A Field Study of Employee e-Learning Activity and Outcomes

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Employees with access to e-learning courses targeting computer skills were tracked during a year-long study. Employees' perceptions of peer and supervisor support, job characteristics (such as workload and autonomy), and motivation to learn were used to predict total time spent using e-learning. Results suggest the importance of motivation to learn and workload in determining aggregate time spent in e-learning courses. Time in courses predicted subsequent differences in computer-related skill and performance improvement as judged by participants' supervisors. Implications of these findings for the design and administration of e-learning programs are discussed.

In recent years, organizations have recognized that investing in their employees' skill development is an important means of remaining competitive (Arthur, 1994; Delaney & Huselid, 1996; Pfeffer, 1995). One increasingly common form for this investment is to provide access to convenient, technology-delivered instruction (Baird, Griffin, & Henderson, 2003; Rosenberg, 2001). Technology-delivered instruction has increased dramatically in the past five years and is projected to increase even more in the coming years (Sugrue, 2003), a trend that has been heralded as the *e-learning revolution* (Galagan, 2000). E-learning refers to the use of computers and networking technology for knowledge and skill building.

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Although there are different forms of e-learning, one of the most convenient is asynchronous, self-paced training. Such courses offer employees the opportunity to use a computer to do training when time allows, often at their own desk. This type of e-learning is appealing to employers because it reduces time away from work, as well as travel costs. It is appealing to employees because it provides flexibility about when and where to complete training, and it allows stopping and starting training based on work and life demands.

Despite these appealing features of asynchronous, self-paced courses, there is reason to suspect that utilization may be a problem. Employees may have difficulty finding time to learn amid the requirements of day-to-day work. Moreover, despite efforts by the employer to get employees to learn, employees who are not motivated may continuously procrastinate. Prior research is not clear about the extent to which employees make use of e-learning. Despite popular press reports regarding dropouts and concerns over motivation (Rossett & Schafer, 2003), the academic research is sparse (Brown & Ford, 2002; Salas & Cannon-Bowers, 2001; Welsh, Wanberg, Brown, & Simmering, 2003). More specifically, it is unclear whether all employees are equally willing and able to access e-learning courses and translate that access into improvements in on-the-job performance. Research on e-learning in organizational settings has typically been limited to comparing reactions and learning across different types of delivery rather than examining the degree to which e-learning is used (or not) by employees, and why.

To address the question of e-learning use and barriers to it, this study examines employee choices regarding use of asynchronous e-learning courses in an organizational setting. Thus, this study contributes to the literature on workplace learning, and e-learning in particular, by studying the decisions that employees make regarding time spent learning. Moreover, the effect of time spent learning on supervisor ratings of performance is examined.

Hypothesis Development

A number of theories suggest that time spent learning is a critical choice related to skill acquisition. For example, the theory of deliberate practice advanced by Ericsson, Krampe, and Tesch-Romer (1993) suggests that expertise is acquired only over time with concerted efforts to improve skill. Similarly, Ackerman's PPIK (intelligence as process, personality, interest, and knowledge) theory suggests that investment of time and effort is the primary means by which individuals develop domain-specific competence (Ackerman, 1996). These theories suggest that time is an important determinant of learning, yet it is seldom examined directly. In order to examine the effects of instructional interventions and individual differences, time is typically held constant in training research (Kanfer & Ackerman, 1989; Mathieu, Tannenbaum, & Salas, 1992). As a result, little is known about who makes choices to spend time engaged in learning. In a recent review of deliberate practice theory, Ericsson (1996) acknowledges that while motivation and environmental support seem to be

critical for encouraging time in practice, little is known about the nature of these effects. More important for the purposes of this study, the few recent studies that do examine motivation and time spent learning have limitations.

Two studies that predicted time spent learning found relatively weak effects for learners' dispositions (Brown, 2001; Fisher & Ford, 1998). Moreover, each study was done in a controlled learning environment. Fisher and Ford (1998) examined undergraduates learning a novel prediction activity in a laboratory setting. Brown (2001) examined adult employees, but they completed training at a centralized facility. The effect of dispositional characteristics was weak, perhaps in part because more context-specific factors, such as motivation to learn the specific content of the training program, were at play. Because employees typically engage in e-learning at work (Rosenberg, 2001), research is needed on motivation of and choices made by adult learners while they balance competing demands of work and learning.

Most models of training effectiveness suggest that both individual and situational factors play a role (Mathieu & Martineau, 1997; Noe, 1986; Quinones, 1997). Thus, rather than examining disposition as these prior studies have done, this study examines employees' motivation as context-specific individual factors and characteristics of the employees' work situation, including the level of support by supervisors and peers and the degree to which their jobs allow the opportunity for learning. Specific hypotheses are presented in the next sections.

Motivation to Learn. Motivation to learn has been defined as the specific desire of the employee to learn program content (Noe, 1986). Colquitt, LePine, and Noe (2000) demonstrated that this construct is related to a variety of learning outcomes across studies. Most relevant to this study, Noe and Wilk (1993) demonstrated that motivation to learn generally predicts participation in development activities, such as attending conferences and workshops (see also Tharenou, 2001). Because participating in asynchronous, self-paced e-learning requires similar personal initiative, motivation to learn should be an important predictor of time spent using e-learning.

HYPOTHESIS 1 (H1). *Employees with higher motivation to learn will spend more time in e-learning activities than employees with lower motivation to learn.*

Supervisor and Peer Support. Research suggests that a supportive work environment is essential for encouraging participation in learning experiences (Kozlowski & Hults, 1987; Maurer & Tarulli, 1994; Noe & Wilk, 1993; Tharenou, 2001). Most research in this area has examined participation in voluntary development activities using self-report measures. No published empirical studies have examined prediction of participation in completely technology-mediated training available during work hours, although reports in the trade press suggest that support is essential (Sloman, 2002). In this

study, support of both supervisors and coworkers is examined, as both are relevant to training motivation and success (Facteau, Dobbins, Russell, Ladd, & Judisch, 1995; Noe & Wilk, 1993).

Learning support involves efforts on the part of supervisors and peers to assist the learner in using resources for and taking risks in learning. From supervisors, support means encouraging the employee to learn new skills and try them on the job. From coworkers, support means supporting the employee by helping balance workload to allow training and discussing information following training. In the context of e-learning, both should be essential.

HYPOTHESIS 2 (H2). *Employees with more supervisor and peer support will spend more time in e-learning activities than employees with less support.*

Job Characteristics. Another situational factor that may influence whether employees take time to learn is their job. Certain job characteristics may pose barriers to participation in learning activities by placing practical constraints on how much time is available to commit to learning or limits on employees' discretion in choosing learning over other activities. Conceptually, these refer to job characteristics of workload and autonomy.

Workload refers to the degree to which an employee has to work hard and has a lot to do (Spector, Chen, & O'Connell, 2000). Employees with high workload should have less time available to commit to learning at work. Conversely, employees with lower workload should have time available to engage in learning. Despite the commonsense appeal of this hypothesis, it has not been examined in training research (Russ-Eft, 2001).

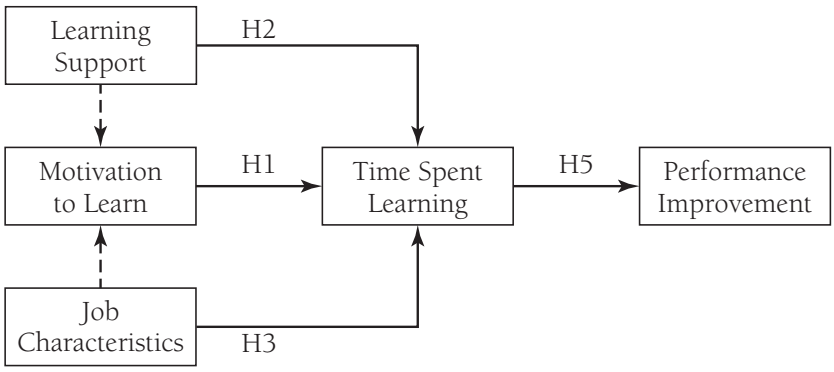
HYPOTHESIS 3a (H3a). *Employees with higher workload will spend less time in e-learning activities than employees with lower workload.*

Autonomy refers to the degree to which an employee has discretion over when and how work is completed (Spector et al., 2000). Employees with high work autonomy should be able to arrange time for e-learning more easily. That is, they should have the discretion to choose learning over other possible work activities during the course of a workday. Conversely, employees with little autonomy should find it difficult to modify their work schedules to accommodate time for learning. Moreover, because of a lack of control over work scheduling, employees with little autonomy may be less likely to start learning out of a concern for being interrupted and pulled away from their learning experience.

HYPOTHESIS 3b (H3b). *Employees with higher autonomy will spend more time in e-learning activities than employees with lower autonomy.*

Overall Model. The overall model suggested by these hypotheses is portrayed in Figure 1. The model depicts both direct and indirect effects of

Figure 1. Research Model



support and job characteristics on time spent learning, and time spent learning as the primary antecedent of performance improvement. The relationships among support, job characteristics, and motivation (indicated with dotted lines) are not central to the research questions here, as explained below.

Many researchers argue that motivation to learn has been the primary mediator of the relationship between individual and situational characteristics, and training outcomes (Mathieu & Martineau, 1997; Noe, 1986; Quiñones, 1997). However, some research on employee and career development suggests that situational characteristics can have direct effects on learning outcomes (Dubin, 1990). In other words, situations may facilitate or constrain participation in learning above and beyond the effects of motivation. This additive model suggests that even when learners are highly motivated, situational effects can limit their participation. Consistent with Dubin's model, the hypothesis of this study is that for e-learning opportunities, the effects for support and job characteristics will be direct. In other words, although work environment and job characteristics may influence time indirectly through motivation, they are still expected to have direct effects on time spent learning.

HYPOTHESIS 4 (H4). *Learning support, job characteristics, and motivation to learn will have additive effects on time in e-learning activities.*

Finally, participation in e-learning should improve the employee skills and performance that are the focus of the learning experience. That is, consistent with theory on expertise, employees who spend more time using e-learning should improve on-the-job performance targeted by the e-learning program. Although such an outcome is the ultimate goal of nearly all training efforts, on-the-job performance is seldom assessed as an outcome of training (Colquitt et al., 2000).

HYPOTHESIS 5 (H5). *Employees who spend more time in e-learning activities will improve their content-related skills and performance more than employees who spend less time in e-learning activities.*

Method

Setting. A computer-skills-focused e-learning curriculum offered at a large midwestern university was the setting for this research. Access to e-learning courses was provided through a single Web page, and the courses ran on software installed on all computers on campus. Neither the university administration nor the human resource department offered formal recognition or rewards for taking courses; participants were encouraged but not required to discuss their participation with their immediate supervisor.

Forty-six unique courses were available covering twelve of the most commonly used software programs across campus. The selection of courses, determined by a volunteer committee representing administrative units, targeted the broadest possible audience and computer tasks: office support software including word processors, spreadsheets, databases, presentation preparation, calendaring, and electronic communications. Nearly all courses had multiple sections to accommodate differences in program version (for example, MS Word97 and MS Word2000) and skill level (for example, Introduction, Intermediate, and Advanced). Each course was a stand-alone, asynchronous program created by a single established e-learning vendor.

Each stand-alone program was divided into modules, and each module used the same instructional method. Each module began with specific objectives and an overview of content. Written explanations of key concepts followed. Then each program demonstrated key tasks and offered practice with a partially functional interface that was identical to the interface of the actual program being taught. Each practice episode included feedback.

Sample. Participants were 311 employees who registered to have access to these courses. The vast majority of participants were staff (93 percent); the remainder were faculty (3 percent) and student workers (3 percent). Only forty-five participants (14.5 percent) reported having taken a computer-based training course prior to the start of the pilot. Participants were generally women (77 percent) who used the computer six or more hours per day (53 percent). Participants varied widely in age (17 percent between twenty-six and thirty-five years; 31 percent between thirty-six and forty-five years; 37 percent between forty-six and fifty-five years; and 13 percent fifty-six years or over) and education (11 percent high school degree; 33 percent associate degree or some college; 27 percent bachelor's degree; 22 percent master's degree or some graduate work; 5 percent Ph.D., M.D., or equivalent higher degree).

Procedure. The design of this research is summarized in Table 1. The research began when access to an e-learning library of computer software courses was advertised through e-mail and letters to department heads and computer training staff. All registrants received an instruction packet with basic instructions, a letter describing the purpose of the study, the presurvey (measuring demographics, learning support, and job characteristics), and a consent form. Employees granting consent (52 percent of all enrollees) completed the presurvey and provided contact information for themselves and their

Table 1. Description of Research Design and Timing of Measures

Description	*Measures Collected*	*Time Period*
Open enrollment, invitation with informed consent and presurvey	Learning support (peer and supervisor), job characteristics (autonomy, workload)	January–March
Participant telephone interviews	Motivation to learn	May–June
Supervisor telephone interviews	Performance improvement	October–November
End of program	Time spent e-learning (since enrollment)	December

supervisors. No data were available to compare employees who participated in the research with those who did not.

One hundred participants were randomly selected for telephone interviews as a means to collect motivation data. Telephone interviews were used to prevent response bias and to avoid any concern over writing and mailing written comments regarding the programs; resource constraints prevented interviewing all participants. Interviews were conducted over the course of a month such that all participants had at least a full month to read the materials sent and try out the training. This was deemed important because many participants had not seen an e-learning course prior to enrolling; thus, the assessment of motivation was taken at a time when all participants would have a realistic preview of the e-learning programs. Using a structured protocol, four research assistants conducted fifty-seven complete interviews (18 percent of the participant sample). Twelve employees could not be reached in the appropriate time window because of vacation, maternity leave, or job transfer. Thirty-one other participants were reached but declined to participate for various reasons. A number of those who declined noted that they had not begun using the training, so they did not feel they could accurately discuss it. Consequently, motivation data oversample employees who had already begun using the e-learning courses. Statistically, those interviewed did not vary from the larger participant sample except that they tended to be slightly less educated, $t(304) = 1.95$, $p = .05$.

Confidential telephone interviews were also used to collect supervisor ratings of performance. These interviews were conducted after the official close of the program period, approximately four months following the period of the participant interviews. The timing of the supervisor interviews ensured that all participants had at least nine months to work on the training. Seventy-one (23 percent) participants were rated by their supervisors. This subsample did not vary from the larger sample except that they tended to be younger, $t(302) = 2.30$, $p < .05$.

Measures.

Control Variables. To control for competing explanations regarding participation in e-learning, a number of control variables were assessed. Martocchio (1993) suggested that age is related to willingness to take computer training, so a single item measure was used to assess age, along with education and tenure in department. A single item was also used to assess average hours of daily computer use. Employees who use the computer more often may be more likely to value computer training and have more opportunities to use it. Respondents' employment status (faculty, full-time staff, or student employee), sex, tenure on the job, and any experience with computer-based training courses were also requested. Finally, how employees became involved was assessed with a checklist of options (Mathieu et al., 1992; Hicks & Klimoski, 1987). Employees who volunteered should be more motivated and more likely to complete training. Those who checked off "volunteered" were coded 1; all others were coded 0.

Motivation to Learn. A five-item ($\alpha = .80$) measure of motivation to learn was adopted from Noe and Schmitt (1986). A sample item was, "I have a strong desire to learn the material covered in the CBT seminars." These data were obtained during a telephone interview, and respondents were asked to tell the interviewer their level of agreement along a five-point scale.

Learning Support. Three items from Tannenbaum (1997) were used to assess both supervisor support (for example, "My supervisor encourages employees to improve their skills whenever possible") and peer support for learning (for example, "In my department we discuss how to use what we learn in training"). Exploratory factor analysis revealed that these two measures loaded on the same factor, so they were combined to a single measure of perceived learning support. The resulting six-item scale has acceptable internal consistency ($\alpha = .84$). A five-point response scale was used for this measure.

Job Characteristics. Five workload ($\alpha = .81$) and seven autonomy ($\alpha = .90$) scale items from Spector et al. (2000) were used. Sample items included, "I am always rushing to meet deadlines" and "I am able to use my judgment about how the work should be done," respectively. A five-point response scale was used for both measures.

Time Spent in e-Learning. To obtain an objective measure of e-learning use, computer records were examined. The server tracked the amount of time trainees spent in each module and aggregated that time into a total number of minutes spent across all courses. The time measure was highly skewed, so it was log-transformed. Because time values of zero were in the data and the log of zero is undefined, one minute was added to all values prior to transformation.

Performance Improvement. In a confidential telephone interview following the close of the pilot, supervisors were asked to indicate whether their subordinates' computer skills and computer-related job performance had improved over the preceding nine-month period ("Since the beginning of last year, have

you noticed any improvement in the quality of the computer work done by PARTICIPANT'S NAME?" and "Since the beginning of last year, have you noticed any improvement in PARTICIPANT'S NAME's computer skill?"). Responses were highly correlated, and a two-item composite was formed ($\alpha = .69$). The resulting variable is ordinal in nature, with a value of 0 (no improvement noted with either question), .5 (improvement noted in one question), or 1.0 (improvement noted on both questions).

Data Analysis. Hierarchical regression was used to test the hypotheses. For hypotheses regarding time, the log of total time e-learning was regressed onto the predictors. Because of incomplete data in some variables, pairwise estimation was employed.

Results

Descriptive statistics and correlations are shown in Table 2. In general, control variables of age, sex, education, tenure, and prior computer-based training (CBT) experience were not correlated with time spent in e-learning. Training assignment (volunteered or not), workload, and motivation to learn were related to time in the expected directions. Time also correlated with performance improvement as hypothesized.

To test H1, H2, and H3, the log time variable was regressed onto the control variables in step 1 and the hypothesized predictors in step 2. Table 3 reports these analyses. In step 1 of the equation, the only significant control variable was whether participants volunteered ($\beta = .17$, $p < .01$). The direction of the coefficient indicates that participants who volunteered spent more time using e-learning. The effect for average daily hours of computer use was in the direction expected, but just outside the bounds of a .05 significance level ($\beta = .11$, $p < .10$).

Step 2a of the regression tests the first hypothesis by examining the effect of motivation to learn on time independent from the other predictors. Results indicated that motivation to learn predicted time ($\beta = .37$, $p < .01$). Thus, H1 was supported.

Step 2b of the regression tests the effects of situational variables of support and job characteristics. H2 predicted that learners with more supportive peers and supervisors would spend more time e-learning. This hypothesis was not supported ($\beta = -.05$, $p > .20$). H3a, which predicted that employees with greater workload would spend less time in e-learning, was supported ($\beta = -.12$, $p < .05$). H3b predicted that learners with more autonomy would spend more time e-learning. This hypothesis was also not supported ($\beta = -.07$, $p > .20$).

H4 suggested that the effects for work and work environment would be direct and not mediated through motivation to learn. To test this hypothesis, simultaneous estimation of all coefficients was conducted (see step 2c of Table 3). Results revealed that the magnitude of the effect for workload is

Table 2. Descriptive Statistics and Correlations

	M	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
1. Age	3.48	.93	—												
2. Sex	.22	.41	.01	—											
3. Education	2.75	1.07	−.08	.23*	—										
4. Tenure	2.81	1.29	.33**	.09	−.09	—									
5. Computer Use	3.34	.82	−.14*	−.17**	−.07	−.10	—								
6. CBT Experience	.14	.35	.05	.05	.03	.02	.06	—							
7. Volunteered	.63	.48	.02	.06	.14*	.01	−.15**	−.00	—						
8. Workload	3.67	.68	.01	.10	.10	.13*	.07	.05	.05	(.81)					
9. Autonomy	3.86	.68	−.13*	−.03	.14*	.04	.18**	−.06	.02	.27**	(.90)				
10. Support	3.93	.59	−.03	−.04	.02	−.09	.05	.06	−.12*	.18**	.29**	(.84)			
11. Motivation[a]	4.33	.57	.05	−.17	.03	−.01	.09	.05	−.22	−.12	−.37**	−.18	(.80)		
12. Time	1.48	1.21	−.02	.00	.00	−.03	.08	.01	.16**	−.13*	−.09	−.09	.30*	—	
13. Performance[b]	.68	.41	.17	−.15	−.06	.00	.18	−.01	−.18	−.07	−.08	.01	.22	.28*	(.69)

Note: Unless otherwise noted, minimum pairwise $N = 301$. Age, education, tenure, and computer use (average daily hours) are all measured on five-point Likert scale. Sex (0 = female; 1 = male), prior computer-based training (CBT) experience (0 = no; 1 = yes), and volunteered (whether trainees volunteered to be part of the pilot: 0 = no; 1 = yes) are dichotomous measures. Time spent e-learning is log-transformed minutes. Alpha coefficients are presented in the diagonal when appropriate.

[a]$N = 57$. [b]$N = 71$.

*$p < .05$. **$p < .01$.

Table 3. Regression of Log Time on Controls, Perceived Support, Job Characteristics, and Motivation to Learn

Step/Variable	β	*t*	R^2	*F*	ΔR^2	ΔF
1			.04	1.59	—	—
Age	.00	−0.15				
Sex	.02	0.39				
Education	−.03	−0.43				
Tenure	−.02	−0.39				
Computer Use	.11	1.80+				
CBT Experience	.00	0.04				
Volunteered	.17	2.98**				
2a[a]			.16	1.08	.12	6.69*
Motivation[a]	.37	3.09**				
2b			.06	2.02*	.03	2.96*
Workload	−.12	−2.04*				
Autonomy	−.07	−1.05				
Support	−.05	−0.79				
2c[a]			.18	.82	.14	1.79
Workload	−.12	−.82				
Autonomy	.08	.48				
Support	−.00	−.02				
Motivation[a]	.39	2.39*				

Note: Unless otherwise noted, minimum pairwise $N = 294$.

[a]$N = 57$.

*$p < .05$. **$p < .01$.

unchanged from step 2b, although the effect is no longer significant at the .05 level ($\beta = -.12$, $p < .10$). This result is consistent with direct effects, but the reduction in significance raises concerns about statistical power. Thus, support for H4 was equivocal.

Finally, H5 predicted that employees who spend more time engaged in e-learning will have a greater improvement in training-related dimensions of their job performance. To test this hypothesis, supervisor performance ratings were regressed onto the log time variable, holding control variables constant. Supporting the hypothesis, the standardized regression coefficient for time was .31 ($t(59) = 2.57$, $p = .01$, $\Delta R^2 = .09$). Because the performance variable has a limited distribution (it is scaled from 0.0 to 1.0), an ordinal regression analysis (PLUM in SPSS 10.0) was also run to test the model. The parameter estimate for log time remains significant at .43 (Wald = 4.59, $p < .05$, Cox and Snell pseudo $R^2 = .07$). Because these coefficients are difficult to interpret, raw time data were plotted at different levels of the dependent variable. Employees whose skills and performance did not change according to their supervisor (Performance = 0.0, $N = 15$) had performed less than an hour of e-learning on average ($M = 57$ minutes, $SD = 178$). In comparison, employees

whose skills and performance improved (Performance = 1.0, $N = 40$) had performed nearly eight hours of training on average ($M = 446$ minutes, $SD = 916$).

Discussion

The purpose of this study was to examine the degree to which different employees make use of e-learning, and why. Job characteristics, perceived learning support, and motivation to learn were all examined as possible factors that explain variability in time spent using e-learning. Results suggest the importance of motivation to learn and workload in determining how long employees use e-learning. In addition, the greater time employees spent using e-learning, the more their computer-related skill and performance improved, as judged by their supervisors.

These findings provide partial support for the model presented in Figure 1. More specifically, results suggest direct effects of workload on time spent learning, even controlling for motivation to learn and other variables (such as whether the participant voluntarily enrolled). Results also support the connections between motivation, time, and performance improvement. Results do not support the proposed relationships for learning support or for autonomy.

Implications for HRD Theory and Research. The results are consistent with theory supporting the importance of time as a learning mechanism. Past studies with weak effects of motivation on training outcomes (Fisher & Ford, 1998; Hicks & Klimoski, 1987; Noe & Schmitt, 1986) may have occurred because the research was conducted on formal training programs with fixed durations. In this study, learners were provided with considerable leeway regarding time, and the effects of motivation on time and of time on performance improvement were clear.

The results for workload suggest what could be called an e-learning paradox: employees with the greatest workload, who are likely to need training to improve their efficiency, were least likely to spend time learning. Thus, those who needed the training most were the least likely to actually do it. The workload effect was not reduced in magnitude when motivation was controlled, suggesting that the effect may be independent of learners' motivation. As noted by Russ-Eft (2001), the effect of workload on learning activity and outcomes is an overlooked area of research. In addition to the effect observed here, it is likely that workload plays a role in determining opportunity to use trained skill (Ford, Quiñones, Sego, & Sorra, 1992) and transfer of knowledge among employees (Szulanski, 1996). Thus, further research on the effects of workload on various training outcomes is warranted.

Implications for HRD Practice. Practically, this study suggests the importance of how e-learning programs are administered in terms of assignment and support. Consistent with Mathieu et al. (1992), whether participants volunteered was positively related to time in e-learning. Thus, e-learning programs

should rely on invitations and marketing rather than forced compliance. Similarly, as noted above, espoused support from supervisors and coworkers may be less critical than actual support in the form of reduced workload or release time. Some companies, including Dow Chemical, use internal advertising efforts to encourage volunteer learning activity and help employees create time to learn at work. This effort includes passing out doorknob hangers with sayings such as "Learning in Progress" and "Cybersurfing for Skills." Efforts such as these may prove critical for the success of e-learning initiatives that use asynchronous, self-paced courses.

These results also suggest the need to address organizational infrastructure and policy that accompany e-learning offerings. Organizations need to be proactive in creating time and perhaps even space within which learning can occur. These efforts can be formal, as in the creation of learning centers, or informal, as in the education of supervisors regarding the importance of protected time. Organizations also need to be attentive to employee motivation, as levels of motivation influence the use of e-learning resources. The use of incentives might prove valuable, but they also have a potential to stimulate unethical behavior (cheating) or be perceived as controlling, which may diminish motivation (Deci & Ryan, 2000). Concerted efforts to convince employees of the value of e-learning offerings may prove more useful.

Limitations and Future Research. There are a few limitations to this study. First, the data on motivation to learn and performance were not available for the full sample, and thus the sample size for relationships with these variables was relatively small. In addition, there is some evidence that these measures were biased toward those who had completed some of the training. The incomplete sampling of motivation and performance was not ideal, but its consequences may not be severe. The most likely effect is that the data on motivation and time were restricted in range. Such restriction generally attenuates observed relationships, rendering hypothesis tests more conservative.

Second, time is not a perfect indicator of the learning process. As others have noted (Fisher & Ford, 1998; Yin, 2001), time does not capture learners' cognitive processes. Ericsson (1996), for example, notes that the level of concentration during practice influences the benefits of practice. However, it should be noted that although time is not a perfect measure, it is a necessary condition for learning. Thus, measuring time offers a means to determine if any learning activity has occurred. In the context of this study, there were many learners who did not engage in any learning activity. In this situation, time is an important conceptual and practical consideration. A related limitation is that the time measure used in this study was obtained from the computer during asynchronous learning. Time spent learning may have different effects in live, synchronous training environments as compared to asynchronous environments like the one studied here. In this study, it is possible that participants logged into training but then paid attention to something else. Yet there was a large correlation between module completion and time on task ($r = .80$, $p < .01$),

which suggests that few learners started training and let time pass without making progress. Future research could ask learners to self-report their attention and metacognition (Brown, 2001) to determine if these processes varied across learners with different job characteristics. In addition, future research that compares the nomological network of time across synchronous and asynchronous training would be warranted.

Third, the focus of this study is on a single set of skills (computer skills) that has pedagogical advantages (for example, readily available simulated practice) and disadvantages (for example, it requires some computer skill to improve computer skill using a computer) unique to the learning outcome of interest. Thus, the results of this study may not be applicable to e-learning initiatives that focus on other content and learning outcomes, such as leadership training. The results also might not be generalizable to e-learning programs with different pedagogical features.

This study examined the degree to which different employees made use of e-learning opportunities. Results suggest that the use of such opportunities varies widely across employees. Moreover, the extent of use, as indexed by time spent using the programs, predicted supervisors' ratings of employees' training-related job performance. Thus, organizations and employees would benefit from knowing how to support employees in their efforts to use technology as a learning tool on the job. Efforts to encourage employees to volunteer and boost their motivation, while reducing practical obstacles created by workload, would help increase e-learning use.

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