

ORIGINAL ARTICLE

# The effects of training managers on management competencies to improve their management practices and work engagement of their subordinates: A single group pre- and post-test study

Hidehiko Adachi | Yuki Sekiya | Kotaro Imamura | Kazuhiro Watanabe |  
Norito Kawakami 

Department of Mental Health, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan

## Correspondence

Norito Kawakami, Department of Mental Health, Graduate School of Medicine, The University of Tokyo, 7-3-1, Hongo, Bunkyo-ku, Tokyo 113-0033, Japan.  
Email: nkawakami@m.u-tokyo.ac.jp

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## Abstract

**Objectives:** The aim of this study was to investigate the effect of a training program for managers on their management competencies and work engagement of their subordinate workers and to investigate the mediating effect of management competencies on the subordinate work environment.

**Methods:** A training program, developed based on the UK Health and Safety Executive management competencies framework, was offered to managers in a finance company in Japan. Management competency was assessed at baseline and 1 month after the intervention. Work engagement was assessed at baseline and at a 1-year follow-up. Multilevel correlations between changes in components of management competency and changes in subordinate work engagement were analyzed.

**Results:** Although 6 of 12 components of management competency increased significantly following the intervention, significant intervention effect on subordinate work engagement was not found. Among 12 components of management competency, the integrity of managers showed significant multilevel correlation with work engagement of their subordinates. Subgroup analyses revealed that this multilevel correlation increased when a manager and a subordinate differed in gender.

**Conclusions:** The results of this study indicated that the training program developed in this study effectively improved the management competency of managers and that integrity of managers may facilitate work engagement of subordinate workers, especially when a manager and a subordinate are of different genders. Thus, a training program focused on improving the integrity of managers could enhance the work engagement of employees.

## KEYWORDS

management competency, multilevel analysis, training program for managers, work engagement

## 1 | INTRODUCTION

Recently, work engagement has received attention as a potentially important factor influencing the health and well-being of workers.<sup>1</sup> Work engagement is a positive, fulfilling, work-related state of mind characterized by vigor, dedication, and absorption.<sup>2</sup> Previous studies have indicated that work engagement predicts other work-related outcomes, such as job performance, turnover intention, organizational commitment, service climate, and customer loyalty<sup>3,4</sup> as well as mental health outcomes, such as depression and anxiety.<sup>5,6</sup>

Research on the effects of interventions aimed at improving work engagement has been increasing. Knight et al<sup>7</sup> conducted a meta-analysis according to the Cochrane Collaboration's<sup>8</sup> guidelines for systematic reviews. Their meta-analysis of 14 controlled studies (including non-randomized controlled trials) revealed a small but reliable effect of interventions on work engagement (Hedges'  $g = 0.29$ , 95% CI [0.12 to 0.46]). Knight et al<sup>7</sup> classified the contents of interventions (three interventions for individual employees and one intervention for supervisors) into four types, which are personal resource building, job resource building, health promotion, and leadership training, but did not find a significant difference in their effects on work engagement. Therefore, while previous studies have indicated that it is possible to improve work engagement through intervention, the types of intervention that are more effective are still unknown, and more studies on each type are needed.

The management behaviors of managers can have a considerable influence on the mental health of subordinate workers. Based on the results of a systematic review of three decades of research, Skakon et al<sup>9</sup> concluded that positive manager behaviors, such as consideration and support, are positively related to well-being and low distress, or an unpleasant emotional experience, among their subordinate workers. Kunie et al<sup>10</sup> reported that the communication behaviors of managers are positively related to work engagement of nurses. Therefore, training managers may improve subordinate workers' work engagement. However, only a few studies have investigated the effect of an intervention targeting supervisors on work engagement of their subordinate workers. Angelo et al<sup>11</sup> conducted a quasi-experimental study in which they randomly allocated 4 of 7 units of firefighters to the intervention group and the rest (3 units) to the control group. Supervisors in the intervention group participated in a 3-day workshop on stress management and leadership. Subordinate firefighters were surveyed before and 4 months after the intervention. They measured two factors of work engagement (vigor and dedication) and found a marginally significant intervention effect on vigor, which remained in the intervention group while it decreased in the control group. Biggs et al<sup>12</sup> conducted a controlled study of the effect of a 5-day workshop for police officers and found a significant although small

( $\beta = 0.08$ ,  $P < .05$ ) intervention effect on work engagement at 7 months follow-up.

These previous reports indicate that offering training workshops to managers or supervisors may be effective in improving subordinates' work engagement. However, the number of studies is still limited. None of the existing studies measured the intervention effect on workshop participants (managers), making it impossible to determine how the intervention changed participants. Additionally, a 3- or 5-day workshop is time-consuming; thus, it might be necessary to develop a more focused intervention that would require less time and energy. To develop an effective intervention that is less demanding in terms of time, we need to know what changes in managers' behaviors influence work engagement of their subordinates. It might be fruitful to investigate the aspects of managers' behaviors that improved work engagement of their immediate subordinate workers following the intervention. To design an intervention program that is more effective and efficient, detailed research on changes in managers' behaviors might help identify specific aspects of attitudes or skills of managers that have an important effect on work engagement of subordinate workers.

One effective intervention to improve managers' behaviors that affect distress and well-being of subordinate workers has been developed through extensive research by Yarker et al<sup>13,14</sup> commissioned by the UK Health and Safety Executive (HSE). The researchers interviewed 216 employees, 166 line managers, and 54 Human Resources professionals to explore managers' behaviors associated with the well-being of employees. Based on the results of the qualitative analysis, they developed a 66-item inventory named stress management competency indicator tool (SMCIT) for HSE to capture the behaviors relevant to the management of well-being, health, and stress of employees. Subsequently, they developed a training program that gives participants opportunities to receive feedback on their management competencies using SMCIT and to discuss and plan ways to improve their management behaviors. Toderi et al<sup>15</sup> pointed out the efficacy of such an intervention in the development of positive leadership and manager behaviors. Therefore, based on the framework of Yarker et al's training program, it might be possible to offer an effective intervention to managers to promote their management competencies that would facilitate improvement in work engagement among subordinate workers. Additionally, examining the relationship between management competencies and work engagement of subordinate workers may provide insights into the management competencies that are more important for improving the work engagement of subordinate workers.

The study aimed to investigate the effect of a training program for managers based on the HSE management competencies framework aimed at improving management competencies at 1-month follow-up and work engagement of subordinate

workers at 1-year follow-up using a single-group pre- and post-test study design. The study also investigated a mediating effect of management competencies on the improved work environment, looking at multilevel correlations between the changes in the components of management competencies and changes in work engagement of subordinate workers.

## 2 | SUBJECTS AND METHODS

### 2.1 | Study design

A single-group pre- and post-test study was conducted. The condition of the participating organization did not allow us to set a control group. The central aim of this study was to investigate the influence of management competency on the work engagement of subordinate workers. The Ethical Committee of the University of Tokyo reviewed and approved the design and procedure of this study before its start (10535-3).

### 2.2 | Participants

This study was conducted in a financial enterprise business (total employee size ca 1618) in Japan. All managers and their subordinate workers in all the offices of this company in Japan were recruited to participate in the study.

The Human Resources division of this company instructed all managers to participate in the manager training program. We included managers who supervised at least one subordinate worker (the inclusion criterion). Managers who had management experience of <3 months were excluded (the exclusion criterion). The researcher fully explained the aims and procedures of the study and participating managers provided the written consent when they completed the baseline questionnaire.

The data were collected from all subordinate workers of this company using a web-based questionnaire administered 1 month before the study began (July 2014) and 1 year later (July 2015). The baseline inclusion criteria for subordinate workers included working in this company and having an immediate supervisor. Subordinate workers who reported directly to a manager with management experience of <3 months were excluded. The aims and procedures of the current study were fully explained to the subordinate workers through an online document at the end of the first survey before the study. The data from subordinate workers who did not give the consent to participate in the study were removed.

### 2.3 | Intervention

We developed an original training program named “A guide to management for healthy vibrant workplace” based on the HSE management competencies framework. A clinical psychologist (YS) and professor of occupational mental health

(NK) developed a draft of the training program. The draft of the training program was presented at a research meeting, and the comments from researchers and practitioners in occupational mental health were used to further improve the program. The aim of this program was to enable the participants to take appropriate actions to support the mental health of their subordinate workers. The program offered in the form of a 150-min workshop comprised lectures on various topics, group works, and homework. Each workshop included 20-30 participants, and four workshop sessions were provided by the same instructor (YS) without changing the content of the program. The program was divided into five sections, (a) Self-check: Participants completed the SMCIT (see below for the detail) to assess their own strengths and weaknesses in daily management competencies, (b) Announcing the strength: Each participant announced his or her strength, as indicated by the best score on the SMCIT, (c) Group discussion: The participants discussed effective management skills in small groups to help them choose three most important skills, (d) Presentation: Each group explained the result of its discussion to other participants, and (e) Setting personal Goals: Participants set personal goals and decided on an action plan regarding management skills to help their subordinates be healthier and more vibrant. The training program aimed to; (a) enable the participants to assess their own current management competency using an evaluative tool; (b) allow the participants to gain ideas about management behaviors through group discussion; and (c) enhance improvements in everyday behaviors in the workplace by setting personal goals and making action plans to put the content of the program into practical use.

### 2.4 | Outcomes

Managers completed paper-and-pencil self-report questionnaires before the intervention and a web-based self-report questionnaire 1 month after the intervention. Subordinate workers responded to web-based self-report questionnaires before and 1 year after the intervention.

#### 2.4.1 | Primary outcome: work engagement of subordinates

We used the Brief Job Stress Questionnaire (BJSQ),<sup>16</sup> an 80-item multi-dimensional job stress questionnaire, to measure work engagement of subordinate workers. Work engagement sub-scale of the BJSQ was used to assess work engagement of subordinate workers. The scale consists of the following two questions; “Do you feel lively at work?” and “Do you feel proud of your job?” Those two items were measured on a four-point Likert scale ranging from 1 (disagree) to 4 (agree), and the average score on these two questions was used as an indicator of work engagement, with a higher score indicating better engagement.

## 2.4.2 | Secondary outcome: HSE management competencies of managers

The managers' management competency was assessed using the Japanese version of the SMCIT.<sup>17</sup> Originally developed by the HSE, UK, and later translated into Japanese by Kawakami et al<sup>17</sup> this scale consists of 66 items measuring four competency areas; (a) Being respectful and responsible, (b) Managing and communicating existing and future work, (c) Managing the individual within the team, and (d) Reasoning/managing difficult situations. Each of those four competency areas consists of three sub-competencies measured by 3 to 9 items each. All 66 items were measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Sub-competencies included in each area, with the number of items included in the parentheses, are as follows. Area 1 includes integrity (5), managing emotions (6), and considerate approach (6). Area 2 includes proactive work management (9), problem-solving (4), and participative/empowering (9). Area 3 includes personally accessible (4), sociable (3), and empathetic engagement (8). Area 4 includes managing conflict (5), using organizational resources (3), and taking responsibility for resolving issues (4).

The internal consistency reliability (Cronbach's alpha) of the original version was over 0.90 for all four competencies.<sup>14</sup> Kawakami et al<sup>17</sup> reported Cronbach's alpha coefficients of 0.915, 0.951, 0.904, and 0.921 for four scales 1-4 respectively. Cronbach's alpha coefficients for 12 subscales ranged from moderate to high, as follows, integrity (0.762), managing emotions (0.844), considerate approach (0.836), proactive work management (0.901), problem-solving (0.871), participative/empowering (0.907), personally accessible (0.676), sociable (0.702), empathetic engagement (0.887), managing conflict (0.926), using organizational resources (0.616), and taking responsibility for resolving issues (0.853).

## 2.5 | Demographic characteristics

Demographic characteristics of managers and subordinate workers (managers' gender, managers' age, subordinates' gender, and subordinates' approximate age) were also collected at baseline.

## 2.6 | Statistical analyses

The amount of change in manager-level management competency was calculated by subtracting the baseline score from the score at 1-month follow-up. The amount of change in worker-level work engagement was calculated by subtracting the baseline score from the score at 1-year follow-up. At first, to examine the intervention effect on manager-level management competency and on worker-level work engagement, we conducted paired *t*-tests of differences between mean scores of 12 components of

management competency and total score of work engagement for both pre- and post-test. Cohen's *d*, a standard measure of effect size, was calculated for each change in score. Second, to examine the relationships between the change in manager-level sub-competencies and the change in worker-level work engagement, we conducted multilevel linear regression analyses with random intercepts and fixed slopes. We investigated the relationships between the manager-level sub-competencies, which had increased significantly after the intervention, and the worker-level work engagement. In those analyses, workers (level 1; worker-level) were nested within a unit (level 2; manager level). We estimated three models in the multilevel analyses: an unconditional model (Model 1), a crude conditional model (Model 2), and an adjusted conditional model (Model 3). First, we conducted the analyses to examine workplace-level variance in subordinate workers' work engagement score without including any explanatory variables (Model 1; null model). Second, we included explanatory variables, ie, scores of sub-competencies, in the analyses (Model 2). These explanatory variables improved significantly after the intervention, and they were entered in the analysis individually, one by one. Finally, we conducted multilevel analyses, which included adjustment covariates (Model 3), specifically, manager-level age, manager-level gender, worker-level gender, and worker-level age group. Worker-level age group comprised individuals in their 20s, 30s, 40s, and 50s. Subgroup analyses were also conducted where in one group, subordinates and managers had the same gender while in the other group, they did not. The statistical analyses were conducted using the statistical package SPSS version 22 (SPSS Inc).

## 3 | RESULTS

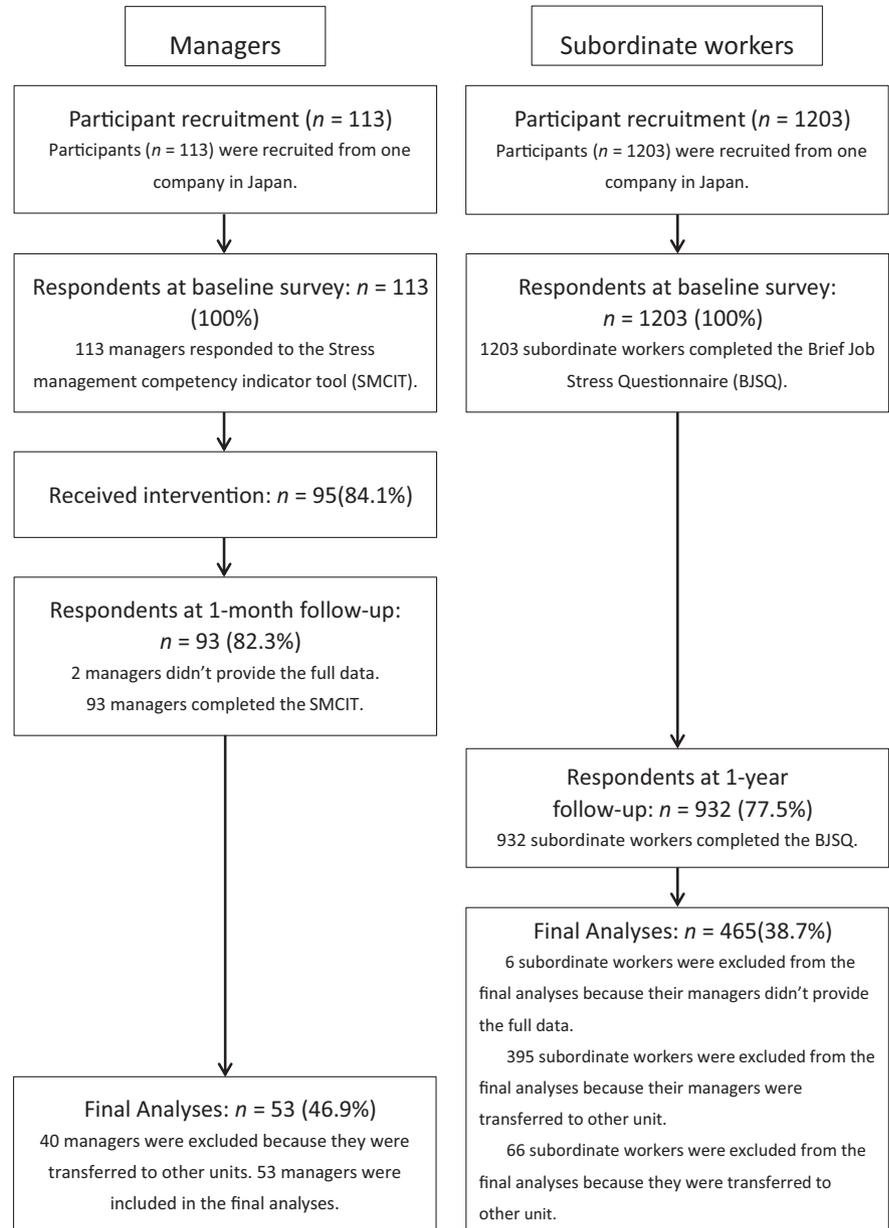
### 3.1 | Participant recruitment

The participant flowchart is shown in Figure 1. A total of 95 managers (93 men and 2 women) and 1203 subordinate workers (600 men and 603 women) participated in this study and responded to the baseline survey in July 2014. Of those, 93 managers (98%; 91 men and 2 women) completed the 1-month follow-up survey in August 2014 and 932 subordinate workers (78%) completed the 1-year follow-up survey in July 2015. Of those, 40 managers and 592 subordinate workers were excluded from the analyses because of either transfer to other units or incomplete data. We used the data obtained from 53 managers (56%; 51 men and 2 women) and 465 subordinate workers (39%; 195 men and 270 women) in the final analyses.

### 3.2 | Baseline characteristics

The average age of 95 managers was 44.69 (SD = 2.88), and approximately half of them were in their late forties. Of 1203 subordinate workers, 3, 308 were in their teens (18-19), 405 were in their 20s (20-29), 303 in their 30s (30-39), 363 in their 40s (40-49),

**FIGURE 1** Participants flow chart for managers and subordinates. The figure presents the flow chart for managers and subordinate workers at the baseline and at the final analysis



and 123 in their 50s (50-60) (Table 1). All participants were full-time white-collar employees working only day shifts.

The final, 1-year follow-up, analyses included 53 managers (51 men and 2 women) and 465 subordinate workers (195 men and 270 women). The average age of those 53 managers was 44.28 (SD = 2.76). Of 465 subordinate workers, 2 were in their teens (18-19), 119 were in their 20s (20-29), 168 were in their 30s (30-39), 123 were in their 40s (40-49), and 53 were in their 50s (50-60) (Table 1). Among managers, baseline participants ( $n = 95$ ) and those included in the final analyses ( $n = 53$ ) did not differ in their age ( $t(146) = 0.79$ ,  $P = .433$ ) and gender ratio ( $\chi^2 = 0.36$ ,  $df = 1$ ,  $P = .548$ ). Among subordinate workers, baseline participants ( $n = 1203$ ) and those included in the final analyses ( $n = 465$ ) did not differ significantly in their

age ( $t(1665) = 0.331$ ,  $P = .740$ ), but the latter group had a significantly higher ratio of female participants ( $\chi^2 = 8.48$ ,  $df = 1$ ,  $P = .004$ ) compared to baseline participants.

### 3.3 | The change in management competencies among managers

Table 2 shows the means and SDs of the secondary outcome variables at baseline and 1-month follow-up. Our intervention yielded significant beneficial effects. A comparison of management competencies at baseline and 1-month follow-up indicated that scores for 6 of 12 sub-competencies, including integrity, considerate approach, proactive work management, problem-solving, participative/empowering, and empathetic engagement increased significantly with moderate to small effect sizes.

**TABLE 1** Baseline demographic characteristics of managers and subordinates

Variables	Baseline (n = 95)		For analysis (n = 53)		P for difference
	n	%	n	%	
Managers					
Gender					.548
Male	93	97.9	51	96.2	
Female	2	2.1	2	3.8	
Age					.433
35-39	4	4.2	3	5.7	
40-44	39	41.1	24	45.3	
45-49	47	49.5	26	49.1	
50-60	5	5.3	0	0	
Variables	Baseline (n = 1203)		For analysis (n = 465)		
	n	%	n	%	
Subordinate workers					
Gender					.004
Male	600	49.9	195	41.9	
Female	603	50.1	270	58.1	
Age					.740
18-19	3	0.2	2	0.4	
20-29	308	25.6	119	25.6	
30-39	405	33.7	168	36.1	
40-49	363	30.2	123	26.5	
50-60	123	10.2	53	11.4	
Unknown	1	0.1	0	0	

Note: The table presents demographic information of managers and subordinates, such as gender and age.

### 3.4 | The change in work engagement among subordinate workers

Scores for work engagement of subordinates did not increase significantly from baseline (Mean = 2.53, SD = 0.71) to 1-year follow-up (Mean = 2.56, SD = 0.73). The average change was 0.04 (SD = 0.55), and the effect size was small (Cohen's  $d = 0.05$ ).

### 3.5 | Relationships between changing management competencies and work engagement

We conducted multilevel analyses to examine the relationship between worker-level work engagement and six sub-competencies, which had increased significantly after the intervention (see Table 3). The unconditional variance of random intercept of the change in work engagement in Model 1 was 0.01 (SE = 0.01,  $P = .14$ ). The unconditional

intercept in Model 1 was 0.04 (SE = 0.03,  $P = .247$ ). In the crude conditional model (Model 2), improvement in the managers' integrity had a significant positive association with the change in work engagement of subordinate workers ( $\gamma = 0.05$ ,  $P = .030$ ). This significant relationship was also confirmed after adjusting for the covariates ( $\gamma = 0.05$ ,  $P = .027$ , in Model 3). The changes in the remaining five sub-competencies of managers were not significantly associated with the change in work engagement of subordinates.

Although managers' and subordinates' gender were adjusted for in Model 3, the relationship between subordinate work engagement and manager integrity might be different depending on whether genders of a manager and a subordinate are the same. Therefore, we conducted subgroup analyses where in one group, subordinates and managers had the same gender while in the other group, they did not (see Table 4). In the same gender group (50 managers and 199 subordinates), although the relationship between subordinate work engagement and manager integrity was positive, it did not reach significance ( $\gamma = 0.03$ ,  $P = .459$ , in Model 3). In the different gender group (47 managers and 266 subordinates), both integrity and managers' problem-solving were significantly associated with work engagement ( $\gamma = 0.08$ ,  $P = .006$ ;  $\gamma = 0.05$ ,  $P = .043$ , respectively, in Model 3).

## 4 | DISCUSSION

The present study examined the effect of a newly developed training program for managers based on HSE management competencies framework designed to improve their own management competencies and work engagement of their subordinate workers. The results indicated that some management competencies of managers improved significantly after the intervention. While no significant intervention effect was observed for work engagement of subordinates, the integrity of managers was proposed to have a positive influence on the work engagement of subordinate workers.

The training program we provided for managers resulted in a significant increase in 6 of 12 sub-competencies among the participating managers, specifically, integrity, considerate approach, proactive work management, problem-solving, participative/empowering, and empathetic engagement. Our training program was developed based on the HSE management competency framework,<sup>14</sup> which was designed to include the opportunities for managers to receive feedback about the strengths and weaknesses in their current management competency and set personal goals on everyday management behaviors. Those components of the program may have helped managers objectively reassess their everyday behaviors and maintain conscious efforts to improve their behaviors, resulting in more considerate and supportive behaviors.

**TABLE 2** Changes in management practices between baseline and 1-mo follow-up among managers (n = 53) who participated in the training on UK Health and Safety Executive Management Competencies for Preventing Stress among Workers

Area	Sub-competencies	Number of items	Score range	Baseline		1-mo follow-up		<i>t</i> -test <i>P</i> -value	Effect size Cohen's <i>d</i>
				Mean	SD	Mean	SD		
1	Integrity	5	5-25	18.2	1.7	18.7	1.7	.020	0.33
	Managing emotions	6	6-30	22.3	2.6	22.8	2.2	.100	0.23
	Considerate approach	6	6-30	22.0	2.8	22.9	2.8	.028	0.31
2	Proactive work management	9	9-45	32.8	3.7	34.0	3.6	.008	0.38
	Problem solving	4	4-20	15.4	1.9	15.9	1.8	.011	0.37
	Participative/empowering	9	9-45	32.6	3.5	33.5	3.5	.045	0.28
3	Personally accessible	4	4-20	15.3	2.0	15.4	1.9	.402	0.12
	Sociable	3	3-15	10.0	1.5	10.3	1.8	.098	0.23
	Empathetic engagement	8	8-40	29.5	3.1	30.4	3.3	.016	0.34
4	Managing conflict	5	5-25	19.5	2.2	19.7	1.9	.379	0.12
	Use of organizational resources	3	3-15	10.3	2.1	10.8	2.1	.086	0.24
	Taking responsibility for resolving issues	4	4-20	15.8	1.7	16.1	1.8	.133	0.21

*Note:* The table presents means and standard deviations for sub-competencies of Stress management competency indicator tool at the baseline and 1-mo follow-up. Significant improvement was indicated for 6 of 12 sub-competencies, including integrity, considerate approach, proactive work management, problem-solving, participative/empowering, and empathetic engagement. *P*-values and values of Cohen's *d* are also presented. Area 1: Being respectful and responsible, Area 2: Managing and communicating existing and future work, Area 3: Managing the individual within the team, Area 4: Reasoning/managing difficult situations.

Significant positive changes in the competency Areas 1 and 2 of managers might have resulted from the participants' selection of personal goals. In the last part of our intervention, the participants were asked to set personal goals and develop action plans. They most frequently selected active communication with subordinates to clarify instructions or formulate a common understanding of the direction of the team's work. These goals might have helped managers better manage the existing and future work, with a more respectful and considerate approach toward individual subordinates.

Sub-competencies in Area 3 involve interpersonal communication with individuals in the team. These competencies might be more deeply related to nonverbal aspect; therefore, they might be more difficult to control compared to sub-competencies in Areas 1 and 2.

Sub-competencies in Area 4 could also be difficult to increase after the intervention because the scores in the Area, such as managing conflict and taking responsibility for resolving issues, were already high at the baseline. Those high scores might be one of the reasons for the lack of intervention effect on management competencies in Area 4.

Despite significant improvement in managers' behaviors, significant intervention effect on work engagement of subordinates was not found. However, previous studies<sup>11,12</sup> have shown that subordinate work engagement could be improved by providing managers with training. Compared to these studies, the intervention in the present study was much

less intense, and the duration of follow-up was longer. Our intervention may not have been intense enough to achieve persistent improvement lasting until 1-year follow-up. Future studies should test the long-term effect of a more intensive training program focused on specific management behaviors.

The results of this study suggest that integrity might be one of the important characteristics of managers' behaviors that affect work engagement of subordinates. Multilevel linear regression analyses showed that the increase in the integrity of managers predicted improvement of work engagement among subordinates. Subgroup analyses showed that regardless of whether a manager and a subordinate have the same gender, the relationship between managers' integrity and subordinate work engagement was positive while in the same gender group, it did not reach statistical significance. In the different gender group, an increase in managers' scores on problem-solving was also positively related to subordinate work engagement. Based on these results, it appears that subordinates with managers whose integrity improved following our intervention may have increased their work engagement and that this relationship was more likely when genders of a manager and a subordinate were different. Managers with high levels of integrity might interact with their subordinates in an open and transparent manner. Such an attitude is conceptualized as a part of authentic leadership style,<sup>18</sup> which is positively related to work engagement of subordinates.<sup>19</sup> Open communication between a manager and subordinates

**TABLE 3** The effects of changes in different aspects of management practices on the change in subordinate workers' work engagement

Independent variable		Model 2 (crude)			Model 3 (adjusted) <sup>a</sup>		
		Fixed effect	SE	<i>P</i> -value	Fixed effect	SE	<i>P</i> -value
Integrity	Intercept	0.01	0.03	.794	−0.12	0.53	.821
	Change	0.05	0.02	.030	0.05	0.02	.027
	Random intercept	0.01	0.01	.233	0.01	0.01	.275
Considerate approach	Intercept	0.03	0.03	.407	0.01	0.56	.979
	Change	0.01	0.01	.325	0.01	0.01	.301
	Random intercept	0.01	0.01	.155	0.01	0.01	.174
Proactive work management	Intercept	0.02	0.03	.509	−0.06	0.57	.921
	Change	0.01	0.01	.330	0.01	0.01	.403
	Random intercept	0.01	0.01	.106	0.01	0.01	.127
Problem solving	Intercept	0.02	0.03	.514	−0.09	0.54	.868
	Change	0.03	0.02	.090	0.03	0.02	.134
	Random intercept	0.01	0.01	.207	0.01	0.01	.225
Participative/empowering	Intercept	0.03	0.03	.352	−0.04	0.56	.938
	Change	0.01	0.01	.479	0.01	0.01	.513
	Random intercept	0.01	0.01	.129	0.01	0.01	.149
Empathetic engagement	Intercept	0.03	0.03	.404	−0.04	0.56	.940
	Change	0.01	0.01	.437	0.01	0.01	.474
	Random intercept	0.01	0.01	.151	0.01	0.01	.171

Note: The table presents values of fixed effect, SE, and *P*-value obtained from multilevel linear regression analyses with random intercepts and fixed slopes. In those analyses, three models were estimated: an unconditional model (Model 1), a crude conditional model (Model 2), and an adjusted conditional model (Model 3).

<sup>a</sup>Models were adjusted for supervisors' gender and age and for subordinates' gender and age groups.

might help them share their work-related goals more clearly and strengthen subordinates' trust in their manager as well as the sense of safety in the workplace. A psychologically safe environment is important, as it allows workers to express their opinions freely and feel a sense of control in their job and thereby become more motivated.<sup>20,21</sup> A manager and a subordinate of different genders might share fewer values or ways of thinking compared to a manager-subordinate pair of the same gender, which suggests that high integrity and problem-solving ability of managers are even more important in making subordinates feel safe and engaged. It might be possible to develop a training program targeting specifically the integrity of managers to improve work engagement among subordinates.

The present study has several limitations. First, the present study did not have a control group; thus, factors other than the intervention program, such as a natural course, might have influenced the results. Second, the data in this study was obtained from workers of one company with a unique situation or culture that might have affected the results. Third, the outcomes of management competencies and work engagement were measured using self-reported measures; hence, a response bias could have influenced the results. Further research with a more rigorous design that would use evaluation by

subordinate workers or third-party raters, a randomized control, and a larger sample is needed to confirm the efficacy of our intervention and the influence of integrity on work engagement.

## 5 | CONCLUSIONS

The results of this study indicated that the training program developed in this study effectively improved the management competency of managers and that integrity of managers may facilitate work engagement of subordinate workers, especially when genders of a manager and a subordinate are different. Thus, a training program focused on improving the integrity of managers could enhance the employees' work engagement.

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**TABLE 4** Subgroup analyses: the effects of changes in different aspects of management practices on the change in subordinate workers' work engagement

Independent variable			Model 2 (crude)			Model 3 (adjusted) <sup>a</sup>		
			Fixed effect	SE	<i>P</i> -value	Fixed effect	SE	<i>P</i> -value
Same gender manager-subordinate pair (50 managers, 199 subordinates)	Integrity	Intercept	0.00	0.05	.947	0.01	0.81	.993
		Change	0.03	0.04	.473	0.03	0.04	.459
		Random intercept	0.03	0.02	.256	0.03	0.03	.199
	Considerate approach	Intercept	−0.01	0.05	.881	0.18	0.80	.823
		Change	0.02	0.02	.227	0.02	0.02	.227
		Random intercept	0.02	0.02	.273	0.03	0.02	.213
	Proactive work management	Intercept	−0.02	0.05	.696	0.07	0.81	.933
		Change	0.03	0.02	.112	0.03	0.02	.113
		Random intercept	0.03	0.02	.201	0.04	0.03	.159
	Problem solving	Intercept	0.01	0.05	.907	0.04	0.81	.964
		Change	0.01	0.03	.729	0.01	0.03	.744
		Random intercept	0.03	0.02	.253	0.03	0.03	.198
	Participative/empowering	Intercept	−0.01	0.05	.856	0.01	0.80	.995
		Change	0.02	0.01	.176	0.02	0.02	.179
		Random intercept	0.03	0.02	.242	0.03	0.03	.188
	Empathetic engagement	Intercept	0.00	0.05	.982	0.07	0.81	.936
		Change	0.01	0.02	.482	0.01	0.02	.463
		Random intercept	0.03	0.02	.235	0.03	0.03	.183
Different gender manager-subordinate pair (47 managers, 266 subordinates)	Integrity	Intercept	0.02	0.04	.520	−0.18	0.66	.781
		Change	0.09	0.03	.003	0.08	0.03	.006
		Random intercept	0 <sup>b</sup>	0	—	0 <sup>b</sup>	0	—
	Considerate approach	Intercept	0.06	0.04	.154	−0.16	0.75	.835
		Change	0.01	0.01	.607	0.01	0.01	.700
		Random intercept	0.01	0.01	.419	0.01	0.01	.508
	Proactive work management	Intercept	0.06	0.04	.134	−0.18	0.74	.808
		Change	0.00	0.01	.929	0.00	0.01	.754
		Random intercept	0.01	0.01	.399	0.01	0.01	.537
	Problem solving	Intercept	0.05	0.03	.130	−0.04	0.68	.949
		Change	0.06	0.02	.006	0.05	0.02	.043
		Random intercept	0 <sup>b</sup>	0	—	0.00	0.01	.957
	Participative/empowering	Intercept	0.06	0.04	.114	−0.28	0.74	.709
		Change	0.00	0.01	.934	−0.01	0.01	.627
		Random intercept	0.01	0.01	.378	0.01	0.01	.522
	Empathetic engagement	Intercept	0.05	0.04	.194	−0.16	0.74	.829
		Change	0.01	0.02	.402	0.01	0.02	.575
		Random intercept	0.01	0.01	.475	0.01	0.01	.537

*Note:* The table presents the coefficients of fixed effect, SE and *P*-value obtained from the subgroup analyses with random intercepts and fixed slopes. In those analyses, subordinate participants were stratified depending on whether their gender was the same as or opposite from that of their managers. Three models were estimated in each analysis, as presented in Table 3: an unconditional model (Model 1), a crude conditional model (Model 2), and an adjusted conditional model (Model 3).

<sup>a</sup>Models were adjusted for managers' gender and age and for subordinates' gender and age groups.

<sup>b</sup>Because those values of coefficient were too small, *P*-values could not be calculated.

## DISCLOSURE

**Approval of the research protocol:** The Ethical Committee of the University of Tokyo reviewed and approved the design and procedure of this study before the start of the study (10535-3). **Informed consent:** Participants were fully informed about the aim and procedure of this study prior to giving consent to participate in this study. **Registry and the registration no. of the study/trial:** N/A. **Animal studies:** N/A. **Conflict of interest:** NK receives personal funds from Junpukai Foundation, Softbank, Sekisui Co. Ltd., Riken Institute, etc, and research grants from Fujitsu Ltd., Fujitsu Software Technologies, Softbank, etc, outside the submitted work. The other authors report none.

## AUTHOR CONTRIBUTIONS

NK developed the study design. YS and NK developed the content of the training and collected the data, and YS served as a training instructor. HA, KW, and NK analyzed and interpreted the data. HA and KI conducted a literature search and wrote the manuscript. All authors read and approved the final manuscript.

## ORCID

Norito Kawakami  <https://orcid.org/0000-0003-1080-2720>

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