TECHNICAL REPORT

Learning to Earn: Direct Incentives for Work-Based Literacy Learning

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National Center on Adult Literacy
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LEARNING TO EARN:

Direct Incentives for Work-Based Literacy Learning

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Abstract

This report explores the impact of an innovative compensation system on the development of literacy skills among manufacturing and assembly workers in a high performance organization. The “pay-for-knowledge” (PFK) compensation system ties workers’ wages directly to the work-related skills and knowledge they demonstrate. By developing additional job-related skills, workers directly increase their rate of pay.

The report analyzes the development of work-related literacy skills in 185 manufacturing and assembly workers during the initial year of the PFK compensation system. Four specific workplace literacy skills in the PFK system are analyzed in detail: blueprint reading, gauge reading, shop math, and introductory statistical process control. Most workers participated in training, acquired new job-related skills, and increased their pay substantially as a response to this new compensation system. Both formal training and informal learning contributed to the observed skill acquisition.

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INTRODUCTION

Motivation has long been a central concept in adult literacy education. Once past the age of compulsory education, adults are no longer a captive audience for literacy instruction. Motivation becomes an explanatory concept for why some adults participate in skills training programs and why some do not. Recruitment and retention of students into adult education programs is consequently a central programmatic concern.

Efforts to increase the basic skills of the workforce, such as workplace literacy programs, also need to consider motivational variables. If training programs are offered "on-the-clock," workers may be assigned or otherwise choose to participate. But the extent to which workers will study or practice outside of work hours (or participate at all if programs are offered off-the-clock) is in part a motivational matter.

There has been increasing attention to the importance of motivation in such workplace programs, and to the issues of providing effective incentives in workplace training and education (e.g., Hirsch & Wagner, 1995; Mickulecky, 1995). Most studies merely provide descriptive information of the types of incentives (and sometimes their underlying rationale) that employers and/or unions provide. Mickulecky (1995), for example, describes a range of such incentives for worker education programs, including employee tuition and course support, educational advancement programs, cash bonuses, job retention and promotion, and related support services for workers participating in programs (e.g., child care, transportation, counseling). There are few empirical studies, however, of the actual impact on learning and performance of providing direct incentives to workers for participating in training or for attaining specified learning outcomes.

The innovation of alternative compensation systems provides an interesting opportunity to examine the impact of direct financial incentives on the development of valued workplace skills and knowledge. "Skill-based pay" (Jenkins, Ledford, Gupta, & Doty, 1992) or "Pay-for-Knowledge" (Gupta et al., 1988) compensation systems link workers' pay to the specific work-based skills and knowledge that they can demonstrate. By looking closely at the implementation and impact of one such innovative compensation system in a manufacturing company, the present study will consider the extent to which direct incentives for specific workplace skills and knowledge stimulate participation in training and the development of literacy.

This study builds on the previous work of Hart-Landsberg and Reder (1993), who conducted a qualitative analysis of the apparent effects of the impending pay-for-knowledge (PFK) compensation on workers' development of teamwork and literacy skills. This study goes well beyond the previous work of Hart-Landsberg and Reder in several important respects, however. First, this study examines the effects of the PFK system during the first year after it went into effect, whereas the earlier study examined the effects of the anticipated transition from the traditional compensation system to PFK. Second, this study involves data collected about all manufacturing and assembly workers employed at Hardy rather than from the purposively selected (and much smaller) set of informants participating in Hart-Landsberg and Reder's ethnographic study. Third, this study utilizes systematic and relatively uniform measures of participation in training and assessment of specific literacy skills.

FOCUS OF STUDY

Hardy Industries,[1] a manufacturer of both Original Equipment Manufacturer (OEM) and aftermarket specialty products for the international automotive industry, was selected as a site in which to examine the impact of direct compensation incentives on the growth of workplace skills and knowledge. This privately held company, which employs a workforce of approximately 435, has been in business for 45 years. Details of the Hardy workplace setting and organization structure have been described previously[2] (Hart-Landsberg & Reder, 1993; Reder, Hart-Landsberg, Schwab, & Wikelund, 1991).

Widely regarded as an innovative and forward-looking company within the highly competitive automotive industry, Hardy has implemented three broad innovations that are well suited to the purposes of this study: a restructured, high performance organizational model; a skill-based "Pay-for-Knowledge" (PFK) compensation system; and a wide range of

training and education opportunities for workers to learn valued skills and knowledge. These innovations have been progressively implemented at Hardy over the course of the past four years.

Restructuring at Hardy Industries

Hardy has been attempting to restructure its organization, physical plant, manufacturing processes, and human resources into the Toyota model of a high performance work organization. Self-managing, product-centered teams are charged with their own engineering, process design, manufacturing, and quality control. Teams are given much flexibility in and responsibility for designing and managing their work. The ideal worker is seen as being a highly flexible member of a production team, having a wide range of skills, able to participate in a variety of roles within the team, familiar with numerous technologies, and an active participant in the design and management of the team's work. Emphases on "quality," "total employee involvement" (in all aspects of the team's work and company's affairs), and "continuous improvement" pervade employee training and internal discourse designed to support the ongoing reorganization.

The Pay-for-Knowledge (PFK) Compensation System

The PFK compensation system is seen by Hardy's management as crucial to the successful implementation of their high performance model. Under their previous compensation system (one which is traditional in U.S. business), workers were paid according to the value of their given jobs, how well they performed them, and how long they had worked for the company. Hardy's new PFK system attempts to reward workers in a different way—in terms of the breadth and depth of their demonstrated work-related skills and knowledge. Hardy workers who learn a given job (with its requisite skills and knowledge) will not receive increased compensation merely by continuing to do that job well; they must acquire additional skills and knowledge to progress.

Some characteristics of Hardy's PFK system and the early phases of its implementation have been described previously (Hart-Landsberg & Reder, 1993). Appendix A to this report provides materials taken from the PFK manual[3] given to Hardy employees for orientation to the compensation system, its philosophy and goals, its advantages and disadvantages, and how it operates in practice. For the purposes of the present study, several characteristics of the PFK system and its implementation at Hardy should be noted.

The PFK system contains five skill blocks, each containing a menu of 10–20 specific skills on which compensation is based. The skill blocks have been designed so that the higher the skill block, the more complex and valuable (in terms of compensation) are the component skills. Different sets of skill blocks have been developed for various categories of workers. Thus far, skill blocks have been developed for the following six categories of workers: maintenance, tool and die, tool grinding, receiving/ distribution, manufacturing/ assembly, and technicians. In addition, the development of PFK skill blocks is being considered (while traditional compensation remains in effect) for purchasing/planning, clerical/secretarial, human resources, finance/ accounting, engineering, information systems, sales/marketing, and team leaders.

Hardy spends several years in the process of identifying, describing, and placing monetary values on the work-related skills and knowledge in the skill blocks. Peer committees of workers are heavily involved in developing and reviewing the specifications. Their recommendations are subject to several levels of human resources and senior management review. Each selected skill is characterized in terms of a title, a definition, a series of content specifications, and set of certification procedures and instruments to be used (including one or more of the following: written exam; oral exam; hands-on demonstration; or other assessment procedure).

Table 1 displays the five skill blocks for manufacturing/assembly workers, the subject of this study.[4]

PFK compensation at Hardy is determined by adding to a base pay level (presently $6.00/hour for manufacturing/assembly workers) increments for each certified skill in the applicable PFK skill blocks. For example, for each skill certified in Manufacturing/Assembly Block 1, the employee earns an additional

$0.10/hour. Up to 15 skills may be added from Skill Block 1, which could add a maximum of $1.50/hour from Skill Block 1 to the base pay.[5] Skills from Block 2 are each worth an additional $0.20/hour, up to a limit of 10 ($2.00/hr.). Those from Block 3 are each worth $0.30/hour, up to a limit of 10 ($3.00/hour). Skill Block 4 items each add $0.50/hour, up to a limit of 6 ($3.00/hour). The most valuable skills are those from Block 5, each worth an additional $0.75/hour up to a limit of 4 ($3.00/hour). Someone certifying the maximum number of skills allowable from each block would thus receive $18.50/hour, more than three times the base rate for a manufacturing/assembly worker at Hardy.[6]

Table 1

Pay-for-Knowledge Skill Blocks at Hardy (see text for explanation).

Skill Block 1: We will pay $0.10/hr per skill for a max. of 15 skills.

Operate and Set Up-Class A Machine***	*Safety/Housekeeping/Emergency Procedures
Build-Class A Assembly***	Machining Fundamentals for Manufacturing
Cell Specific Computer Transactions	Assembly Toolbox
*Teamwork Communications	Blueprint Reading
	Gauge Reading
Material Handling	Process FMEA I
Schedule/Prioritize	Develop Worksite Standards
Shop Math	QFD I

Skill Block 2: We will pay $0.20/hr per skill for a max. of 10 skills.

*Continuous Improvement Fundamentals	DOE I
*Peer Feedback and Skill Assessment	OEM Shipping
Inventory Management	Basic GDT
*Quality Problem Solving (8D)	Build-Class B Assembly**
TOPS (8D) I	Set Up and Trouble Shoot-Class A Assembly**
Receiving	Operate-Class B Machine***
CADKEY Drafting I	Paint Booth
SPC I	Product Testing I

Skill Block 3: We will pay $0.30/skill for a max. of 10 skills.

Coaching/Training	Operate-Class C Machine***
Meeting Facilitator	Set Up and Diagnose-Class B Assembly
Business Planning/Budgeting	Set Up and Diagnose-Class B Machine**
Customer Service, Diagnosis and Repair	SPC II
CADKEY Drafting II	Cell Layout I
QFD II	Advanced Machining
Vehicle Fit Up	Process FMEA II

Skill Block 4 : We will pay $0.50/skill for a max. of 6 skills.

Applied GDT	CNC Programming
Set Up-Class C Machine**	CMM
Problem Solve and Diagnose-Class B Machine***	DOE II
TOPS (8D) II	

Skill Block 5: We will pay $0.75/skill for a max. of 4 skills.

Problem Solve and Diagnose-Class C Machine	Gage Fixture and Tool Design
Applied SPC	Introduction to Materials
Cell Layout II	Product Testing II
Advanced CNC Programming	Problem Solving and Maintenance
Customer Contact (Technical Support)	Build Fixtures and Tooling

*required
**may certify up to two machines/assemblies
***may certify up to three machines/assemblies

To smooth the transition into the new compensation system and gather support for its implementation, an early feature of this innovation was the policy that all existing employees' pay rates would be "grandfathered" under the PFK system, so that no one would have his or her pay reduced because of PFK.[7] Those subject to PFK are compensated at the higher of two rates: their calculated PFK rate and their previous "grandfathered" rate. Those receiving a higher grandfathered rate are termed "skills-short" at Hardy, because they do not have enough PFK skills to match their current compensation. Despite the apparent income protection PFK provides to the "skills-short," however, increases in compensation are possible only through PFK-based rates. Cost-of-living adjustments, for example, will be applied in the future to PFK pay parameters but not to the grandfathered rates.

Although the implementation of the PFK system at Hardy began in 1990, the transition to actual PFK compensation started in November 1992 when the first paychecks were issued under the new PFK system. The manufacturing/assembly workers studied here were the first group to receive PFK compensation. Although PFK pay did not go into effect until November 1992, many PFK-related activities had been ongoing for a couple of years prior to that time as workers and management prepared for the transition to PFK: Extensive training on PFK skills was offered and taken; PFK certification activities were carried out and logged into the Hardy's PFK database; and workers were periodically apprised of their PFK status and prospective rate of pay.

Further description of details of the PFK system and its implementation is beyond the scope of this report. But it is worth noting that considerable care has been taken at Hardy to develop objective certification procedures for assessing each PFK skill. The certification process for given skills may involve one or more of the following: a written test (e.g., for blueprint reading), a hands-on demonstration (e.g., for setting up a machine), or peer and/or team leader appraisal (e.g., for communication skills).

Role of lifelong learning, skills, and knowledge

Hardy's plan for implementing the high performance model and the PFK compensation system requires that the workers become lifelong learners. Through participating in a combination of formal training offered at the worksite by Hardy, external classes offered at local colleges, and informal on-the-job training, workers are expected to acquire needed skills and knowledge on an ongoing basis to meet the demands of an ever-changing workplace and industry. In the four years since the restructuring process began at Hardy, demand has increased dramatically for classes offered at the Hardy site as well as for classes offered at nearby two- and four-year colleges. Because of the diversity of the locations, and the duration and content of all the various education and training involved, it is difficult to summarize its scope and extent in a comprehensive way. A snapshot of just the training currently offered onsite at Hardy as this report is being prepared suggests the scope and extent of ongoing training. Appendix B displays the current training schedule. Particular types of training—those closely associated with the specific PFK skills being investigated—will be examined in more detail below.

As Hart-Landsberg and Reder (1993) demonstrated, literacy plays a vital role in the ongoing restructuring of work at Hardy Industries. The use of written information pervades the design, performance, and monitoring of work in all teams. The social organization of work into self-managing teams appears to have increased demands on many workers to utilize written information for participating actively in the design and carrying out of their work activities. Hardy's PFK compensation system—with its associated formal training and informal work-based learning and frequent written assessments—also appears to be increasing the literacy requirements in the workplace. Functional literacy is part of the actual content of some work tasks and skills assessed under PFK (e.g., blueprint reading). In other skill areas such as workplace safety, written materials are the medium of instruction for training. And, of course, many skills in the PFK system are assessed and certified through procedures that involve reading and writing.

Scope of this report

This report examines the development of work-related skill and knowledge among Hardy's manufacturing and assembly employees in response to the PFK incentives for learning. Of particular interest will be selected PFK skills often considered to be part of basic "workplace literacy" requirements in many sites. Literacy is interwoven throughout many of the PFK items from all skill block levels, whether as part of the skill itself, part of the formal training provided for the skill, or as part of the testing/ certification process for that skill.

The specific PFK skills examined in this study are Blueprint Reading, Gauge Reading, Shop Math, and Introductory Statistical Process Control (SPC I). Looking again at Table 1 above, it can be seen that the first three of these skills are from Skill Block 1 for manufacturing/ assembly workers, whereas SPC I is from Skill Block 2. These are considered to be part of the core skills for Hardy workers.[8] In this report, these four skills will be termed target skills.

Considering both the overall and target PFK skills, several essential questions will be addressed:

- To what extent are workers acquiring PFK skills and knowledge?
- To what extent are workers participating in voluntary formal training designed to help them acquire specific skills and knowledge valued by the PFK system?
- What is the relationship between participation in formal training and skill acquisition?

METHODOLOGY

This report is based primarily on the analysis of several sets of documentary data collected and maintained by Hardy human resources management. Personnel data files provide information about employee characteristics such as age, gender, job title, team assignment, date of hire, and rate of pay. A skills certification database provides information about employees' PFK status. Two "snapshots" were taken of these continuously updated personnel and PFK databases, one in October 1992 and a second a year later in October 1993, providing longitudinal data on employees' pay and PFK skills. The number of full-time employees who were in the personnel database at both time points was 371. Of these, 185 were manufacturing/assembly workers compensated through the PFK system. The study will examine this group of 185 Hardy manufacturing/ assembly workers.

Data on all PFK skills were collected. Some analyses presented below are aggregated by Skill Block level. Much of the analysis, however, concerns the four target workplace literacy skills described above: Blueprint Reading, Gauge Reading, Shop Math, and SPC I. Certification of each of these skills requires a passing score on a secure written test[9] that involves constructed rather than multiple-choice responses. Passing scores range from 75% (Shop Math) to 80% (Blueprint Reading). A sample of one form of the Shop Math test (no longer in use) is attached in Appendix C. Workers may take a "challenge test" at any time to receive credit for one of these skills or may take the corresponding course before taking the test.

Training records maintained by the company provided information about employee participation in various classes offered onsite by Hardy. These databases provided cumulative information about course enrollment and completion from 1990 (when the PFK system was first announced) to the present. For the purposes of this study, four particular courses were of interest: Blueprint Reading, Gauge Reading (Measuring Instruments), Shop Math, and Introductory Statistical Process Control (SPC I). Each of these courses, corresponding closely to its namesake PFK skill being investigated here, has been offered numerous times over the past few years. The following table shows the number of class hours and type of instructor (internal Hardy staff or external community college instructor) for each of these classes:

BRIEF PROFILE OF MANUFACTURING/ ASSEMBLY WORKERS

There were 185 full-time manufacturing/ assembly (M/A) workers on PFK compensation for the full year ending in November 1993. Most (71%) of these workers are men, the minority (29%) are women. As of October

1993, their ages ranged from 21 to 67, with an average of 39.5 years. About 83% are high school graduates and a majority of those without a high school diploma have earned GED certificates. Ten (10) have received two-year college degrees, six more have earned four-year degrees. Only a small percentage (9%) are not native speakers of English. As Reder et al. (1991) noted, most of these M/A workers attended local high schools and, as a human resources staff noted, "liked shop in high school."

Manufacturing/assembly workers selected for this study had been at Hardy at least since October 1992 when the first data "snapshot" was taken. Their tenure at Hardy by October 1993, when the second snapshot was taken, ranged from 13–377 months (a span of more than 30 years), with a mean value of 104.6 months (more than 8 years). The age at which these M/A workers were originally hired at Hardy averages 30.7 years, with a range of 18–64.

In October 1992, just before their pay was converted to the PFK system, the wages of these M/A workers had a mean of $10.66/hour, with a range of $5.85 – $19.04/hour. A year later, under the PFK compensation system (with the grandfathering provisions noted above), their wages increased an average of 14.9% to a mean of $12.25/hour. The median wage increased from $11.06 to $12.26.

Richer qualitative profiles of these M/A workers (particularly of those called the "skills poor" at Hardy, i.e., those with weak basic skills) and their jobs are available elsewhere (Hart-Landsberg & Reder, 1993, in press).

DEVELOPMENT OF PFK SKILLS AND KNOWLEDGE

Table 3 displays the overall growth of M/A workers' PFK skills and knowledge in the different Skill Blocks.[10] The mean number of skills at each level is shown for the snapshots taken in October 1992 ("Time 1") and October 1993 ("Time 2"). The average total number of skills is also shown, as is the mean PFK hourly wage calculated from the workers' certified skills.[11]

At Time 1, just before their PFK-calculated compensation went into effect, M/A workers had already been participating in PFK-related training and certification activities for a couple of years, and had already accumulated a substantial number of certified skills. Nevertheless, successful completion of additional training and certification activities (including written test-taking) in the ensuing year resulted in significant learning of additional skills and knowledge, as reflected in the increased PFK skills at all levels. The results of paired t-tests for the Time 1 and Time 2 values of each indicator are shown in the rightmost columns; each difference is statistically significant at the .05 level or better.

For example, looking at the results for Skill Block 2, we see that the 185 M/A workers averaged 4.87 and 7.10 certified skills at Time 1 and Time 2, respectively. The difference in number of skills certified between the two points in time is 2.23 skills, which corresponds to the average number of additional skills from Skill Block 2 workers certified during the year between the two snapshots. The statistical significance of this difference was examined with

Table 2

Features of formal classes offered by Hardy Industries for the four target workplace literacy skills in this study.

Course	Hours	Teacher
Blueprint Reading	33	External Instructor
Gauge Reading	33	Internal Instructor
Shop Math	25	Internal Instructor
SPC I	10	Internal Instructor

In addition to these documentary data sources, a brief written survey was distributed to Hardy employees in May 1992 in order to get information about workers' educational background and about the training that they had taken both at the Hardy premises as well as at two- and four-year colleges. All but 8 (N=177) of the 185 workers examined in this study completed the questionnaire.

a t-test, which produced a t-value of 13.01, which has a probability of less than 0.001 (denoted .000 in the table) of occurring due to chance.

Although skill development continued at each Skill Block level, more skills from Blocks 2 and 3 were developed during the Time 1—Time 2 observation period than from the other Skill Blocks. The higher rate of skill acquisition for Blocks 2 and 3 is probably the result of several factors. First of all, as noted above, many of these workers had previously acquired and/or certified the lowest level (i.e., Skill Block 1) skills prior to the implementation of PFK at Time 1; training and certification activities for those skills had been available for a considerable period prior to Time 1. Second, some of the higher level skills in Skill Blocks 4 and 5 were relatively new and potentially challenging to many workers and were not priorities for initial acquisition (given that they could get credit for other more easily acquired /certified skills in lower Skill Blocks). Third, many of the high level skills were difficult to acquire until training had been taken and skills acquired from lower blocks.

The bottom row of Table 3 displays the total value (in dollars per hour) of the PFK skills at the two time points. The manufacturing and assembly workers gained an average of $1.23 per hour in wages over this period as a result of the skills and knowledge that they acquired. This corresponds with an average wage increase of 11.8% over a one-year period (ignoring the grandfathered pre-PFK wages that the "skills short" employees maintained).

Table 4 displays the percentage of Hardy's M/A workers who had certified each of the four target workplace literacy skills at the two time points. The rightmost column of the table displays the relative learning gain between the two time points (i.e., the percentage of those who had not learned the skill by Time 1 who had learned it a year later at Time 2). For example, 45% of the M/A workers had learned Blueprint Reading by the first time point; an additional 18% (for a total of 63%) had learned it by the second time point. The relative proportion who learned between the two time points is the ratio of how many learned it between the two time points (18%) to the number who had not learned it by the first time point (55% = 100% – 45%), which is .33, which converts to the 33% figure shown in the rightmost column. This indicates that, of those who had not certified the skill by Time 1, about 1 in 3 had done so by Time 2.

Although many workers had acquired the Blueprint Reading, Gauge Reading, and Shop Math skills by Time 1, many others continued to acquire those skills during the ensuing year. Many fewer M/A workers had acquired the more complex and valuable Statistical Process Control skills during this period of time, even though over one-quarter of the workers had acquired this skill by the second time point.

Table 3

Development of PFK skills and knowledge between two points in time one year apart.

Level	# Skills Time 1	# Skills Time 2	t (df=182)	p
Skill Block 1	10.34	11.01	2.42	.016
Skill Block 2	4.87	7.10	13.01	.000
Skill Block 3	3.97	5.32	7.50	.000
Skill Block 4	2.16	2.74	5.14	.000
Skill Block 5	0.25	0.36	2.57	.011
Total Skills	21.60	26.54	7.22	.000
PFK Value ($/hour)	$10.46	$11.69	5.96	.000

Note: For each Skill Block, the mean number of certified skills is shown for the time points labeled "Time 1" and "Time 2." The total number of skills and their PFK wage value are displayed in the bottom two rows of the table. The two rightmost columns show the results of a t-test carried out on the difference between the two time points; the columns labeled "t" and "p" show, respectively, the t-value and the probability that the observed difference results from chance alone.

ROLE OF FORMAL TRAINING IN LITERACY SKILL ACQUISITION

Table 5 provides detailed information about the numbers and percentages of M/A workers who did or did not take the formal training courses offered by Hardy for the four target workplace literacy skills. The table also provides skill attainment outcomes for workers who did and did not choose to participate in the training. For each target skill listed in column (a), columns (b) and (c) display the percentage and number of workers who took the available training, and column (e) shows the number of workers who did not take that particular training. Looking at the data for Blueprint Reading, for example, 118 of the 185 workers (63.8%) took the Blueprint Reading course offered by Hardy. As the table indicates, the introduction of PFK appears to have stimulated broad participation in training for these workplace literacy skills.[12] Between one half and two thirds of the M/A workers have taken the formal training for the lowest level (i.e., Skill Block 1) target literacy skills, whereas slightly more than one quarter have taken the shorter duration but more difficult training for the Level 2 introductory statistical process control.

Table 5 also provides information about the impact of training on skill acquisition. Column (d) displays the percentage of workers who took the formal training and who subsequently became PFK-certified for the skill; column (f) displays the corresponding percentage for those workers who did not take the training. Using Blueprint Reading again as an example, of the 118 workers who took the training course, 78.8% passed the written test for the skill and became PFK-certified (and paid) for it. Of the 67 workers who did not take the course, only 37.3% attained PFK certification.

Overall, the training appears to be effective: Between 63% and 94% of those taking one of these courses subsequently passed a written certification test for the skills involved. The SPC requirement, a Level 2 skill, appears more difficult to acquire, both in terms of the lower percentage of M/A workers taking the training and the lower percentage of those taking the training who pass the certification requirement. With the exception of Shop Math, the percentage of workers not taking the formal training who passed the skill tests was much lower than the corresponding percentage among workers who did take the training. For Shop Math, the two percentages were quite similar (83.7% among those who took the training versus 79.0% among those who did not take the training). Apparently, most of the workers are able to acquire and/or certify their Shop Math skills regardless of whether they take the training or not.

It is clear from Table 5 that for each of these target workplace literacy domains, skill attainment is not the unique byproduct of formal training. Even though most individuals who certified these skills did so after taking the relevant formal training course, there were substantial numbers of individuals who certified these skills without benefit of such formal training. Some individuals may have acquired the skills before PFK was introduced; some workers may have learned these skills informally on the job, from peers, and through other learning experiences. There is substantial qualitative as well as much anecdotal evidence indicating that all of these are routes to literacy learning among M/A workers at Hardy (Hart-Landsberg & Reder, 1993, in press).

Table 4

Development of target workplace literacy skills. See text for explanation.

PFK Skill	Percent With Skill at Time 1	Percent With Skill at Time 2	Relative Learning Gain (%)
Blueprint Reading	45	63	33
Gauge Reading	54	81	59
Shop Math	63	81	49
SPC I	1	27	26

Table 5

Participation in formal training and the impact of formal training on acquisition of target skills. See text for explanation.

(a) PFK Literacy Skill	(b) % of Workers Who Took Training	(c) # of Workers Who Took Training	(d) % of Trained Workers Passing PFK Cert.	(e) # of Workers Who Did Not Take Training	(f) % Non-Trained Workers Passing PFK Cert.
Blueprint Reading	63.8	118	78.8	67	37.3
Gauge Reading	65.9	122	94.3	63	57.1
Shop Math	56.2	104	83.7	81	79.0
SPC I	28.1	52	63.5	133	12.8

Thus, although there is strong evidence of other pathways to work-based learning, formal training appears to have a strong impact on skills acquisition. For three of the four target workplace literacy skill areas, participation in the formal training appears to have had substantial impact on acquisition and certification of the skills involved. Only in the case of Shop Math is the certification percentage of those not taking the training (79.0%) comparable to that of those who do take the training (83.7%). In the case of Blueprint Reading, Gauge Reading, and Statistical Process Control, the corresponding rates are much lower among those who do not take the training than among those who do take the training.

Underlying these aggregate data on training and skill development are the experiences of individual workers. Brief sketches of four workers will help to illustrate the overall trends in skill development that were stimulated by the PFK system.

- Lucy[13] is an assembler in her 30s who had worked at Hardy less than a year at the time the PFK system went "on-line." She has a two-year (AA) college degree. By the inception of PFK, she had certified a total of 9 skills, including Shop Math of the four target skills being investigated here. She certified Shop Math by passing the written challenge test (i.e., she did not take the Shop Math course). At the end of the year (Time Point 2), Lucy had certified a total of 20 PFK skills, including all four of the target literacy skills. She took courses and passed tests for the three target skills she acquired over the year of observation: Blueprint Reading, Gauge Reading, and SPC I. Her hourly wages rose from $5.85 to $8.90 over the year (her initial PFK wage was $7.00). Because her PFK skills entitle her to a higher wage than she earned under the traditional compensation system, Lucy is not termed "skills short" at Hardy.

- Donna is a machine specialist in her 50s. She has worked at Hardy for more than 10 years. She has a high school diploma. Donna has taken courses at Hardy to prepare for certification tests in each of the four target skill areas being studied except Shop Math, which she passed by challenge test. She had certified 22 skills by Time 1 when PFK went "on-line," including all of the target literacy skills except SPC I. By Time 2, she had added another PFK skill, and taken the class for SPC I, but had not yet been certified for SPC I. With the addition of the one PFK skill, Donna slightly increased her pay "on paper," but not in actuality, because her pre-PFK wage ($11.28) was still higher than her pay on paper under PFK. Although she still receives the higher amount of pay, she is termed "skills short" at Hardy (by about $0.70/hour). She continues to try to increase her skills so that eventually she will be eligible for an increase in pay. She took the SPC I course at Hardy during the year of observation, but had not yet passed the certification test.

• Daryl is in his late 30s and has been working at Hardy as a machine operator for 5 to 6 years. He does not have a high school diploma or GED certificate. He has been taking basic skills education in the evenings at a nearby community college, trying to raise his literacy skills for PFK. By the time the PFK system went into effect, Daryl had certified 23 skills, including all of the target literacy skills except SPC I. He took the Shop Math course and certification test twice, finally passing Shop Math. He now has 24 certified skills, raising his PFK wage on paper to $11.20/hr. Daryl is still "skills short," however, and continues with education and training activities to raise his skill level up to and eventually beyond his current pay, set under the pre-PFK compensation system.

• Dale, who is in his 40s, has worked at Hardy for more than 10 years, primarily as a machine operator. Because of an early childhood head injury, Dale never went to school, and his literacy skills were not well developed by the time he arrived at Hardy. Although he had been a productive employee, the many changes taking place at Hardy (e.g., the transition to self-managing teams, the advent of PFK) posed major challenges for Dale. He prepared for PFK through a combination of courses and training offered on-site at Hardy and off-site at local community colleges. Dale had certified 21 PFK skills by the time the new compensation system was phased into operation, but none of the four target literacy skills. He has participated in basic skills classes during the ensuing year, however, and has made considerable progress developing his literacy skills. By the end of the year, he had passed only one of these four target literacy skills (SPC I). Although he had taken the Blueprint Reading class, he did not pass the certification test. Since Dale's PFK wage "on paper" is still below his pay rate under the traditional compensation system, he is among the "skills short" at Hardy.

CONCLUSIONS

This study of the manufacturing/assembly workers at Hardy Industries provides clear evidence that direct monetary incentives stimulate participation in formal training and the development of a wide variety of skills in the workforce. Observed skill development cuts across a wide variety of functional areas and levels of complexity. Workplace literacy skills—such as blueprint reading, gauge reading, shop math, and statistical process control—respond strongly to these incentives.

Despite the fact that the PFK incentives result in increases in both training participation and skill development, the evidence from this study indicates that formal training is only one factor underlying the growth of functional literacy skills. Although this particular study provides no direct evidence of which other learning processes might have contributed to the observed development, previous research at Hardy has identified a rich variety of informal teaching and learning processes active in everyday work activities (Hart-Landsberg & Reder, 1993). Further research should be able to tell us more about the ways in which these informal processes respond specifically to the PFK incentives and other organizational changes taking place at Hardy Industries. This knowledge should inform the design of more effective workplaces, ones in which all workers have ample opportunities to develop the skills and knowledge valued and needed by their company.

As the four brief biographical sketches presented here illustrate, individuals from a broad range of backgrounds respond positively to the PFK incentives, participating in basic skills education and training, developing new workplace literacy and technical skills, and increasing their wages as a result.[14] Although many individuals do use "challenge tests" (i.e., certification tests taken without first taking the corresponding formal training course) to gain PFK certification for a given skill, most workers first take formally offered courses to acquire sufficient skill and knowledge to pass the certification test.

It is important to emphasize that the development of workers' skills and knowledge at Hardy went hand-in-hand with the advancement of their earnings. Workers were indeed learning-to-earn. The combined financial incentives and ample opportunities to learn are evidently a potent mix for stimulating the growth of workplace literacy and other job-linked skills and knowledge.

But neither the high performance organization model nor the PFK compensation system being innovated at Hardy should be viewed as a panacea for the development of the workplace or the literacy skills of the workforce. Although such innovations can be effective tools for the development of human resources and organizations (as they have been at Hardy), the findings of this study should not be construed as a blanket endorsement of any particular organizational model or compensation system. Indeed, there are many complex organizational and social issues underlying the changes taking place at Hardy (Hart-Landsberg & Reder, 1993). What the findings of this study do strongly indicate is the considerable promise of direct incentives for stimulating the development of work-based learning and literacy. ■

FOOTNOTES

[1]The company name and the names of all individuals are pseudonyms.

[2]The pseudonym Handy rather than Hardy was used by Reder et al. in their 1991 publication.

[3]The company's name has been changed to Hardy throughout these materials.

[4]Adapted from Hardy materials.

[5]Some skills within a skill block can be certified several times, once for each applicable machine or technology (e.g., "Operate and Set Up - Class A Machine" in Skill Block 1 can be certified for up to three different [from a long list of] machines).

[6]At the present time, manufacturing/assembly workers must also meet an educational requirement to receive more than $15.50/hour under Hardy's PFK system. The requirement is a two-year or four-year college degree; those not having a degree must file a plan to obtain and demonstrate progress (e.g., so many credit/year) in order to receive more than $15.50/hour. The particular dollar threshold was determined in relation to the maximum that manufacturing/assembly workers could make in other local companies without having a degree.

[7]When PFK compensation first took effect (November 1992), the grandfathering of traditional pay was to be in effect only for three years, after which everyone would receive PFK-determined rates of pay. During the ensuing year, the grandfathering was made permanent.

[8]These skills also occur in the Skill Blocks for other categories of workers, such as Tool and Die, Tool Grinders, Maintenance and Technicians.

[9]Certification of Gauge Reading also requires passing a hands-on demonstration with the measuring instruments used at Hardy.

[10]Two of the 185 M/A workers had partially missing data, so these tables are based on N=183.

[11]The PFK value of the skills is merely "pay on paper" (i.e., it does not replace the wage paid at Time 1, just before the PFK rates went into effect, nor at Time 2 is it what the "skills short" are paid, i.e., those whose PFK wages on paper are less than their grandfathered pre-PFK wage rates).

[12]The availability of training and training participation data prior to the introduction of PFK is not comparable with that availability afterwards, making it difficult to determine the overall impact of PFK on participation. Qualitative data collected in an earlier period at Hardy, however, indicate that many individuals increased their participation in training programs because of the emerging PFK system (Hart-Landsberg & Reder, 1993, in press).

[13]All names used are pseudonyms. Ages and job tenure are reported only in general ranges to preserve anonymity.

[14]This diversity was not fully captured in the four individual thumbnail sketches, in which some individual details (e.g., ethnicity) were suppressed to preserve confidentiality.

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