

Effects of a competence development intervention on informal learning and work engagement – a randomized controlled trial

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Abstract

Purpose – The purpose of this study was to investigate the long-term effects of a competence development intervention on mid- and late-career employees' participation in informal learning activities and their work engagement, and how workplace contextual factors moderate these effects.

Design/methodology/approach – A randomized controlled field experiment was conducted in 15 work organizations. A total of 367 participants were randomly assigned into either an intervention ($n = 183$) or a comparison group ($n = 184$). Of these, 248 responded to a six-month follow-up questionnaire. The intervention consisted of four 3-h workshops facilitated by trained trainers in the organizations.

Findings – The results indicated that the intervention had a significant main effect on employees' work engagement. Moreover, the beneficial effects of the intervention on increasing the use of informal learning depended on perceived age-equality of opportunities and supervisory support for development in the workplace.

Originality/value – This field-experimental study demonstrates how a resource-building group intervention can improve employees' work engagement and highlights the moderating role of workplace contextual factors in the long-term effects of the intervention on informal learning at work.

Keywords Competence development, RCT study, Intervention study, Informal learning, Work engagement

Paper type Research paper

Introduction

In today's rapidly changing work environment, many employees find it difficult to remain in their careers until retirement, often because their skills become outdated or their competence



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no longer meets the evolving job demands (Battisti *et al.*, 2023). Thus, it is essential to increase individuals' capacity to acquire new skills and knowledge, especially during mid- and late-career (OECD, 2021), and to provide workplace resources and developmental practices that sustain employees' motivation and engagement, and enhance organizational productivity (Mori *et al.*, 2024; Roczniowska *et al.*, 2022).

In response to these challenges, targeted workplace-based interventions could help mid- and late-career employees continuously develop their competences and stay engaged at work. One approach is to implement resource-building interventions that enhance the skills, confidence and resilience needed to navigate contemporary workplace changes. This may result in promoting employees' informal learning, a self-directed process critical for acquiring new skills in dynamic environments (Cerasoli *et al.*, 2018). In addition, by addressing individual resources, such as self-efficacy and resilience, interventions can help employees navigate their careers more proactively and better respond to job demands through increased competence. Enhancing these resources can also promote motivation and engagement at work (e.g. Knight *et al.*, 2017; Watson *et al.*, 2018). However, the long-term effectiveness of such interventions in fostering continuous career-related learning while also enhancing work engagement – particularly among mid- and late-career employees – remains insufficiently explored.

The success of these interventions often hinges on key workplace contextual factors that shape the transfer of the intervention effects into actual learning behaviors (e.g. Watson *et al.*, 2018). For instance, supervisory support for development creates a psychologically safe space for growth and engagement in informal learning (Blume *et al.*, 2024; Tannenbaum and Wolfson, 2022). Similarly, organizational innovation and flexibility allow employees to share and implement their ideas and initiatives during developmental efforts (e.g. Patterson *et al.*, 2005). These factors not only enhance the immediate intervention outcomes but also are crucial for sustained impact on competence development and well-being (see Blume *et al.*, 2024; Nielsen and Shepherd, 2022). Prior research has provided evidence of a relationship between different workplace contextual factors, informal learning, and work engagement (Berg and Chyung, 2008; Jeon and Kim, 2012; Uhunoma *et al.*, 2020; Zia *et al.*, 2021), but these studies have mainly used cross-sectional designs, resulting in temporal ambiguity and limiting findings to associations and correlations. Moreover, investigations into the impact of workplace interventions on learning and work engagement have primarily utilized quasi-experimental designs, lacked control groups or focused solely on formal workplace learning (see Watson *et al.*, 2018).

This study addresses these research gaps by using a randomized controlled field experiment (RCT) to investigate the long-term effects of a workplace-based intervention aimed at career-related competence development and work engagement among mid- and late-career employees. Our study also explores how supportive workplace environments, characterized by high levels of organizational innovation and flexibility, age-equality of opportunities, and high supervisory support, can foster informal learning and work engagement, offering organizations evidence-based strategies to support employees amid rapid workplace changes and evolving job demands.

Literature review

Competence development, informal learning and work engagement

Rapid changes in the workplace can create competence-related challenges for mid- and late-career employees, as they are less likely to be retrained or upskilled following technological and organizational shifts due to their shorter remaining working lives. This places their skills and competencies at risk of becoming outdated (Battisti *et al.*, 2023; Yashiro *et al.*, 2022). In

addition to occupation-specific skills, transversal competences such as communication, collaboration and lifelong learning skills are crucial for mid- and late-career employees, as they promote adaptation to new technologies and ensure continued employability (OECD, 2021).

For mid- and late-career employees, who often participate less in formal training and development activities than their younger colleagues (Maurer, 2001; OECD, 2020), informal learning offers a flexible, accessible means of acquiring new skills, adapting to technological advancements and sustaining engagement in their roles. Informal learning encompasses self-directed, experiential activities such as learning-by-doing, seeking feedback, and collaborative problem-solving, which occur outside formal training programs or educational settings (Cerasoli *et al.*, 2018; Lohman, 2005). In the workplace, informal learning manifests in various forms, including interpersonal learning with or from colleagues, and independent learning through self-reflection or non-interpersonal sources (Kittel and Seufert, 2023; Misko, 2008; Noe *et al.*, 2013). Unlike formal learning, informal learning is typically employee initiated and aligns closely with their immediate needs and goals, which makes it invaluable in dynamic work environments that demand adaptability and continuous learning (e.g. Cerasoli *et al.*, 2018).

While informal learning is pivotal for employees' performance and competence development, cross-sectional studies have provided empirical evidence that underscore its positive relationship with work engagement (Susomrith *et al.*, 2019; Uhunoma *et al.*, 2020; Zia *et al.*, 2021). Work engagement, a pervasive affective-cognitive state comprising vigor, absorption and dedication, reflects high levels of energy, willingness to invest effort and a sense of significance and enthusiasm in one's work (Schaufeli *et al.*, 2006). Work engagement is an important factor in achieving positive work-related outcomes, including enhanced job performance and improved employee well-being (e.g. Knight *et al.*, 2019; Mori *et al.*, 2024), which highlights the importance of workplace initiatives that support its development.

Individual resources, such as self-efficacy, have been suggested to be effective drivers of both learning and work engagement (e.g. Choi and Jacobs, 2011; Knight *et al.*, 2019; Tannenbaum and Wolfson, 2022; Zia *et al.*, 2021), and appear to empower individuals to persevere and maintain their commitment to work in pursuit of their objectives (Knight *et al.*, 2019). Previous research on career interventions grounded in social-cognitive frameworks has demonstrated how individual resources – including both self-efficacy and resilience against setbacks as important factors – can enhance career-related skills and work engagement (e.g. Akkermans *et al.*, 2015; Vuori *et al.*, 2012, 2019). In this context, competence development interventions targeting to improve such career self-management behaviors, such as reflection on one's strengths and goal selection (Akkermans *et al.*, 2015; Hirschi and Koen, 2021), and resources that promote individuals' confidence and readiness to develop their occupational competences throughout their careers could lead to positive work- and well-being-related outcomes. Based on social learning theory (Bandura, 1997) and the theory of planned behavior (Ajzen, 1991), self-efficacy serves as a motivational driver that can increase the likelihood that employees will engage in career-related skill development behaviors and cultivate positive attitudes toward continuous learning (Maurer, 2001). In addition, drawing on Meichenbaum's cognitive stress inoculation approach (Meichenbaum, 2007), recognizing potential barriers to competence development and developing solutions for them with problem-solving exercises can build resilience and, thus, prepare employees to handle unexpected challenges and persist in their developmental efforts.

Group-based resource-building interventions in the workplace that leverage interactive discussions – incorporating vicarious experiences and social persuasion – constitute a

suitable method for building resilience against setbacks and a sense of mastery. This active approach in a group-based intervention aligns with Myers (2018) relational theory of vicarious learning, which describes how workplace learning through others' experiences is increasingly interdependent, with employees co-constructing shared understanding through interaction and collaboration. Using a resource-building competence development intervention to increase employees' awareness and use of informal learning behaviors in on-the-job contexts as well as to enhance their work engagement generates the following hypotheses:

- H1. Resource-building intervention will broaden employees' engagement in informal learning activities.
- H2. Resource-building intervention will enhance employees' work engagement.

The moderating role of workplace contextual factors

Intervention research has underlined the crucial role of workplace contextual factors (e.g. organizational climate, supervisory support) in shaping the long-term effects of organization-based interventions (e.g. Nielsen and Shepherd, 2022; Watson *et al.*, 2018). In this respect, workplaces differ as learning environments in the degree of support they provide for employees' learning opportunities. Expansive learning environments embed learning as an intrinsic part of work, partially aligning personal and organizational goals, whereas restrictive environments prioritize immediate job requirements and "getting the job done," overlooking the importance of new innovations (Fuller and Unwin, 2004). In their meta-analysis, Cerasoli and colleagues (2018) showed that employees' perceptions of informal organizational support, such as a positive learning climate and innovative culture, are positively associated with informal learning behaviors.

A key component in creating an expansive learning environment is supervisory support for development, which can provide employees with resources, constructive feedback and a sense of competence and belonging (Blume *et al.*, 2024; Knight *et al.*, 2017). This plays a pivotal role in facilitating informal learning and positive career outcomes (e.g. De Vos *et al.*, 2011; Wolfson *et al.*, 2018) as well as enhancing work engagement (Lee and Eissenstat, 2018). Furthermore, age-inclusive HR policies that foster an age-diverse climate can provide opportunities for employees across all age groups to engage in further training and development (Boehm *et al.*, 2014; Wilckens *et al.*, 2021), which have also shown to be related to work engagement (see Mori *et al.*, 2024). Moreover, an innovative and flexible organizational climate fosters adaptability and openness to change, creating an environment in which new ideas thrive and learning is supported (Jeon and Kim, 2012; Sung and Choi, 2014). Conversely, rigid norms can result in "organizational inertia" (Patterson *et al.*, 2005), hindering employees' ability to transfer and utilize their skills.

Despite prior research acknowledging the importance of workplace climate and support, the moderating role of these factors in determining the long-term outcomes of workplace interventions remains underexplored, especially in controlled studies, such as RCTs (Nielsen and Shepherd, 2022). Addressing this gap highlights the importance of developing interventions that are adaptable to various organizational contexts and capable of yielding sustainable improvements in informal learning and work engagement (see Nielsen and Abildgaard, 2013). The next set of hypotheses consider how organizational contextual factors moderate the effects of a competence development intervention on informal learning and work engagement based on the framework of expansive learning environments. The

positive effects of a resource-building intervention on informal learning and work engagement would be stronger among employees who:

H3a. Viewed their organizational climate as innovative and flexible.

H3b. Perceived their organization as promoting age-equal opportunities for development.

H3c. Felt they received strong supervisory support for development.

Methods

The recruitment of organizations and the intervention phase of the study took place between December 2021 and May 2023. We aimed to obtain a representative sample of mid- and late-career employees from various occupational fields and educational backgrounds. To meet the power calculations, the minimum total sample size was set to 330, using an alpha cut-off of 0.05 and power of 0.80 (Dong and Maynard, 2013), based on the effects shown in previous similarly conducted field experimental studies adopting related variables (Vuori *et al.*, 2019).

Participating organizations

We contacted personnel directors and HR representatives in 75 medium- to large-sized Finnish public and private organizations. Seventeen agreed to participate, but two withdrew before the baseline data collection, due to participant recruitment issues or staff changes. Ultimately, 15 organizations participated: seven self-governing municipalities; five governmental organizations; and three private enterprises in financial services, insurance and the food industry. Their employee numbers ranged from 300 to 15,000.

Each organization signed an agreement to recruit participants for the intervention study and to conduct one or two workplace intervention training programs. These intervention programs were delivered in the workplaces by trained trainers, most of whom were from the organizations' HR departments (see section Competence Development Intervention). They also agreed to the data protection guidelines and allowed the employees and trainers to participate in the study during working hours. The organizations received the training program and self-study materials, including free training for at least two internal trainers. The researchers provided each organization's contact person with information leaflets and marketing material to advertise the study to their personnel. The materials covered its content, enrollment and randomization procedure, highlighting that it targeted employees aged 35 and over in various occupational fields who sought to strengthen their occupational skills and competences in the rapidly changing working life. While classifying career phases by age is somewhat subjective, employees over 55 are generally in late career stage, whereas those between 35 and 54 are in their mid-career stage (Rae, 2005). The study was promoted via the organizations' intranet, email, communication platforms (e.g. Teams) and brief Microsoft Teams presentations by the researchers. It was advertised and implemented as "Skilled and Renewable Career."

Study participants, randomization procedure and follow-ups

Participation was voluntary, but required acknowledgment of the information letter and data protection guidelines, and completion of an online questionnaire at baseline. Of the 368 individuals who completed the baseline questionnaire, one withdrew before randomization, leaving 367 eligible participants (Figure 1). The participants' ages ranged from 30 to 65, with a mean of 48.7 years (SD = 7.62). Six employees under the age of 35 expressed interest in

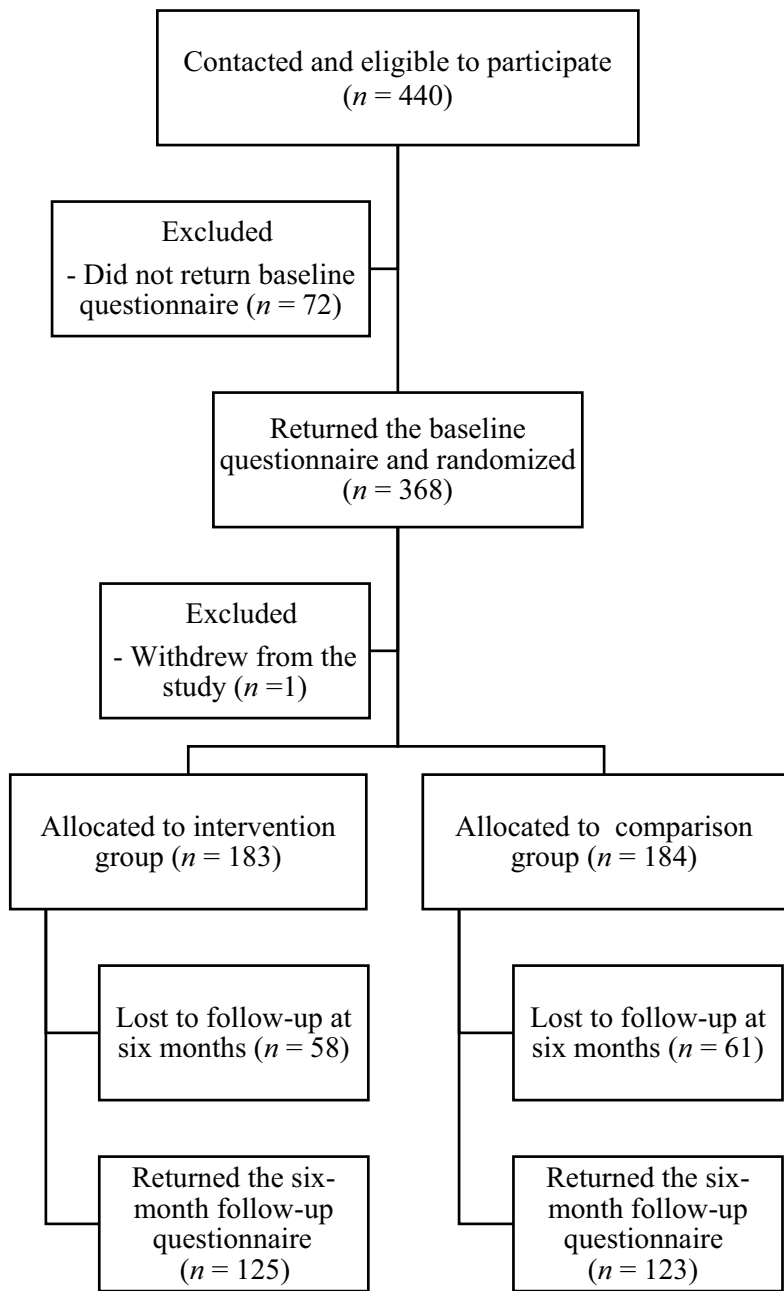


Figure 1. Study design and study participants
Source: Authors' own work

participating in the study and were included in the analyses to maintain adherence to the intention-to-treat (ITT) approach, despite deviating from the initial age eligibility criteria (see Moher *et al.*, 2010). Among the eligible participants, 81% were women, 96% were in full-time and 4% in part-time employment (at least 50% of full working time). Most had higher education (76% held at least a bachelor's degree or tertiary-level qualification). Public sector employees constituted 77% of participants, with 57% in the municipalities and 20% in state administration, whereas 23% worked in the private sector. Compared to the general Finnish workforce (aged 35–64), individuals with higher education (49%), women (52%) and public sector employees (31%) were overrepresented in our study, and private sector employees (69%) were underrepresented (Statistics Finland, 2024). Therefore, our sample is not fully representative of the general Finnish workforce, which should be considered when interpreting the results.

The 367 respondents who completed the baseline questionnaire were randomized into either the intervention group (group training, $n = 183$), or the comparison group (self-study material, $n = 184$) (see Figure 1). Randomization was conducted separately for each organization, using a block design with a block size of 2 and a 1:1 allocation ratio. We used a computer-generated random number generator in Microsoft Excel for the randomization. Participants were then informed of their group assignment: the intervention group was invited to training workshops, and the comparison group received self-study material via email with one month to review it during working hours. Six months after the intervention, all the participants received the follow-up questionnaire via email. Those who did not respond after two email reminders received the questionnaire and a return envelope by post.

Competence development intervention

Training of trainers. The intervention phase began with the training of at least two trainers—mainly from HR departments and a few OSH representatives – selected by participating organizations. The research group conducted four workshops, each comprising four 3-h sessions, spread over two to three weeks, training 34 trainers total. Before the sessions, trainers received the participant's workbook and trainer's manual, containing the program's background, theoretical principles, group training elements, facilitation guidelines and detailed module activity instructions. During the training, trainers were introduced to the program content and practical aspects of their role as peer-group facilitators.

Competence development training. Trainers in the workplace invited intervention group participants to a 12-h group training program and distributed the workbooks. The group training modules consisted of 19 workshops conducted online (nine), face-to-face (five) or combining both (five), with group sizes of 4–15 employees. The training included discussions, exercises, role-playing and individual reflection assignments where participants, for example, identified their personal skills, competences and strengths; shared ideas on enhancing occupational skills and competences; recognized their social networks and reflected on obtaining social support; discussed how to communicate developmental goals, and created a development plan. The program incorporated social modeling, vicarious reinforcement and mastery experiences through group activities during which the participants were encouraged to disclose their own career experiences and knowledge to foster peer learning. The program activities were expected to increase participants' self-efficacies in competence development and resilience against setbacks, thus equipping them with tools and confidence to pursue developmental goals and effectively manage career-related challenges. It also had short preliminary assignments on using one's strengths, learning experiences and an informational interview, taking about an hour to complete.

The program incorporated the five Michigan Prevention Research Center group training principles (Price and Vinokur, 1995; Vuori et al., 2005):

- (1) *competence development skills training* focused on enhancing the participants' skills, for example in recognizing and communicating their skills and competences;
- (2) *inoculation training* prepared participants to overcome potential development-related barriers and setbacks;
- (3) *active learning and teaching methods* promoted a participant-centered approach and encouraged participants to share their knowledge and experiences;
- (4) *skilled trainers* facilitated group processes and built up trust; and
- (5) *supportive and positive learning environment* fostered peer support and learning.

Comparison group. The comparison group received self-reflection PDF materials via email immediately after randomization. These materials contained brief exercises and information on topics similar to the training modules, and participants were instructed to read them within a month. After the workplace competence development intervention, the comparison group was asked whether they had read the material and how long they had spent doing so. We found no statistically significant differences between the outcome measures of those who read the material fully or partially and those who did not, and thus decided to treat the comparison group as one group.

Effectiveness of randomization and response rates

Of the 367 participants measured at baseline, 248 (68%) completed the six-month follow-up questionnaire. The response rates of the intervention groups in participating organizations ranged from 52% to 100% ($M = 68.3\%$, $SD = 46.7$), and those of the comparison groups from 43% to 88% ($M = 66.9\%$, $SD = 47.2$). We found no significant differences between the baseline characteristics of the intervention and comparison groups, confirming successful randomization. To account for potential dropout bias, we compared participants who did not complete the six-month follow-up to those who did, and found no significant differences between demographic characteristics, outcome measures, or dropout rates between the intervention and comparison groups.

In terms of intervention attrition, 97% participated in at least half the sessions. Three participants (2.7%) did not attend any sessions, and five (5%) did not disclose their participation status and were thus classified as no-shows. There were no significant differences between the demographic characteristics or outcome measures of attendees and no-shows. In accordance with the intention-to-treat principle, all the participants completing the six-month follow-up questionnaire were included in the analyses, regardless of their adherence. Two participants were excluded from the work engagement analyses due to a careless response pattern in both the baseline and follow-up questionnaires.

Measures

We measured participation in learning activities and work engagement at baseline and the six-month follow-up. Responsiveness to the intervention was assessed immediately after implementation. All other measures were in the baseline questionnaire. Table 2 presents the measures' reliability estimates.

Demographic characteristics. Participants reported their level of education, gender and age. Education level was categorized as low (upper secondary level or lower) or high (bachelor's degree or higher).

Responsiveness to the intervention. To measure the participants' responsiveness – a key aspect of intervention integrity, specifically their engagement in the program and its activities – participants in the intervention condition evaluated the program's relevance and usefulness. They responded to four items on a five-point scale ranging from 1 (*completely disagree*) to 5 (*completely agree*).

Participation in informal learning activities. As a measure of the extent of participation in informal learning activities, the baseline and six-month follow-up questionnaires asked how participants had developed their occupational skills over the last six months. This measure was adapted from the Adult Education Survey (Eurostat, 2017), which examined informal learning participation. The learning activities included various informal learning behaviors (Misko, 2008; Noe et al., 2013) related to learning from different sources (*asking supervisor/colleagues for feedback; observing other people's work; teaching, guiding, or instructing others; receiving coaching or mentoring from a designated instructor; acting as a coach or mentor to others; reading field-related literature; trying new working methods; participating in online training; participating in employer-organized training; taking on new responsibilities and tasks; participating in job rotation; participating in webinars*). Participants selected all the applicable activities from a list of 12 items.

Work engagement. Work engagement was measured using the Ultra-Short Measure of Work Engagement (Schaufeli et al., 2019), containing three items depicting the dimensions of vigor, dedication and absorption. A sample item is "At my work, I feel bursting with energy." Participants rated items on a seven-point scale, ranging from 0 (*never*) to 6 (*every day*).

Workplace contextual factors. Organizational innovation and flexibility was measured using the Organizational Climate Measure (OCM) (Patterson et al., 2005). A sample item is "New ideas are readily accepted here." Participants rated items on a five-point scale, ranging from 1 (*completely disagree*) to 5 (*completely agree*). Age-equality of opportunities was measured using two items from the organizational climate dimension (OC1-2 and OC1-3) of the Later Life Workplace Index (LLWI) measure (Wilckens et al., 2021). Participants rated the items on a five-point scale, ranging from 1 (*completely disagree*) to 5 (*completely agree*). Supervisory support for development was measured using two items developed for this study: "My supervisor supports the development of the competences needed in my work" and "My supervisor encourages me to develop my career in a personally suitable direction." Participants rated items on a five-point scale, ranging from 1 (*not at all*) to 5 (*very much*).

Statistical analyses

Statistical analyses were conducted using SPSS version 29 and Mplus version 8 (Muthén and Muthén, 1998). Mixed-effects models estimated with robust covariances were used to analyze the long-term effects, with organization as the clustering unit. We used the TYPE=COMPLEX function in Mplus to account for the hierarchical data structure and to adjust standard errors for potential non-independence of the observations within the clusters. Independent variables were condition, baseline measurement of the outcome variable, moderator variables, and interaction terms. Moderation effects were analyzed by adding interaction terms of the condition variable and the respective moderator variable to each model separately. Moderator variable values were standardized before product terms were calculated. Simple slope analyses used criteria of one standard deviation below the mean, at the mean, and above the mean, to form the two-way interaction terms, reflecting the low, medium and high moderator values, respectively.

Results

Responsiveness to the intervention

Participants in the intervention condition evaluated positively their engagement and the perceived benefits of the program. Specifically, they evaluated the program as follows:

- I found participating in the training inspiring ($M = 4.24$, $SD = 0.80$);
- Participating in the training felt burdensome ($M = 2.05$, $SD = 1.05$);
- I gained new ideas and solutions for my work from the training ($M = 3.84$, $SD = 0.94$); and
- I feel that the training exercises were relevant for me ($M = 3.94$, $SD = 0.76$).

Main effect analyses. Table 1 shows the means and standard deviations of the study variables and Table 2 shows Pearson's correlations.

Regarding *H1*, which stated that resource-building intervention will broaden employees' engagement in informal learning activities, results showed no statistically significant main effect on informal learning participation, thus *H1* was not supported (Table 3). However, regarding *H2*, which stated that resource-building intervention will enhance employees' work engagement, we observed a statistically significant main effect on work engagement, supporting *H2*. Work engagement increased more in the intervention group (baseline: $M = 4.50$, $SD = 1.01$; six-month follow-up: $M = 4.52$, $SD = 1.07$) than in the comparison group (baseline: $M = 4.60$, $SD = 1.06$; six-month follow-up: $M = 4.39$, $SD = 1.22$). Cohen's d -value was 0.22, indicating a small-sized effect (Cohen, 1992).

Interaction effects. Regarding *H3a* – stating that positive effects of the intervention on informal learning and work engagement would be stronger among employees who viewed their organizational climate as innovative and flexible – results showed that organizational innovation and flexibility did not moderate the intervention effect on work engagement ($Est. = -0.17$, $p = 0.18$), and only moderated the intervention effect on the use of informal learning in one-sided testing ($Est. = 0.44$, $p = 0.09$). Thus, *H3a* was not supported.

Next, we tested *H3b*, which stated that the positive effects of the intervention on informal learning and work engagement would be stronger among employees who perceived their organization as promoting age-equal opportunities for development. Results showed that age-equality did not moderate the intervention effect on work engagement ($Est. = 0.06$,

Table 1. Means and standard errors of study variables in intervention and comparison groups

Variable	Intervention		Comparison	
	<i>n</i>	<i>M</i> (<i>SD</i>)	<i>n</i>	<i>M</i> (<i>SD</i>)
<i>Baseline</i>				
Informal learning	183	5.93 (2.18)	184	5.80 (2.06)
Work engagement	183	4.55 (1.07)	184	4.58 (1.19)
Organizational innovation and flexibility	183	2.85 (0.78)	184	2.86 (0.78)
Age-equality of opportunities	183	3.71 (0.91)	184	3.69 (0.93)
Supervisory support for development	183	2.85 (0.80)	184	2.82 (0.85)
<i>Six-month follow-up</i>				
Informal learning	123	5.45 (2.18)	122	5.48 (2.36)
Work engagement	124	4.52 (1.07)	122	4.40 (1.07)

Note(s): *n* = Sample size, *M* = Mean, *SD* = Standard error

Source(s): Authors' own work

Table 2. Correlations and reliability estimates of study variables

Variable	1	2	3	4	5	6	7	8	9	10	11
<i>Baseline</i>											
1. Condition (0 = comparison, 1 = intervention)	–										
2. Age	–0.01	–									
3. Educational level	0.01	–0.18**	–								
4. Gender	–0.09	0.04	0.05	–							
5. Informal learning	–0.02	–0.02	<0.01	0.04	–						
6. Work engagement	–0.06	0.01	–0.05	–0.01	0.23**	(0.82)					
7. Organizational innovation and flexibility	–0.09	–0.02	0.01	–0.01	0.18**	0.24**	(0.87)				
8. Age-equality of opportunities	–0.05	–0.25**	0.17**	–0.03	0.22**	0.27**	0.44**	(0.85)			
9. Supervisory support	0.01	–0.04	0.07	–0.01	0.13*	0.16*	0.54**	0.47**	(0.78)		
<i>Six-month follow-up</i>											
10. Informal learning	–0.01	–0.09	0.09	0.03	0.61**	0.22**	0.07	0.06	0.07	–	
11. Work engagement	0.06	–0.02	0.07	<0.01	0.22**	0.59**	0.27**	0.25**	0.10	0.28**	(0.84)
Note(s): Cronbach's alphas are shown in the diagonal in parentheses; * $p < 0.05$, ** $p < 0.01$											
Source: Authors' own work											

Table 3. Main and interaction effects of intervention to the outcomes in six-month follow-up

Variable	Informal learning		Work engagement	
	Est.	SE	Est.	SE
<i>Main effects</i>	0.02	0.26	0.23*	0.11
<i>Interaction effects</i>				
Model 1				
Organizational innovation and flexibility	-0.32*	0.13	0.22*	0.10
Intervention × organizational innovation and flexibility	0.44	0.26	-0.17	0.12
Model 2				
Age-equality	-0.31	0.16	0.09	0.14
Intervention × age-equality of opportunities	0.59**	0.21	0.06	0.17
Model 3				
Supervisory support	-0.26	0.14	-0.04	0.09
Intervention × supervisory support	0.56*	0.22	0.08	0.09

Note(s): The models are adjusted for the baseline measurement of the outcome variables; * $p < 0.05$, ** $p < 0.01$

Source(s): Authors' own work

$p = 0.74$) but moderated the intervention effect on the use of informal learning ($Est. = 0.59$, $p < 0.01$). Simple slope tests indicated increased use of informal learning when age-equality was perceived as high ($Est. = 0.59$, $p < 0.01$). In contrast, the slope was not statistically significant when age-equality was perceived as low ($Est. = -0.56$, $p = 0.15$). Thus, $H3b$ was partly supported.

Regarding $H3c$ – stating that the positive effects of the intervention on informal learning and work engagement would be stronger among employees who perceived strong supervisory support for development – results showed that supervisory support did not moderate the intervention effect on work engagement ($Est. = 0.08$, $p = 0.39$) but moderated the intervention effect on the use of informal learning ($Est. = 0.56$, $p < 0.05$). Simple slope tests indicated increased informal learning use due to the intervention when supervisory support was perceived as high ($Est. = 0.56$, $p < 0.05$) but was not significant when supervisory support was perceived as low ($Est. = -0.59$, $p = 0.16$). Thus, $H3c$ was partly supported. Overall, the intervention's effects on informal learning seem to largely depend on the workplace contextual factors.

Given six participants were under the age of 35, i.e. in their early career, and did not meet the initial age eligibility criteria, we conducted additional analyses excluding these participants. Post hoc sensitivity analyses – adhering to the per-protocol principle – indicated that the findings were consistent with the primary results derived from the intention-to-treat analyses.

Discussion

Our study examined how a resource-building group intervention could enhance employees' participation in informal learning and their work engagement over the long term. The results were partly in line with our hypotheses. Regarding the intervention's main effects, participation significantly increased the participants' work engagement aligning with prior career management research showing that increasing employees' specific self-efficacies and preparation against setbacks enhances work engagement (Akkermans *et al.*, 2015; Vuori *et al.*, 2012, 2019). Although prior research on the predictive relationship between various personal

resource interventions and work engagement has yielded mixed results (Knight *et al.*, 2017, 2019), our RCT study demonstrated a significant positive causal effect. Our results show how an intervention developed to enhance employees' individual resources in developing their skills and competences can be beneficial in increasing their work engagement, reflected in high levels of energy, willingness to invest effort and a sense of significance at work. The lack of moderating effects of organizational factors implies that work engagement is less dependent on these contextual factors.

We found that the intervention had no significant long-term main effect on utilizing informal learning activities as part of on-the-job learning. However, our examination of interaction effects revealed a significant beneficial moderator effect on informal learning. More precisely, participants who perceived better age-equality of opportunities and supervisory support for development in their organization adopted informal learning to a larger extent. However, the moderation of organizational innovation and flexibility was only significant in one-sided testing, thus serving only as an indication of its moderating role, requiring further exploration in future studies. Despite no main effect on informal learning, these results mainly align with our hypotheses, demonstrating the importance of organizational climate and support in employees' efforts to develop competence. Prior studies have highlighted the pivotal role of organizational factors in workplace learning participation (e.g. Sung and Choi, 2014; Uhunoma *et al.*, 2020; Zia *et al.*, 2021), and our study contributes to this body of literature by using a causal inference design to empirically confirm these findings. Our findings extend the expansive learning environment framework (Fuller and Unwin, 2004) by showing that a more supportive and age-equal workplace learning context seems pivotal in transferring increased individual resources into actual on-the-job learning behaviors. The study also contributes to the theory-based intervention research by empirically testing, via a randomized controlled trial, how established theories of social learning (Bandura, 1997), planned behavior (Ajzen, 1991) and stress inoculation training (Meichenbaum, 2007) can be applied to enhance learning and engagement at work. The sustained intervention effects on outcomes underscore the significance of social learning processes and proactive coping strategies in building motivational resources – such as efficacy beliefs and resilience – essential for continuous competence development throughout the career.

Overall, organizational factors appear crucial for the sustained impact of the intervention on informal learning behaviors. Prior research has discussed the role of organizational characteristics in the implementing and ensuring the efficacy of workplace interventions (Moullin *et al.*, 2019; Nielsen and Abildgaard, 2013; Watson *et al.*, 2018), and our study provides evidence that considering the organizational context is imperative. Indeed, given that many workplace interventions report negligible effects on subjective well-being and learning (Watson *et al.*, 2018), contextual factors may partly explain the underlying positive or even detrimental outcomes in different contexts.

Strengths, limitations and future research

Employing a randomized controlled trial design, our study reliably assess the moderating impact of perceived organizational factors on the intervention's effects on learning and occupational well-being. The randomization process allowed us to confidently attribute observed outcome differences to the conditions to which participants were exposed. In addition, conducting the study across diverse public and private sector workplaces with a substantial sample enhanced generalizability and applicability of our findings. The delivery of the intervention by trained trainers within workplace settings facilitated its practical dissemination and contextual implementation.

However, our study has some limitations. First, most participants had a high level of education, as recruiting companies with a significant proportion of blue-collar employees proved to be challenging. This imbalance may limit the applicability to less-educated populations. Second, women were overrepresented compared to the broader Finnish workforce, a factor to consider when interpreting the results; generally, men participate less in behavioral group interventions than women (Knox *et al.*, 2023). Third, while we assessed varied informal learning methods, participants might have engaged more frequently in some specific methods. Despite these limitations, we believe our findings sufficiently demonstrates the intervention's efficacy and provide meaningful insights. While this study empirically supports resource-building interventions in promoting workplace learning and engagement, future research could investigate mechanisms by which individual resources translate into sustained long-term outcomes. Future studies could also examine how such individual-level benefits contribute to broader organizational outcomes, such as job retention, productivity and employee performance.

Conclusions

Our study underscores the value of competence development interventions that enhance mid- and late career employees' individual resources through peer learning and support, particularly for fostering informal learning and work engagement. The findings also emphasize the critical importance of organizational factors in determining both the efficacy and transfer of training in workplace interventions promoting competence development. The results suggest that supporting competence development using a group-based intervention is most effective when management and organizational climate support employees' initiatives. To maximize the benefits of such bottom-up workplace interventions, learning and development (L&D) and other HR professionals should cultivate a workplace climate that encourages innovation, values age-diversity and equips supervisors to support employees' motivation and learning. This could involve training supervisors to recognize and support informal learning, embedding peer-based learning into workplace routines and aligning employees' developmental needs with organizational objectives through ongoing collaborative discussions.

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