



Short Communication

Individual and contextual variables enhance transfer for a workplace eco-driving intervention



Layla R. Mansfield*, Frankie Guros, Donald M. Truxillo, John MacArthur

Portland State University, Portland, Oregon, USA

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ABSTRACT

The adoption of energy efficient driving styles and practices, eco-driving, has been recognized in the literature as an option for reducing vehicle energy consumption. Prior eco-driving research has looked at the effectiveness of various eco-driving programs. However, the characteristics of the individuals participating in fleet eco-driving programs and the role of the supervisor as an advocate for eco-driving practices have remained relatively unexamined. An eco-driving intervention intended to increase eco-driving behaviors in a work organization was conducted with fleet drivers in three public organizations. Drawing from the workplace training literature, we hypothesized that employee eco-driving behaviors will increase after the implementation of an eco-driving intervention, but that these behaviors will be dependent on the participant's pre-intervention motivation and support from their supervisor for implementing eco-driving practices. Survey data were collected pre- and post-intervention from 51 fleet drivers (average age 45.3 and 33% female), and results indicate that the eco-driving intervention was effective when either high levels of pre-intervention motivation or supervisor support were present.

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1. Introduction

Eco-driving is driving that is economical, ecological, and safe, with the goal of reducing fuel consumption and greenhouse gas emissions (Martin, Chan, & Shaheen, 2012). Eco-driving practices have been found to be effective in reducing energy consumption, with energy savings ranging from 2% to as high as 20% (Barkenbus, 2010; Stillwater & Kurani, 2013). Thus, although eco-driving practices appear to be effective, the wide range of results suggests that there may be unexamined individual and situational factors that may explain the broad range of findings. We contend that there are individual and contextual variables known to affect the success of workplace trainings (e.g., Burke & Hutchins, 2007) that can lead to understanding *how* and *why* other workplace interventions work, such as eco-driving programs, and for *whom* they may be most effective. These issues have received little empirical examination in the eco-driving literature.

1.1. Transfer of eco-driving behavior

Eco-driving programs are focused on changing a driver's behavior by increasing knowledge about driving practices that save fuel and lower emissions (Martin et al., 2012; Stillwater & Kurani, 2013). We believe that the workplace training

* Corresponding author.

literature on training transfer can provide insights into understanding the individual and contextual variables that will contribute to the change in driving behaviors post-intervention.

Training transfer is the extent to which knowledge and skills acquired in the training context are applied in the work setting and how these changes are maintained over time (Baldwin & Ford, 1988). In the present study, we define transfer as the extent to which the eco-driving intervention leads to actual change in eco-driving behaviors. To determine what may affect transfer we utilized Baldwin and Ford's (1988) framework of training transfer indicating that there are three types of factors that impact training outcomes and training transfer. These include the *training design*, the *trainee characteristics*, and the *work environment*. Previous eco-driving interventions have explicitly focused on the training design when evaluating the transfer of eco-driving knowledge gained in training to actual eco-drive behaviors. For example, Staubach, Schebitz, Köster, and Kuck (2014) found reductions in fuel consumption for those who received feedback from an eco-driving support system simulator. Thus, the design of the feedback system was found to be an effective way to deliver knowledge of eco-driving practices that in turn was related to an increase in eco-driving behaviors.

However, the impact of the other two factors – trainee characteristics and the work environment – has remained unexamined in the eco-driving literature. As such, the present study examines the role of trainee characteristics (i.e., trainee motivation) and aspects of the work environment (i.e., supervisor support) on the effectiveness of a workplace eco-driving intervention.

Trainee characteristics. Many trainee characteristics (i.e., personal attributes belonging to the individual trainee) have been shown to influence training transfer and training effectiveness. Perhaps the most important of these is trainee motivation (Blume, Ford, Baldwin, & Huang, 2010; Colquitt, LePine, & Noe, 2000). Training motivation has been shown to predict many training outcomes, including trainee knowledge and skills transfer (Axtel, Maitlis, & Yeararta, 1997; Blume et al., 2010; Chiaburu & Marinova, 2005; Colquitt et al., 2000). Thus, motivation is an important predictor of the effectiveness of training.

Motivation is a key determinant of behavior; as such, we contend that, based on the tenets of VIE theory (Vroom, 1964), employees make rational decisions about whether to exert effort based on their belief that it will lead to an outcome that they value. VIE theory is a motivation theory that names three factors of motivation: expectancy, instrumentality and valence. In the present study, VIE theory would suggest that motivation is a function of an employee's expectancy that the investment in learning about eco-driving will lead to new skills (expectancy), the belief that more efficient driving will be obtained when performing eco-driving practices (instrumentality), as well as the importance placed on the outcome associated with eco-driving, such as fuel and CO₂ reductions (valence). As such, we predict that there will be individual differences in participant motivation that will influence changes in eco-driving behaviors.

Hypothesis 1. Employee baseline (pre-intervention) motivation will predict change in eco-driving behavior post-intervention.

Work environment characteristics. Work environment characteristics (i.e., situational characteristics found in a trainee's work environment) have also been examined as key predictors of transfer (Fecteau, Dobbins, Russell, Ladd, & Kudisch, 1995). Richman-Hirsch (2001) found that a supportive work environment enhanced post-training transfer. Furthermore, research has shown that supportive behaviors displayed by managers, such as discussing new learning and providing encouragement and coaching to trainees about use of new knowledge and skills on the job, can contribute positively to training transfer (Smith-Jentsch, Salas, & Brannick, 2001). As a result, we anticipated that perceived supervisor support for eco-driving behaviors would be a relevant characteristic of the work environment that determines the success of an eco-driving program.

Hypothesis 2. Perceived supervisor support will predict change in eco-driving behavior post-intervention.

This examination of eco-driving motivation and supervisor support is driven by our attempt to bridge what we know about theoretical models of knowledge acquisition from the workplace training literature to fill a gap in the eco-driving intervention literature.

2. Method

2.1. Participants

The data were collected from fleet drivers in three Pacific Northwest public sector organizations. For the largest organization (several hundred drivers), we solicited responses through a link to our survey in an online weekly newsletter. In the other two organizations, we targeted specific departments that drove regularly as part of their jobs (e.g., library couriers, facilities maintenance). Due to the sampling strategy, we were unable to assess how many employees were solicited, and as such, are unable calculate response rate. Overall, we received 127 responses pre-intervention and 73 responses post-intervention. Of these, we were able to match 51 Time 1 (pre-intervention) and Time 2 (post-intervention) responses. The participants provided their email addresses to be included in a raffle incentive. These email addresses were then matched to create our pairs for a total sample ($N = 51$). The average age for drivers was 45.3 ($SD = 9.72$) years, their tenure was 10.6 ($SD = 7.71$) years at their organizations, and 33% were female. The average hours spent driving per week was 7.16 ($SD = 5.96$) hours, and 49% of the drivers spent this time driving in city limits in traffic, while 43% drove in a mix of rural and city settings. Eighty-eight percent of the fleets consisted of light-duty vehicles.

2.2. Procedure

We gathered data two weeks before the implementation of the workplace eco-driving intervention and two weeks after the intervention, leaving a one-month separation between the Time 1 and Time 2 surveys. The surveys were distributed to employees via a link to an online survey.

2.2.1. Materials

The intervention included a variety of educational materials (i.e., posters, tip-cards, videos, static clings) focusing on eco-driving practices (e.g., less idle time, slow starts and stops) that have been shown to be effective in reducing fuel consumption and CO₂ emissions (Barkenbus, 2010; Martin et al., 2012). A private marketing research company that specialized in employee interventions developed the materials. Each organization promoted the eco-driving intervention by (1) including links to the videos in weekly newsletters, (2) discussing eco-driving during meetings, (3) distributing the materials through emails and other internal communications, and (4) placing the educational materials in visible, frequented locations in the workplace.

2.3. Measures

Motivation and demographics were assessed at Time 1 only. All other variables were assessed at both Time 1 and Time 2. Each measure was evaluated on a 1–7 scale from strongly disagree to strongly agree except the eco-driving behavior scale. This measure was also on a 1–7 point scale with the anchors being very unlikely to very likely.

2.3.1. Eco-driving motivation

We adapted the training motivation scale (T-VIES) from Zaniboni, Fraccaroli, Truxillo, Bertolino, and Bauer (2011) to assess motivation toward eco-driving at Time 1 ($\alpha = .87$). The T-VIES is framed within expectancy (VIE) theory, and items are intended to assess a trainee's expectancy, instrumentality, and valence. The responses to the eight items were averaged to create an overall motivation score (Van Eerde & Thierry, 1996). A sample item is, "I think it's important to learn how to save gasoline".

2.3.2. Perceived supervisor support

We adapted Neal and Griffin's (2006) safety climate scale to assess perceived supervisor support for eco-driving at Time 1 ($\alpha = .97$) and Time 2 ($\alpha = .96$). The scale is comprised of three items. A sample item is, "My supervisor places a strong emphasis on efficient driving behaviors". We used Time 2 supervisor support as the predictor of eco-driving behavior change, as this represents the amount of support employees reported during the time of the intervention. Time 1 supervisor support was used as a control variable.

2.3.3. Eco-driving behaviors

We created an 11-item scale to measure eco-driving behaviors. The 11 items measured were the behaviors featured in the materials of the eco-driving intervention. A sample item is, "How likely were you to avoid quick starts and stops?" These types of items have commonly been used to assess eco-driving behaviors (Martin et al., 2012; Scott, Knowles, Morris, & Kok, 2012). This scale was measured at both Time 1 ($\alpha = .73$) and Time 2 ($\alpha = .73$). We used Time 1 eco-driving as a control variable in our analyses to assess change in eco-driving behaviors from Time 1 to Time 2.

2.3.4. Manipulation check

"I am aware of what "eco-driving" practices are and could briefly explain them to another person" was used as a manipulation check item to assess eco-driving awareness both pre- and post-intervention.

3. Results

3.1. Descriptive statistics

Table 1 displays means, standard deviations, intercorrelations, and reliabilities of study variables.

Results for the manipulation check indicated that employee reports of their awareness of eco-driving at Time 2 ($M = 5.65$, $SD = 1.12$) was significantly greater than eco-drive awareness at Time 1 [$(M = 4.22$, $SD = 1.52)$, $(t(46) = 7.62$, $p < .01)$, $d = 1.12$]. Therefore, the intervention appeared to increase eco-driving awareness among the employees.

3.2. Analyses of eco-driving behaviors after the eco-drive intervention

To test each hypothesis, we calculated two regression equations with Time 2 eco-driving behaviors as the dependent variable. We controlled for age, gender, and organization based on previously established relationships between these predictors and the outcome (Cristea, Paran, & Delhomme, 2012; Martin et al., 2012). We controlled for Time 1 eco-driving

Table 1
Means, standard deviations, and intercorrelations among study variables.

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11
1. Age	45.27	9.72											
2. Gender	.33	.48	-.15										
3. Organization 1	.10	.30	-.30*	-.10									
4. Organization 2	.12	.40	-.16	.06	-.16								
5. Eco-knowledge T1	4.19	1.53	.06	-.09	.18	.07							
6. Eco-knowledge T2	5.61	1.11	.28	.12	-.09	-.02	-.24						
7. Eco-motivation T1	5.90	.68	-.07	.02	-.23	-.17	.01	-.16	(.87)				
8. Supervisor Support T1	3.86	1.11	-.14	-.11	.35*	.12	-.07	.10	-.26	(.97)			
9. Supervisor Support T2	4.06	1.25	-.19	-.09	.28*	.22	.11	.10	-.10	.62**	(.96)		
10. Eco-behaviors T1	5.19	.95	.08	-.26	.11	.04	.24	-.90	.37**	.04	-.07	(.73)	
11. Eco-behaviors T2	5.30	.79	.13	.12	.07	.17	.17	.08	.43**	.14	.15	.58**	(.73)

Notes. Dummy codes were used for the organizations. Cronbach's alpha in parenthesis on the diagonal. Gender was coded as 0 = male 1 = female. N = 51.

* $p < .05$.

** $p < .01$.

behaviors in both equations in order to model change in eco-driving behavior from Time 1 to Time 2. To model how change in supervisor support impacts eco-driving behaviors, we controlled for supervisor support at Time 1.

Hypothesis 1 predicted that baseline (Time 1) motivation would be positively related to a change in eco-driving behavior from Time 1 to Time 2. This hypothesis was supported ($\beta = .39$, $F(1, 39) = 8.78$, $p < .01$, $R^2 = .52$, $\Delta R^2 = .11$; see Table 2). Hypothesis 2 predicted that supervisor support would be positively related to change in eco-driving behavior from Time 1 to Time 2. This hypothesis was also supported ($\beta = .34$, $F(1, 37) = 4.80$, $p < .05$, $R^2 = .49$, $\Delta R^2 = .07$; see Table 3).

4. Discussion

Due to the range of effect sizes found in previous eco-driving studies, the purpose of this study was to understand the psychological and social factors that may contribute to the success of an eco-driving intervention. Few studies have considered the psychological individual differences of participants as potential predictors of the success of an eco-driving intervention (for exceptions see Scott et al., 2012 and Stillwater & Kurani, 2013), and little work has investigated the organizational variables present at the time of eco-driving instruction and their impact on driving behavior. Furthermore, our goal was to highlight these factors as they may be of particular interest to work organizations that employ fleet drivers.

In the present study, the greatest increases in eco-driving behavior were observed when employees had high eco-driving motivation at baseline or experienced high supervisor support. Thus, our findings provide empirical support for the need for supervisors to show support for eco-driving programs. Additionally, our findings indicate that employee motivation prior to the implementation of the eco-driving program can affect whether eco-driving programs result in changes in eco-driving practices among employees.

This study may have a number of implications for work organizations. Consistent with organizational research on employee training and development, we found that employee motivation and perceived supervisor support affected change in self-reported eco-driving behavior, meaning organizations risk not benefiting from an eco-drive intervention that is implemented under suboptimal conditions. Put differently, implementing a costly eco-driving intervention under conditions

Table 2
Hierarchical multiple regression analyses predicting eco-drive behaviors at Time 2 from motivation.

Predictor	Eco-drive behaviors Time 2		
	β	ΔR^2	R^2
Step 1 (control variables)		.12	.12
Age	.32		
Gender	.13		
Organization 1	.13		
Organization 2	.24		
Step 2		.29**	.41**
Eco-drive Behaviors T1	.56**		
Step 3		.11**	.52**
Motivation T1	.39**		

Notes. Dummy codes were used for the organization variable. T1 = Time 1.

N = 51.

* $p < .05$.

** $p < .01$.

Table 3
Hierarchical multiple regression analyses predicting eco-drive behaviors at Time 2 from supervisor support.

Predictor	Eco-drive behaviors Time 2		
	β	ΔR^2	R^2
Step 1 (control variables)		.12	.12
Age	.32		
Gender	.11		
Organization 1	.13		
Organization 2	.24		
Step 2		.31**	.42**
Supervisor Support T1	.14		
Eco-drive Behaviors T1	.57**		
Step 3		.07*	.49*
Supervisor Support T2	.34*		

Notes. Dummy codes were used for the organization variable. T1 = Time 1, T2 = Time 2.

N = 51.

* $p < .05$.

** $p < .01$.

of low motivation and low supervisor support may not be the optimal use of scarce organizational resources. Therefore, organizations should consider the inclusion of lessons, materials, conversations, or other communications that will simultaneously increase individual (e.g., motivation) and contextual (e.g., supervisor support) factors when training employees on eco-driving practices.

This study has some potential limitations. First, much of the eco-driving literature assesses the outcomes associated with eco-driving behaviors objectively (i.e., fuel consumption; Beusen et al., 2009), yet this was not possible in this study. Future research should examine these hypotheses using outcomes such as actual fuel use or other measures of actual behavior and using randomized control trials. Second, the results came from three public agencies in the same geographical area. Future research should utilize other types of organizations to address this limitation. Third, it would be worthwhile to understand which dimensions of motivation (i.e., valence, expectancy, or instrumentality) are most predictive of behavior change. Future work could examine the multi-dimensionality of this measure in its prediction of behavior change. Finally, future research should examine ways to improve employee motivation for eco-driving as well as supervisor support for it.

5. Conclusion

The findings of our study indicate that the effectiveness of a workplace eco-driving intervention aimed at reducing energy consumption may be dependent on contextual and psychological factors that have not been empirically examined in the eco-driving literature. These findings inform research and organizations alike who may plan on implementing eco-driving interventions and indicate that even brief, inexpensive interventions may influence driver behavior when certain conditions (i.e., supervisor support, motivation) are present.

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