.323	
−2 X log likelihood	1703.38		1789.70		1850.15		2259.21	

Note. $N = 462$ participants nested within 65 teams (58 experimental teams, 7 control teams), with 796 observations across two time points (T1: $n = 462$, T2: $n = 334$). At T1, this represented 395 participants in experimental teams and 67 participants in control teams. At T2, the sample included 273 participants in experimental teams and 61 participants in control teams. Gender was coded 0 = female, 1 = male. Experimental group was coded 0 = control, 1 = experimental. Time was dummy coded with Time 1 as reference. Age, industry, and team tenure were measured in categorical intervals. *$p < .05$.**$p < .01$.

Table 5. Multilevel analysis of intervention effects across time for the experimental group.

	Need satisfaction		Autonomous motivation		Well-being		Perceived team effectiveness	
Variable	B	SE	B	SE	B	SE	B	SE
Intercept	5.44**	0.14	5.54**	0.17	5.75**	0.14	4.84**	0.19
Age	0.02	0.03	0.06	0.03	0.02	0.03	0.01	0.04
Gender	0.21*	0.05	0.15*	0.06	0.13**	0.04	0.27**	0.07
Years on current Team	0.03	0.02	0.01	0.02	0.02	0.01	0.02	0.01
Industry	0.02	0.01	0.03	0.01	0.04	0.02	0.02	0.03
Time 2	0.27**	0.03	0.14**	0.03	0.17**	0.03	0.26**	0.05
Time 3	0.25**	0.05	0.19**	0.04	0.21**	0.05	0.27**	0.06
Variance components								
Team	0.048		0.083		0.008		0.159	
Individual	0.241		0.393		0.317		0.372	
Occasion	0.172		0.158		0.178		0.297	
−2 X log likelihood	1469.18		1559.13		1537.86		1958.79	

Note. $N = 395$ participants nested within 58 teams, with 870 observations across three time points (T1: $n = 395$, T2: $n = 273$, T3: $n = 202$). Gender was coded 0 = female, 1 = male. Time 2 and Time 3 represent dummy coded variables with Time 1 as reference. Age, industry, and team tenure were measured in categorical intervals. *$p < .05$.**$p < .01$.

to changes in both outcome variables, reflecting potential direct effects alongside mediated paths. This model showed improved but still suboptimal fit: $\chi^2 = 589.239$, df = 274; TLI = .87; CFI = .85; RMSEA = .09; SRMR = .10. Model 3 (M3), our final iteration, acknowledged that according to SDT, psychological need satisfaction is a fundamental predictor of both autonomous motivation and well-being. Therefore, we incorporated direct paths from need satisfaction at T1 to autonomous motivation, well-being, and team effectiveness at T1, controlling for these theoretically interconnected psychological experiences at baseline to more accurately assess subsequent changes. This theoretically grounded modification yielded significantly better fit indices: $\chi^2 = 521.43$, df = 271; CFI = .94; TLI = .93; RMSEA = .05; SRMR = .08. A chi-squared difference test between M2 and M3 confirmed significant improvement ($\Delta\chi^2 = 67.809$, Δdf = 3, $p < .01$). To validate our hypothesized directionality, we tested an alternative model reversing the independent variable with the two dependent variables. This alternative model showed poor fit: $\chi^2 = 943.43$, df = 276; CFI = .86; TLI = .83; RMSEA = .07; SRMR = .13, supporting our originally hypothesized direction of effects in M3.

As depicted in Figure 4, changes in need satisfaction from T1 to T2 predicted subsequent shifts in autonomous motivation, psychological well-being, and perceived team effectiveness from T1 to T3. Given that the changes in need satisfaction between T1 and T2 were found to be predictive of shifts in autonomous motivation between T1 and T3, these results provided substantial support to Hypothesis 2b. Changes in autonomous motivation from T1 to T3 were linked to changes in perceived team effectiveness from T1 to T3. However, changes in autonomous motivation were not related to changes in well-being from T1 to T3. This failed to support Hypothesis 3b, as the changes in need satisfaction between T1 and T2 consistently emerged as the sole significant predictor of variations in well-being from T1 to T3. An additional observation from the model indicated that the initial levels

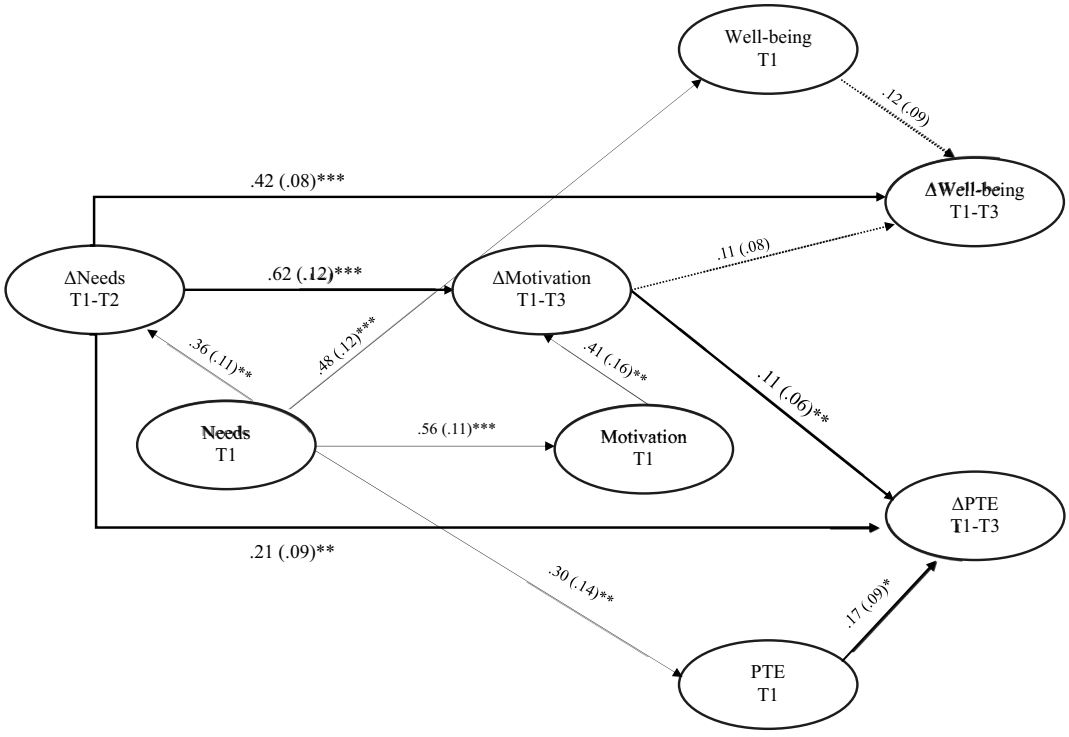

Figure 4. A latent change score model (LCSM) examining the impact of shifts in needs satisfaction on autonomous motivation, psychological well-being, and perceived team effectiveness pre- and post-intervention. *Note*. Displayed coefficients are unstandardized with standard errors denoted in parentheses. Grey dotted lines signify non-significant relationships. Labels: T1 = Time 1; T2 = Time 2; T3 = Time 3; ΔNeeds = needs satisfaction shift; ΔMotivation = shift in autonomous motivation; ΔWell-being = alteration in psychological well-being; ΔPTE = change in team perceived efficacy. The data were clustered by participant teams to account for team-driven variance. Model fit: $\chi 2 = 521.43$; df = 236; CFI = .94; TLI = .93; RMSEA = .05; SRMR = .08.

of well-being among participants did not significantly explain the variations they experienced in well-being from T1 to T3. Finally, we employed bias-corrected bootstrapped confidence intervals with 5,000 iterations to delve into the possible indirect influence of changes in autonomous motivation from T1 to T3 in the association between alterations in need satisfaction from T1 to T2 and shifts in perceived team effectiveness from T1 to T3. There was a significant indirect effect, B = .08, *SE* B = .03, CI [0.029, 0.128], suggesting partial mediation and supporting Hypothesis 4b.

Discussion

This study examined the impact of the Totem activity on individual outcomes through SDT. Results showed that participants experienced increased need satisfaction, autonomous motivation, psychological well-being, and perceived team effectiveness compared to the control group. Longitudinal analyses revealed that changes in need satisfaction explained variations in motivation, well-being, and perceived team effectiveness over the 3-week period.

Theoretical implications

Our findings contribute to SDT, particularly as it pertains to team dynamics, an emerging extension of SDT (Grenier et al., 2024). Grenier et al. (2024) proposed that team-level autonomous motivation influences team effectiveness, but empirical evidence for these relationships was lacking. Our study provides initial empirical support by examining these relationships at the individual level, demonstrating how fluctuations in participants' autonomous motivation mediate the relationship between need satisfaction and perceptions of team effectiveness over time. This relationship aligns with previous findings showing that individuals experiencing need satisfaction and autonomous motivation engage in better information sharing and demonstrate greater goal persistence (Gagné et al., 2019; Koestner et al., 1999; Sheldon & Elliot, 1998). Our findings advance SDT by demonstrating how team-based interventions can enhance individual need satisfaction and motivation, subsequently shaping individuals' perceptions of team effectiveness. This understanding is particularly crucial as organizations increasingly rely on team-based structures and virtual collaboration, where traditional motivational approaches may fall short.

Contrary to some prior research (e.g., Gradito Dubord et al., 2022), autonomous motivation did not mediate the need satisfaction – well-being relationship. Instead, fluctuations in well-being were explained by changes in need satisfaction during the Totem activity. This aligns with meta-analytic evidence showing stronger associations between need satisfaction and well-being, while performance-related outcomes tend to relate equally to both constructs (Van den Broeck et al., 2016, 2021). Our results suggest that in team-based interventions, the motivational pathway to well-being may operate primarily through need satisfaction rather than through autonomous motivation.

This research also enhances the positive technology (PT) literature by investigating psychology-based digital interventions in the workplace. The rise of digital interventions for I/O psychology is a growing trend (SIOP, 2021), yet these interventions often lack a theoretical basis, with their effectiveness largely unverified (Lau et al., 2020). Our study underscores the importance of grounding digital interventions in validated theoretical frameworks (Karlsen et al., 2022).

Additionally, our findings enrich positive psychology literature by demonstrating the effectiveness of an online team-based intervention using the VIA Character Strengths framework (Peterson & Seligman, 2004; www.viacharacter.org). By integrating SDT as a theoretical framework, this study addresses critiques about the lack of theoretical grounding in positive psychology interventions (van Zyl et al., 2024), showing how need satisfaction drives positive outcomes from strengths-based approaches in professional settings.

Finally, this research advances our understanding of feedback dynamics within organizations. While the principle of positive feedback is straightforward – reinforcing desirable behaviours – delivering high-quality feedback is complex (Carpentier & Mageau, 2013). We propose that strengths-oriented feedback, which highlights observed character strengths in employees (Gradito Dubord et al., 2022; Niemiec, 2014), is a legitimate form of positive feedback that enhances optimal employee functioning.

Practical implications

Our findings demonstrate that the Totem activity significantly enhances employees' need satisfaction, motivation, psychological well-being, and perceived team effectiveness. These results support the adoption of evidence-based, technology-assisted interventions like Totem in organizational HR strategies, particularly to address virtual work challenges affecting mental health and team dynamics. Current literature reveals that most digital workplace interventions lack strong theoretical foundations and empirical validation, raising concerns about their practical utility. In contrast, Totem's dual grounding in positive psychology and descriptive feedback theory, combined with the empirical support demonstrated in this study, positions it as a scientifically validated option for team building. For practitioners, this underscores the importance of selecting team-building activities with robust empirical support. Managers should prioritize interventions like Totem that offer both theoretical rigour and demonstrated effectiveness, rather than opting for untested solutions.

Second, the efficacy of the Totem activity to promote strengths-oriented feedback implies that organizations might benefit from embedding such feedback mechanisms within their team development strategies and training programmes. For instance, during performance review discussions, leaders might effectively highlight the strengths and unique contributions of team members and encourage their use. Expanding on this, organizations could contemplate scheduling regular strengths-focused feedback sessions and assess their cumulative influence on team dynamics and employees' well-being over time.

Third, following an initial Totem session, organizations should integrate its principles into regular workflows to maintain benefits. For example, HR teams could organize quarterly "strength spotlights" where employees demonstrate how they have applied recognized strengths to actual projects, translating the initial feedback into ongoing practice. Complementing this with brief monthly virtual check-ins, such as structured 15-min peer recognition rounds, might help reinforce positive dynamics while accommodating the time limitations of distributed teams. This phased approach could ensure the intervention's impact extends beyond a one-time activity.

Fourth, for organizations aspiring to augment psychological well-being and perceived team efficacy, our study has highlighted the merits of interventions that bolster need satisfaction (see also Slemp et al., 2021). Remarkably, we found that a single session of a need-supportive activity can engender enduring enhancements in well-being and perceived team efficacy. To leverage this, enterprises could strategically facilitate activities like Totem before pivotal team endeavours or post-organizational transitions to consistently nurture a climate of positive team interactions.

Finally, for multinational corporations managing established virtual teams, the Totem platform might offer a culturally adaptable solution for strengthening collaboration. Its customizable interface facilitates meaningful strength-based exchanges across language barriers, while maintaining implementation fidelity

across diverse locations. The visual, card-based format provides teams with a shared vocabulary and reference points for giving feedback, helping to bridge intercultural differences in communication norms that could challenge even well-established teams. In brief, for multinational teams working remotely, Totem's need-supportive activities could help mitigate virtual work challenges by concurrently enhancing well-being and perceived team effectiveness, key outcomes demonstrated in our study.

Limitations and future research

Several limitations of this study may influence how our findings are interpreted. First, relying on self-reports for all variables raises concerns about common method bias (CMB). Although psychological states like need satisfaction and well-being are difficult to assess otherwise, we acknowledge this limitation. To reduce bias, we used multiple measurement times and the HSF technique (Podsakoff et al., 2024). Future research should incorporate more objective measures of individual and team outcomes.

A second limitation is the lack of a 3-week follow-up measurement for the control group, which constrains direct comparability of longitudinal outcomes between groups and prevents causal inferences about the sustained effect. Although the control group was waitlisted and later exposed to the Totem activity, a follow-up could have introduced data contamination. If the experimental group reported higher scores on the study's continuous variables right after the intervention compared to the control group, this difference would potentially persist at the 3-week mark. Future studies should include control groups assessed at multiple time points.

While our study demonstrated significant effects at the 3-week follow-up, this short-term assessment cannot address the sustained impact of the intervention. Prior research shows that the durability of workplace intervention effects varies, with some studies using follow-ups of 3 months or more to capture stable changes in cognition and behaviour (Abildgaard et al., 2018; van; Wingerden et al., 2016). Our compressed timeline, though justified by organizational constraints and supported by comparable strength-based intervention research (Gradito Dubord et al., 2022; van Woerkom & Myers, 2019), leaves open whether improvements in well-being and perceived team effectiveness would persist, diminish, or strengthen over time. Future studies should include several follow-ups at different times to better capture these dynamics.

A third limitation of our study was the absence of team-level measures, such as team performance indicators, which would have provided a clearer understanding of the intervention's impact on team-level outcomes. While we captured individual perceptions of team effectiveness, our analysis remained anchored at the individual level, as we asked participants to rank their perceptions of their own team's efficacy. The data were clustered by the team to account for variance attributable to team dynamics, as indicated by our preliminary analysis. Future studies would benefit from integrating team-level measurement outcomes, such as measures of team-level motivation, measures of team processes like coordination and conflict management (Grenier et al., 2024).

A fourth limitation is that individuals with higher baseline need satisfaction and autonomous motivation benefited most from the intervention. Our longitudinal analysis showed that initial levels of these variables strongly influenced change (Figure 4), suggesting a "rich get richer" effect. Satisfied individuals may be more inclined to support others (Gilbert & Kelloway, 2018) and engage with the Totem game, raising concerns about how to support those with low initial need satisfaction. While this aligns with positive psychology's goal of enhancing work experiences (Dubreuil & Forest, 2017), future research should explore how to adapt the game for individuals starting with need deficits.

Finally, the predominance of North American employees from the private service sector and governmental entities in our sample limits the generalizability of our findings to other countries and industries, suggesting that subsequent studies should explore the applicability of these results across varied demographic groups.

Conclusion

Overall, our study contributes to understanding how virtual work influences individual outcomes by highlighting the benefits of Totem, a digital strength-based team-building activity, on individual outcomes, and perceptions of team functioning. As virtual teams become more common, interventions like Totem may be helpful for fostering perceived team effectiveness and overall well-being.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This research was supported by a grant from the Social Sciences and Humanities Research Council of Canada (SSHRC), [Grant Number 756-2023-0020].

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Data availability statement

The data are not publicly available due to ethical restrictions. Requests for access should be directed to the corresponding author.

Ethical approval statement

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.

To conduct this study, an ethical certificate (CER-23–300–07.13) was obtained from the Université du Québec à Trois-Rivières.

Informed consent

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

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