

Linking Workplace Literacy Skills and Transfer System Perceptions

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Research examining the relationship between workplace literacy and training-related factors is virtually nonexistent. This study examined how variations in individual learning transfer system perceptions were associated with job-related workplace literacy skill differences. Results indicated significant differences in learning transfer system perceptions for employees who had the math and reading skill levels required for their jobs versus those who did not. Findings suggest a complex and little understood relationship between workplace literacy skills and learning transfer system perceptions.

Changes in the workplace—the increasing importance of knowledge work, new technologies, the importance of work teams and teamwork, and participation in the globalization process—are fostering a shift away from workers with lower skill levels to those with higher skill levels. These changes are requiring not only workers to obtain higher levels of education but are also requiring individuals to develop the capacity to learn, adapt, and change quickly and efficiently to meet challenging demands. Success in today's workplace requires that individuals have a broad set of foundation skills. It is in this context that workplace literacy skills are critical.

Workplace literacy refers to the ability of individuals to respond effectively to the literacy demands of the workplace (Gowen, 1992). Workplace literacy skills are the basic skills needed by employees to successfully perform job duties, learn, and apply learning on the job. These include skills such as reading, writing, mathematics, and listening (U.S. Department of Labor, 1991).

The concept of workplace literacy has increasingly occupied a place of national and international prominence. For example, it is estimated that 10–20 percent of American workers are either functionally illiterate or marginally literate (Lund & McGuire, 1990); one in five lacks the literacy skills needed to function effectively in work or life (Knell, 1990); and nearly half of all Americans have literacy levels well below what is needed to be competitive in today's economy (National Education Goals Panel, 1994). In fact, a recent study

noted that nearly 38 percent of job applicants do not have the workplace literacy skills to do the jobs for which they apply (Baynton, 2001). It is widely agreed that workplace literacy levels such as these have the potential to severely undermine the economic well-being and adaptive capabilities of organizations (National Center on Education and the Economy, 1990; Cappelli & Rogovsky, 1994; Carnevale, Gainer, & Meltzer, 1990; Hays, 1999).

On the other hand, results from the International Adult Literacy Survey (Organization for Economic Cooperation and Development [OECD], 1998) outline the importance of workplace literacy skills for the economic success of individuals and nations. The findings of this benchmark study are consistent with other views (for example, Berryman, 1994) that have linked workplace literacy levels to national wealth and the economic and social performance of society. At the individual level, research has shown that employees' higher literacy skills have improved employment prospects (OECD, 1998) and earn more (for example, Altonji, 1992; Levy & Murnane, 1992). In addition, employers believe that workplace literacy training can improve various aspects of job performance, including quality of output, ability to use new technology, error rates, customer satisfaction, time savings, and safety (Sticht, 1995). Finally, there is research showing that high levels of workplace literacy can enhance organizational performance by increasing innovation (Cohen & Levinthal, 1990; Bartel & Lichtenberg, 1987) and by reducing barriers to the restructuring that firms need to do to remain competitive (Drouin, 1990).

Given this growing concern and interest in workplace literacy, it is surprising to find that no direct empirical research has examined the relationship between workplace literacy skills and employees' ability to improve performance through learning. From a broad perspective, addressing this and other questions is important because learning is a major strategy used by organizations to improve performance. For example, rising levels of investment in training—estimated at more than \$60 billion in 1998 (Lakewood Research, 1998)—and increasing concern with concepts such as continuous learning, lifelong learning, and learning organization strategies reflect intensifying organizational commitment to learning as an adaptive performance improvement strategy.

What is needed is research aimed at examining how workplace literacy influences training participation, learning, and the application of new learning to job performance (that is, learning transfer). For example, although limited research has examined the transfer of literacy skills from the classroom to the workplace (for example, Mikulecky, Lloyd, Siemantel, & Masker, 1998; Taylor, 2000), no research to date has addressed the issues of whether or how differences in workplace literacy skills may affect individual perceptions of organizational learning transfer systems.

We believe that workplace literacy skill levels may influence an individual's ability to participate and learn in training, his or her perceptions of various aspects of work-related training, and ultimately the ability to apply new learning on the job. For example, employees who do not have the basic literacy skills

required by their jobs may purposefully avoid participation in training as a strategy to conceal this weakness. Certainly it is reasonable to suggest that individuals must feel capable of mastering the content of a training program before they willingly participate in that training. Thus, individuals with high workplace literacy levels would be more apt to participate in training than those without such skills. One of the only studies to examine this question indicated that individuals who met the reading and math skill levels required for their jobs were more likely to participate in training and were motivated to do so than did individuals with skill levels insufficient for their jobs (Bates, 2001). It is also possible that workplace literacy skill deficits constrain an individual's ability to profit from training. For example, low skill levels may affect an individual's readiness to learn in training, expectations about training and its performance improvement value, confidence and ability to apply new learning on the job, perceptions of organizational support for learning, learning transfer, or perceptions about the appropriateness of training design.

The goal of the present exploratory study is to examine how workers' job-specific workplace literacy skill levels are associated with differences in perceptions of learning transfer system variables.

Research Question

Do employees with different mastery levels of job-related workplace literacy skills differ in their perceptions of learning transfer system factors?

Method. The data in this study were collected as part of a needs assessment project conducted to address a number of organizational issues including workplace literacy and training transfer problems.

Sample. Participants in this study were 1,079 individuals employed with a state Department of Transportation (DOT) in the southern United States. This included 319 Mobile Equipment Operators, 178 Highway Foreman, 481 Engineering Technicians and Engineering Tech Supervisors, and 77 Highway Maintenance personnel (Specialists and Superintendents). Subjects in each job category were either selected by DOT from a larger population of individuals in that job category or represent the total population for that job category in this organization. Participants were required to attend the data collection sessions but could decline to complete the instruments if they so desired. Of the 1,218 individuals selected to participate in the assessment, 1,079 (88.5 percent) completed the instruments.

Procedure. The workplace literacy assessment instruments and the Learning Transfer Systems Inventory (LTSI) (Holton, Bates, & Ruona, 2000) were administered under the guidance of a Needs Assessment Team, led by the researchers, with the assistance of the organization's District Training Specialists. On-site District Training Specialists administered the assessment instruments during work hours in meetings specifically convened for this purpose. This study coincided with a preliminary trial by the DOT of the

Work Keys system for inclusion in their ongoing employee development program.

Independent Variable Measures. Data on employee workplace literacy levels were assessed using two scales from the Work Keys assessment system. The Work Keys system was developed by American College Testing (ACT), an organization that is well known for its work with college entrance exams. Work Keys is a set of eight criterion-referenced workplace literacy skills assessment tests based on the SCANS model (U.S. Department of Labor, 1991).

The Work Keys assessments are performance-based in the sense that they simulate actual workplace performance of skills to the degree possible given the requirements and limitations of large-scale, standardized assessments (ACT, 1997). Work Keys assessments are also criterion-referenced: the assessments are designed to measure an individual's cognitive and interpersonal skills against the proficiency required to successfully perform a specific job in a particular company. Required proficiency levels across the eight skills assessed by the Work Keys system are established through a process of job analysis and profiling, in which the most important tasks of a job are analyzed to determine the skills and skill levels required for effective performance on the job. The assessments thus provide a metric that can be used to compare an individual's basic skill levels with the requirements of a particular job. Prior to the development of Work Keys, a valid metric for measuring basic workplace skills required for specific jobs and those attained by individual employees did not exist.

As part of an initial trial of the Work Keys system in the DOT, two competency areas were selected by the DOT for assessment. *Reading for Information* and *Applied Mathematics* were chosen by DOT because of their relative importance for the jobs groups in this study. The reading for information assessment measured an individual's skill in reading and understanding work-related instructions and policies. Employees were tested on their ability to understand reading passages, based on actual demands of the workplace, that were in the form of memos, bulletins, notices, letters, policy manuals, and governmental regulations. The applied mathematics assessment measured an individual's skill in applying mathematical reasoning to work-related problems. The assessment required the examinee to set up and solve the types of problems and to do the types of calculations that actually occurred in his or her job. Examinees could use a calculator. A formula sheet was provided that included, but was not limited to, all required formulas. For each assessment, examinees were given forty minutes to solve thirty multiple-choice problems.

These and other Work Keys assessments contain items at lower levels of skill that most individuals can answer correctly and items at upper levels that only a few individuals can answer correctly. Although this configuration of items can lower inter-item consistency estimates, the various assessments have shown adequate levels of reliability as measured by Cronbach's coefficient alpha. For example, reliability studies conducted by ACT on multiple random

samples of 2,000 subjects found that the coefficient alpha for applied mathematics was .86 and that for reading for information was .80 (ACT, 1997).

The mastery levels for the reading for information and applied mathematics assessments for the different job groups being assessed by the DOT were based on jobs previously profiled by Work Keys that were functionally similar to the jobs examined in this study. To determine whether employees with different levels of workplace literacy skills differed in their perceptions of learning transfer system factors, individual scores for the reading and math assessments were dummy coded based on whether the individual met or did not meet the reading and math mastery level identified by the Work Keys profiles as required for functionally similar jobs. Thus employees in each job group were classified according to their level of mastery or non-mastery for the reading for information and applied mathematics skills: individuals who passed the exams scored at or above the required mastery level; those who failed did not. The resulting variables (Pass Math, Pass Read, Pass Both) were used as the grouping factors in the analyses for indicating level of mastery. The job groups and the proficiency levels required for each are shown in Table 1.

Dependent Variable Measures. Learning transfer system variables were assessed using the Learning Transfer Systems Inventory (LTSI). The LTSI (Holton, Bates, & Ruona, 2000) measures sixteen factors in the learning transfer system that may be barriers or facilitators to learning transfer. Table 2 contains descriptions and definitions of each of the constructs measured by the LTSI.

The LTSI is a fourth-generation instrument that has shown evidence of construct- and criterion-related validity (Bates, Holton, Seyler, & Carvalho, 2000; Holton, Bates, & Ruona, 2000; Bates & Holton, 1999; Bookter, 1999; Seyler, Holton, Bates, Burnett, & Carvalho, 1998). The LTSI is divided into two sections representing two construct domains. The first section contained forty-six items measuring eleven constructs representing factors affecting a specific training program attended by the respondent. Constructs included learner readiness, motivation to transfer, positive personal outcomes, negative personal outcomes, personal capacity for transfer, peer support, supervisor support, supervisor sanctions, perceived content validity, transfer design, opportunity to use. This section is program-specific because transfer system factors vary

Table 1. Required Math and Reading Levels by Job Group

	Job Group				
	Mobile Equipment Operators	Highway Foreman	Highway Maintenance Superintendent	Engineering Tech (entry)	Eng Tech (advanced)
Required math level	3	4	5	5	5
Required reading level	4	4	4	5	6

Table 2. LTSI Scales and Definitions

<i>Scale Name</i>	<i>Definition</i>
Learner Readiness	The degree to which an individual had the opportunity prior to attending training to provide input into training content or process, knew what to expect during the training, and understood how training was related to job-related development and work performance.
Performance Self-Efficacy	The extent to which an individual feels confident and self-assured about applying new abilities in their jobs, and can overcome obstacles that hinder the use of new knowledge and skills on the job.
Motivation to Transfer Learning	The extent to which an individual is motivated to utilize learning in his or her work. This includes the degree to which an individual feels better able to perform, plans to use new skills and knowledge, and believes new skills will help him or her to more effectively perform on the job.
Transfer Effort–Performance Expectations	The extent to which an individual believes that applying skills and knowledge learned in training will improve his or her performance. This includes whether an individual believes that investing effort to utilize new skills on the job has made a performance difference in the past or will affect future productivity and effectiveness.
Performance–Outcomes Expectations	The extent to which an individual believes the application of skills and knowledge learned in training will lead to recognition that he or she values. This includes perceptions about the extent to which a link between development, performance, and recognition in his or her organization is established. It involves perceptions about the clarity with which performance expectations are articulated, the extent to which individuals are recognized or rewarded for performance improvement, and the degree to which the organization has created an environment in which individuals feel good about performing well.
Feedback/Performance Coaching	The extent to which an individual receives constructive input, assistance, and feedback from people in his or her work environment (peers, employees, colleagues, managers, and so on) when applying new abilities or attempting to improve work performance. Feedback may include formal or informal cues from the workplace.
Supervisor/Manager Support	The extent to which an individual perceives that his or her managers support and reinforce the use of learning on the job. This includes, for example, managers' involvement in clarifying performance expectations after training, identifying opportunities to apply new skills and knowledge, setting realistic goals based on training, working with individuals on problems encountered while applying new skills, and providing feedback when individuals successfully apply new abilities.

Table 2. (Continued)

Scale Name	Definition
Supervisor/Manager Sanctions	The extent to which an individual perceives negative responses from managers when applying skills learned in training. This could include, for example, the active opposition by a manager or supervisor to the use of new skills and knowledge on the job, the failure to assist individuals in identifying opportunities to apply new skills and knowledge, or providing inadequate or negative feedback when individuals successfully apply learning on the job.
Peer Support	The extent to which peers are perceived to reinforce and support use of learning on the job. This includes the degree to which coworkers at the same or similar job levels assist in identifying and implementing opportunities to apply skills and knowledge learned in training, encourage the use of or expect the application of new skills, display patience when difficulties associated with applying new skills are encountered, or demonstrate appreciation for the use of new skills that enhance performance.
Openness to Change	The extent to which prevailing group norms are perceived by individuals to resist or discourage the use of skills and knowledge acquired in training. This includes an individual's perceptions about his or her work group's resistance to changing the way work is done, their willingness to invest energy to change, and degree of support provided to individuals who strive to use techniques learned in training.
Personal Outcomes—Positive	The degree to which applying training on the job leads to outcomes that are positive for the individual. Positive outcomes can include, for example, increased productivity and work effectiveness, increased personal satisfaction, additional respect, a salary increase or other material reward, the opportunity to further career development plans, or the opportunity to advance in the organization.
Personal Outcomes—Negative	The extent to which individuals believe that applying skills and knowledge learned in training will lead to outcomes that are negative. Negative outcomes can include formal reprimands or penalties, peer resentment, or the acquisition of additional work if performance is improved, or the perception that the possibility of receiving some type of reward for improving performance is remote or nonexistent.
Opportunity to Use Learning	The extent to which trainees are provided with or obtain resources and tasks on the job that enable them to use the skills taught in training. This can include the perception that an organization provides occasions or creates situations in which individuals can apply newly learned skills on the job, and that the resources needed to use new skills (equipment, information, materials, supplies, financial and human resources) are available.

(Continued)

Table 2. LTSI Scales and Definitions (*Continued*)

<i>Scale Name</i>	<i>Definition</i>
Personal Capacity for Transfer	The extent to which individuals have the time, energy, and mental space in their work lives to make changes required to transfer learning to the job. This factor addresses the extent to which an individual perceives that his or her work load, work schedule, personal energy, and stress level facilitate or inhibit the application of new learning on the job.
Perceived Content Validity	The extent to which the trainees judge the training content to accurately reflect job requirements. This factor addresses individual perceptions about the degree to which skills and knowledge taught in training are similar to performance expectations as well as what the individual needed to perform more effectively. It also addresses the extent to which training methods, aids, and equipment are consistent with what is required by or available in the individual's work environment.
Transfer Design	The extent to which training is delivered in ways that give trainees the ability to transfer learning to job application, and the training instructions match the job requirements. This could include, for example, the extent to which the training program clearly links learning with on-the-job performance through the use of clear examples, uses training methods similar to or that mimic those used in the work environment, and incorporates activities and exercises that clearly demonstrate how to apply new knowledge and skills on the job.

depending on the training program or exhibit a different profile of supportive transfer factors. For example, it is possible for a technical training program but not an interpersonal skills program to exhibit strong transfer. It is therefore important to assess some transfer system constructs on a program-by-program basis (Holton, 2000). The instructions for this section directed DOT respondents to think about a specific training program they had attended as a part of their job-related development. These were training programs that subjects were in the process of attending or had attended in the past, and they varied by job group. For example, the specific training programs referenced in this section included standard specifications training; training in various skill areas required by engineers for certification; training for managers and supervisors in planning, scheduling, and controlling maintenance work; maintenance traffic control training; and safety training for the operation of various pieces of highway construction and maintenance equipment. In short, the training referenced in this study ranged from highly technical training for various levels of engineers to supervisory and managerial training to large equipment operation training.

The second section of the LTSI contained twenty-three items measuring five constructs that are not program specific but that may influence any training program. These are termed "training in general scales" (Holton, 2000). These constructs represent more general factors that may influence any training program conducted. For these items, trainees were instructed to "think about *training in general* in your organization." Constructs in this second section included transfer effort performance, performance outcomes, openness to change, performance self-efficacy, and performance coaching.

In many applications of the LTSI, a number of additional items are included in both sections of the instrument as a part of ongoing efforts directed at further refining and developing the instrument. These research items were not included in the current study because of organizational concerns about instrument length.

It is also important to note that items in the LTSI were designed to measure individual perceptions of constructs, including individual perceptions of climate variables in some cases. Although *climate* is often used to refer to a group-level shared interpretation of organizations, climate can also be an individual = level construct, often referred to as *psychological climate*. James and MacIntyre (1996) noted that it is important to study climate from the individual perspective because people perceive particular climates differently and respond behaviorally in terms of how they perceive them. Because transfer of learning refers to *individual behaviors* resulting from learning, it is most appropriate to assess *individual perceptions* of transfer climate, because it is those perceptions that will shape the individual's behavior.

Covariate Measure. Employee beliefs about the extent to which an organization values learning and skill acquisition may affect training-related behaviors and attitudes (Kozlowski & Hults, 1987; Noe & Wilk, 1993), including learning transfer system perceptions. To control for this, the continuous learning culture scale was included in this study as a covariate. Continuous learning culture (Tracey, Tannenbaum, & Kavanaugh, 1995) is a construct that assesses the extent to which individuals perceive an organization's culture to be supportive of learning and was measured using a fifteen-item scale.

Analysis. The intent of this study was to examine variation in individual level learning transfer factor perceptions associated with job-related workplace literacy skill differences. Two different multivariate analyses of covariance (MANCOVA) were conducted to determine whether individuals who had and did not have required levels of workplace literacy skills differed in their perceptions of learning transfer factors. MANCOVA is a regression-like procedure that was used in this study because it is effective in removing extraneous variation in dependent variables that is due to one or more uncontrolled independent variables (Hair, Anderson, Tatham, & Black, 1998). By providing a single test of group differences across all dependent variables, MANCOVA also provides control over the experiment-wide error rate inherent in separate univariate tests. In this study, a two-way MANCOVA was first conducted using

"Pass Math" and "Pass Read" as the factors. This analysis allowed the interaction between the two factors to be assessed as well as the main effects. Second, a one-way MANCOVA was conducted with "Pass Both" as the independent variable. This analysis lumped together in one group respondents who failed to pass the reading or math exam (Fail-1) or failed to pass both of them (Fail-2). The allowed us to compare the perceptions of those who passed both exams (the Pass Both group) with those who did not (the Fail-1 and Fail-2 groups). Where significant multivariate effects were found, post hoc univariate ANOVAs were conducted to determine which dependent variables were different across the groups (Hair et al., 1998).

Results

Table 3 shows means and standard deviations of LTSI variables as a function of test scores for math and reading at or above the required job level (pass) and below the required job level (fail). Also shown are test scores at or above the required level for math and reading together (Pass Both) and below the required level on one or both (Fail-1 or Fail-2). Intercorrelations among the dependent variables and between the dependent variables and the covariate are shown in Table 4. Cronbach's alpha, an estimate of inter-item consistency or homogeneity useful when measures have multiple scored items, is presented on the diagonal of Table 4 as an index of scale reliability. Since the dependent variables are all measures of learning transfer system factors, the significant and often substantial intercorrelations are not surprising.

The results of the multivariate and univariate ANOVAs are shown in Table 5. The top part of the table shows the results for the two-way MANCOVA, while the bottom part of the table (below the dashed line) shows the MANCOVA results for the one-way analysis using "Pass Both" as the between-groups factor.

For the first analysis (two factors, "Pass Read" and "Pass Math"), the table shows that the multivariate test of the interaction effect ($PM \times PR$) was not significant ($F = .49$). This means that the differences across the dependent variables for the individuals who did/did not meet the required math levels are roughly similar to those for individuals who did/did not meet the required reading level. The absence of a significant interaction effect indicates the main effects for reading and math can be interpreted directly. The main effects for both math and reading were significant ($F = 2.10$ and 2.02 , respectively, $p \leq .05$). These results indicate that there is a significance difference across the dependent variables between individuals who met the required math levels and those who did not, as well as significant differences between individuals who met the required reading levels and those who did not.

Univariate tests show that those passing math differed in their perceptions on four learning transfer measures: openness to change, peer support, performance coaching, and supervisor sanctions. For three of the four factors, mean scale scores suggested those who failed the math exam had more negative

Table 3. Means and Standard Deviations of LTSI Variables as a Function of Skill Test Score

Group	CLCult		ContVal		LmrRReady		MotTran		OpenChange		OpptioUse		PeerSup		PerfCoach		PerfSE	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Pass Math	3.42	.62	3.20	.85	3.53	.62	3.68	.65	3.28	.64	3.28	.65	3.48	.68	3.32	.65	3.80	.56
Fail Math	3.54	.59	3.43	.77	3.53	.59	3.78	.64	3.16	.61	3.25	.58	3.41	.71	3.36	.65	3.85	.59
Pass Read	3.45	.61	3.19	.87	3.52	.62	3.69	.66	3.31	.64	3.28	.64	3.49	.67	3.32	.64	3.80	.56
Fail Read	3.49	.60	3.46	.72	3.54	.59	3.76	.64	3.12	.60	3.25	.58	3.40	.72	3.36	.66	3.84	.59
Pass Both	3.42	.63	3.17	.87	3.52	.63	3.67	.66	3.30	.64	3.28	.65	3.48	.68	3.31	.66	3.79	.57
Fail 1 or 2	3.53	.58	3.43	.75	3.54	.58	3.78	.63	3.16	.61	3.26	.59	3.43	.70	3.38	.64	3.85	.58
Group	PersCap		POE		PoNeg		PoPos		SupSanc		SupSupport		TEPE		TransferDsgn			
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD		
Pass Math	2.98	.66	2.93	.83	3.08	.70	2.89	.87	2.47	.61	3.23	.91	3.75	.59	3.46	.84		
Fail Math	3.02	.53	3.08	.75	3.24	.67	3.02	.83	2.83	.74	3.32	.89	3.78	.62	3.68	.67		
Pass Read	2.99	.66	2.97	.82	3.07	.70	2.90	.87	2.46	.60	3.23	.91	3.77	.59	3.47	.85		
Fail Read	2.99	.52	3.02	.78	3.26	.66	3.01	.83	2.85	.74	3.33	.88	3.77	.63	3.66	.65		
Pass Both	2.98	.68	2.94	.83	3.06	.71	2.89	.88	2.43	.59	3.21	.92	3.75	.59	3.43	.87		
Fail 1 or 2	3.00	.52	3.05	.77	3.24	.65	3.00	.82	2.82	.73	3.34	.88	3.77	.62	3.68	.65		

Note: CLCult = continuous learning culture; ContVal = content validity; LrnRReady = learner readiness; MotIran = motivation to transfer learning; OpenChange = openness to change; OpptUse = opportunity to use learning; PeerSup = peer support; PerfCoach = performance coaching; PerfSE = performance self-efficacy; PersCap = personal capacity for transfer; POE = performance outcomes-expectations; PoNeg = personal outcomes-negative; PoPos = personal outcomes-positive; SupSanc = supervisor sanctions; TEPE = transfer effort-performance expectations; TransferDsgn = transfer design.

Table 4. Correlation Coefficients for Relations Among LTSI Scales and Continuous Learning Culture

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 ClCult	91																
2 ContVal	47*	89															
3 LmrReady	29*	36*	70														
4 MotTran	43*	57*	38*	81													
5 OpenChange	54*	26*	13*	20*	76												
6 OptioUse	45*	52*	30*	37*	35*	69											
7 PeerSup	66*	45*	23*	42*	40*	40*	81										
8 PerfCoach	62*	37*	22*	37*	33*	29*	47*	70									
9 PerfSE	38*	37*	31*	38*	20*	27*	35*	38*	80								
10 PersCap	33*	39*	21*	29*	32*	46*	32*	20*	25*	52							
11 POE	64*	52*	24*	48*	39*	46*	47*	50*	29*	35*	80						
12 PoNeg	31*	37*	19*	19*	18*	20*	34*	30*	21*	19*	29*	68					
13 PoPos	40*	38*	24*	37*	25*	30*	37*	36*	24*	28*	51*	44*	62				
14 SupSanc	-17*	-10*	-05	-09*	-31*	-19*	-14*	-05	-09*	-20*	-16*	-04	-05	62			
15 SupSupport	67*	38*	25*	35*	43*	36*	51*	58*	26*	36*	54*	31*	34*	-18*	93		
16 TEPE	50*	56*	33*	61*	23*	43*	46*	43*	49*	33*	56*	24*	35*	-11*	38*	81	
17 TransferDsgn	45*	69*	43*	56*	24*	44*	44*	41*	42*	34*	46*	25*	32*	-06	38*	55*	89

Note: Leading decimals omitted. Reliability estimates (Cronbach's coefficient alpha) for each scale are presented in italic along the diagonal. ClCult = continuous learning culture; ContVal = content validity; LmrReady = learner readiness; MotTran = motivation to transfer learning; OpenChange = openness to change; OptioUse = opportunity to use learning; PeerSup = peer support; PerfCoach = performance coaching; PerfSE = performance self-efficacy; PersCap = personal capacity for transfer; POE = performance-outcomes expectations; PoNeg = personal outcomes-negative; PoPos = personal outcomes-positive; SupSanc = supervisor sanctions; TEPE = transfer effort-performance expectations; TransferDsgn = transfer design.

* $p \leq .05$

Table 5. Multivariate Analysis of Covariance and Univariate Analyses of Variance for Workplace Literacy Skills Tests

Source	Multivariate		Univariate ^b						
	F ^a	CVal	LReady	MotTran	OCmg	OppUse	Peer	PCoach	PerfSE
Cont Lrng Cult	72.74*	—	—	—	—	—	—	—	—
Pass Math (PM)	2.10*	.01	.21	.19	4.21*	1.52	8.32*	5.77*	.03
Pass Read (PR)	2.02*	8.21*	.02	1.01	2.90	.01	.39	4.03*	.18
PM × PR	.49	.00	.16	.00	.01	.42	.01	.06	.01
Cont Lrng Cult	72.37*	—	—	—	—	—	—	—	—
Pass Both ^c	7.12*	90.72*	22.17*	67.15*	132.80*	61.70*	156.70*	174.04*	40.96*
Source	Multivariate		Univariate ^b						
	F ^a	PCap	POE	PoNeg	PoPos	SSanc	SSprt	TEPE	TDsgn
Cont Lrng Cult	72.74*	—	—	—	—	—	—	—	—
Pass Math (PM)	2.10*	.03	1.16	.18	1.98	5.77*	2.48	.00	1.66
Pass Read (PR)	2.02*	.08	.03	3.91*	.03	7.41*	2.96	.02	.92
PM × PR	.49	.01	.16	.30	1.23	3.73*	.22	.16	1.26
Cont Lrng Cult	72.37*	—	—	—	—	—	—	—	—
Pass Both ^c	7.12*	200.56*	32.16*	58.65*	97.12*	34.03*	35.52*	242.96*	78.59*

Note: Multivariate *F* ratios were generated from Pillai's criterion. Wilk's lambda, Hotelling's trace, and Roy's gcr were also significant. ClCult = continuous learning culture; ContVal = content validity; LmrReady = learner readiness; MotTran = motivation to transfer learning; OCmg = openness to change; OppUse = opportunity to use learning; Peer = peer support; PCoach = performance coaching; PerfSE = performance self-efficacy; PCap = personal capacity for transfer; POE = performance-outcomes expectations; PoNeg = personal outcomes-negative; PoPos = personal outcomes-positive; SSanc = supervisor sanctions; TEPE = transfer effort-performance expectations; TDsgn = transfer design.

^aMultivariate *df* = 16,539.

^bUnivariate *df* = 1,554.

^cMultivariate *df* = 16,541; univariate *df* = 1,556.

**p* ≤ .05.

transfer system perceptions than did those who passed. Thus, Fail-Math individuals reported lower values for openness to change and peer support but higher values for supervisor sanctions (a negative indicator of a supportive climate). On the other hand, perceptions of performance coaching were slightly higher for those who failed the math exam.

For the reading test, perceptions also differed on four measures: content validity, performance coaching, personal outcomes negative, and supervisor sanctions. Those who failed the reading test showed higher mean scores across all four of these measures. Thus, the Fail-Reading group reported they perceived training to be content valid. Results also showed higher levels of two factors indicating somewhat contradictory perceptions of the transfer system. A high level of supervisor sanctions suggests that employees see supervisors as actively opposing the use of training (a non-supportive transfer system for this group). On the other hand, a high level of personal outcomes negative indicates a supportive transfer system because it suggests employees perceive that negative outcomes will be forthcoming if they do not use their training. Like the Fail-Math group, the Fail-Reading group also reported relatively higher levels of performance coaching.

The next analysis was more restrictive. The independent variable (Pass Both) lumped together all individuals that failed one (Fail-1) or both (Fail-2) of the tests and compared them with those who passed both tests. A MANCOVA was conducted with continuous learning culture as the covariate. The main effect for "Pass Both" was significant ($F = 7.12, p \leq .01$). Univariate tests showed that persons who passed both tests had significantly different perceptions on all learning transfer system variables. Interestingly, their mean scale scores were lower on all variables except for openness to change, opportunity to use, and peer support. Finally, there was a significant main effect for continuous learning culture, the covariate entered as a control.

Conclusions and Discussion

Published research examining the relationship between workplace literacy and organizational training-related factors is sparse. This study sought to explore whether employees with different mastery levels of job-related workplace literacy skills differed in their perceptions of learning transfer system factors. Results suggested that individuals with reading or math literacy levels that met or exceeded mastery levels consistent with their jobs perceived some transfer system factors differently than did those whose reading or math levels did not meet or exceed job-related mastery requirements. These differences were complex and, at time, paradoxical.

The results of this study indicated that individuals with lower workplace literacy levels tended to see a less supportive environment for the transfer of training. Individuals with math or reading skill levels below the mastery level required for their job perceived greater levels of active resistance in the workplace to the transfer of learning (for example, lower levels of openness to

change and peer support but higher levels of supervisor sanctions). On the other hand, perceptions of performance coaching were significantly higher for both these groups of employees. This may not be surprising, since performance coaching reflects the amount of feedback an individual gets about his or her performance. In other words, it may be reasonable to expect that if low literacy skills represent a barrier to performance improvement, then individuals who fall into this category may be receiving more feedback from supervisors or others as they try to change behaviors.

Curiously, comparisons between the pass-both group and the Fail-1/Fail-2 group revealed that the latter reported higher levels of motivation-related variables (motivation to transfer, transfer effort performance expectations, performance outcome expectations, and positive personal outcomes). Contrary to what would normally be expected, these higher levels of motivation-related variables emerged despite the presence of significantly greater levels of negative outcomes resulting from the application of training for this group of respondents. The Fail-1/Fail-2 group also saw supervisors and managers as both more supportive of transfer (supervisor support) and more negative in their responses to efforts to apply new learning (supervisor sanctions). In other words, this suggests a pattern in which individuals with lower basic workplace skill levels—despite negative responses from their work environment and fewer opportunities to use new learning—are still well motivated to try to improve work through learning. This low skills/high motivation pattern is consistent with what could be expected from people with low literacy levels who may have had to continually work harder to keep up.

Taken together, these findings suggest that individuals with low literacy levels have high expectations about the value of training—they recognize training can help them do their jobs better—but are less able to transfer new skills and knowledge effectively (perhaps because low literacy skills create learning and transfer difficulties). Consequently, they are more likely to encounter negative responses from supervisors and peers than those with higher workplace literacy levels when it comes to the application of learning.

On the other hand, the Pass Both group reported greater work group support for learning transfer (openness to change, peer support) and greater opportunities to use new learning (opportunity to use). However, they also reported less self-confidence in their ability to apply new learning on the job (performance self-efficacy) and less motivation to do so than did individuals who did not reach mastery level on the exams.

In general, these findings suggest that differences in workplace literacy skill levels are associated with potentially meaningful differences in perceptions across a variety of learning transfer system factors, including perceptions of transfer support and training-related motivation. In effect, this finding adds to the body of research suggesting that workplace literacy skills are a key factor in the trainability of individuals and, ultimately, the effectiveness of training. Thus, literacy skills are not only indicative of general information processing capacity and the ability to deal with cognitive complexity—as evidence from

the National Adult Literacy Survey suggests (Gottfredson, 1997)—but they also have implications for how individuals view the system of factors that will influence their ability to apply that learning on the job. Further research addressing the relationship between basic workplace skills and various elements of employee trainability including readiness for learning, motivation to learn, motivation to transfer, training and performance expectations, and various dimensions of training-related self-efficacy is needed to understand more fully how basic skills can influence job-related development through training.

Still, workplace literacy skills, like other psychological characteristics, are probabilistic in their influence on training and training outcomes, not deterministic. That is, their influence may vary as context and other factors change. Moreover, the relationships hinted at in this research are complex and poorly understood at this time. Certainly more research is needed to understand how basic skill levels influence participation in training activities, an individual's readiness to improve job performance through learning, and his or her motivation to do so.

Although it is reasonable to suggest that building the workplace literacy of employees will improve the odds that employees will participate and learn in training and will be motivated to apply that learning on the job, this logic seems to run counter to the approach most organizations take to workplace literacy skills. We noted in the introduction that there is a substantial and important gap between the literacy skills required by today's workplace and those that are present in the workforce. Few businesses, however, are supplying these skills. Baynton (2001) notes that only about 13 percent of organizations offer some kind of remedial training in literacy and math, and this figure represents a reduction of 11 percent of that provided in 1993. The rationale, consistent with a fundamental prediction of human capital theory, seems to be that since workplace literacy skills have application across the economy (that is, they are a public good), there is no incentive for organizations to supply this kind of training. The findings of this study, along with other research, suggest this view is no longer realistic. The message is that organizations may find substantial value added in efforts aimed at profiling jobs, testing, and, where necessary, enhancing the workplace literacy skills of workers prior to investing in other job-related training. Further research should examine the extent to which variations in basic workplace skill levels contribute to increases in performance outcomes from job-related training.

Although this study may spark more questions than it answers, one of its key contributions is linking two construct domains not previously linked in the literature, learning transfer system perceptions and workplace literacy skills. As we have seen, this linkage has important implications for training and learning transfer practitioners and researchers operating in organizational environments with significant numbers of low-skill employees. It certainly points to the need to more fully understand the relationship among workplace literacy skills, learning, and learning transfer.

Study Limitations

There are several methodological limitations of this study that should be noted. First, because the data for this study were collected from a single public sector organization, there are limits on the extent to which the findings are generalizable. In addition, the sampling process in this study was largely controlled by the DOT to the extent that the job groups and the individuals included in the study were selected by the organization's training administrators. It is difficult to estimate the error introduced by this sampling process, and therefore some caution should attend the interpretation of findings. Finally, while this study identified a number of significant differences among the groups studied, it should be noted that some of the mean differences were rather small. The large sample used in the study provided a high level of statistical power capable of detecting small albeit significant effect sizes. Nonetheless, the ability to test transfer perceptions in a more complex design (MANCOVA) and the large number of significant differences suggest that the findings may have important practical implications.

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