5-31-1996

Evaluating the Effects of a Peer Training System on the Subsequent Performance of New Employees

Dariush Khaleghi
Portland State University

Recommended Citation
Khaleghi, Dariush, "Evaluating the Effects of a Peer Training System on the Subsequent Performance of New Employees" (1996). *Dissertations and Theses.* Paper 5325.
https://doi.org/10.15760/etd.7198

THESIS APPROVAL

The abstract and thesis of Dariush Khaleghi for the Master of Science in Psychology presented May 31, 1996, and accepted by the thesis committee and the department.

COMMITTEE APPROVALS:

[redacted]
Leslie Hammer, Co-Chair

[redacted]
Donald Truxillo, Co-Chair

[redacted]
Ellen Skinner

[redacted]
Talya Bauer
Representative of the Office of Graduate Studies

DEPARTMENT APPROVAL:

[redacted]
Roger Jennings, Chair
Department of Psychology

* *

ACCEPTED FOR PORTLAND STATE UNIVERSITY BY THE LIBRARY

by [redacted] on 26 February 1997

ABSTRACT

An abstract of the thesis of Dariush Khaleghi for the Master of Science in Psychology presented May 31, 1996.

Title: Evaluating the Effects of a Peer Training System on the Subsequent Performance of New Employees.

Peer training is one of the most recent training methods identified. Some anecdotal studies claim that peer training is successful, however, there is no empirical data to support such claims.

The purpose of this study was to conduct an empirical evaluation of a Peer Training System (PTS) in a manufacturing environment. Effects of the PTS on reaction, behavior, and results criteria described by Kirpatrick (1959) were explored. The PTS group was compared to a control group that did not receive any systematic training. It was hypothesized that the PTS trainees would obtain higher ratings on four dimensions of performance (operation, technical, training, and teamwork) than the control group, based on ratings from their supervisors, peers, and themselves. This study also sought to explore the trainee reactions to the type of training they received, and attempted to explore whether receiving the PTS accelerated the trainees' job status from temporary or contractor status to regular status.

Forty employees working for a manufacturer of personal computers participated in the study (20 in each, the control and the PTS groups). Participants were selected on the basis of their hire date and matched based on their technical experience, technical or college education, and initial interview results at the time of hire.

The data were analyzed using separate multivariate analysis of variance and analysis of variance. Results did not indicate any significant differences on any of the four dimensions of performance or overall performance between the control and the PTS groups. Focus groups revealed that the PTS group was more satisfied with their training program as compared to the control group. The employment status of the two groups was not able to be compared. Overall, the results did not support previous anecdotal work claiming that peer training is more effective than classical on-the-job training.

Conclusions were drawn that peer training was not effective in improving employee on-the-job performance compared with non-PTS training. The reaction of the new employees to the PTS, however, was positive. In addition, Peer training can be used as a low-cost, just-in-time, and flexible technique to meet the demands of the competitive world markets.

EVALUATING THE EFFECTS OF A PEER TRAINING SYSTEM ON THE SUBSEQUENT PERFORMANCE OF NEW EMPLOYEES

by

DARIUSH KHALEGHI

A thesis submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE
in
PSYCHOLOGY

Portland State University
1997

Evaluating the Effects of a Peer Training System on the Subsequent Performance of New Employees

Many of today's jobs require basic reading comprehension, math, and science, particularly in the high-tech industries where working with manuals (e.g., operation and safety specifications) and documents (e.g., quality indicators and charts) is a part of most jobs. With advances in technologies and rapid obsolescence of existing skills there is a marked technical skill and knowledge deficiency among employees in many industries. Such, general skill and knowledge deficiencies will lead to higher cost for the individual employee, the company, and the economy by lowering the competitive power of the industries in the world markets.

To tackle the problems of unskilled labor and to maximize individual worker potential, specifically, in high-tech industries, many instructional methods and training techniques are being used by companies. On-the-job training, lecture method, programmed instruction (i.e., self-instructional materials and automated teaching machines), computer-assisted instruction (i.e., tutorial programs), audiovisual techniques, machine simulation, and team training are some common training practices (Goldstein, 1993). Historically, on-the-job training has been the primary method used to create and sustain a skilled technical

work force (Spencer, 1983). As the degree of sophistication and complexity of production systems, especially in technical and manufacturing industries increases rapidly, there is more focus on customized training strategies that incorporate more structured on-the-job industry-specific content to the training (Duvall, 1983; Rumberger, 1981). Peer training, which is a more recent form of OJT, is the focus of this study.

Training as summarized by Goldstein (1993) is, "the systematic acquisition of skills, rules, concepts, or attitudes that result in improved performance in another environment" (p. 3). Latham (1988) states that the ultimate objective of any training system is to enhance and change the attitudes, knowledge, and skills of trainees, resulting in more adequate performance of a task or a job. To enhance the skills and competency levels of employees, emphasis must be applied to either on-the-job training methods, off-site instructional methods, or a combination of both. In cases where training is delivered on-the-job, the learning environment is closely associated with the actual job situation. In classroom settings, however, training is delivered far from the working environment (Goldstein, 1993). In either case, the purpose of any training system is a systematic transfer of the desired skills and behaviors from the learning environment to the actual job setting.

Training either in a classroom or on the job is expensive and time-consuming. Many companies hire outside consultants to design and deliver training for their organizations. The recent increase in the number of external training companies shows that training is evolving into a large and profitable industry (Gordon, 1988). Recent studies demonstrate that among the Fortune 500 companies, 91 percent of the companies were delivering training to middle managers, 75 percent to sales associates, 56 percent to secretarial and administrative staff, 51 percent to executives and top managers, and 44 percent to technical operators (Ralphs & Stephen, 1986). Other research on training has found that most companies that have more than 1,000 employees offer at least some type of management training program (Saari, Johnson, McLaughlin, & Zimmerle, 1988.) In the coming decade, therefore, it is expected that employee training and development will continue to become a top priority for many companies (Goldstein, 1991; Milkovich & Boudreau, 1991). Furthermore, our work environments are changing so rapidly that employees have to constantly either retrain themselves or be retrained by companies to keep their current employment or to advance to new jobs (Hodson, Hooks, & Rieble, 1992).

On-the-Job Training

Goldstein (1993) states that nearly all trainees experience some type of on-the-job training (OJT). He reports that in most companies the standard or classical on-the-job training is used. In classical or standard OJT, trainees work in the real job environment where they observe and learn from an experienced worker. Standard OJT has always been critical in creating and sustaining a skilled work force (Spencer, 1983). Denison (1984) reports that standard OJT has been responsible for 55% of the improvements in labor productivity compared to 26% for re-employment schooling between 1929 and 1982.

According to Filipczak (1993), in standard OJT a new trainee would be assigned to a task under the supervision of a senior operator of that task. The new trainee has to observe and follow the instructions of the senior operator and learn through trial and error. The advantages of standard OJT are that the transfer setting is the training setting and the trainee can practice the exact required tasks (Goldstein, 1993). However, Filipczak indicates that there are some key disadvantages that are involved in the process of standard OJT. First, it is expected that the trainee must learn by mere observation, verbal feedback, and guess work. Second, it is expected that a skilled worker is a skilled trainer, which may

not be true. Third, it is expected that a trainer must produce and train simultaneously. This can lessen the effectiveness of a peer as a trainer due to the lack of time and focus. This condition can hurt both the production and the training and may create an environment not conducive either to training or learning. Fourth, it is expected that training will be successful; when the training is not successful, the trainee is to blame. Fifth, in the case where a company is growing rapidly, standard OJT cannot respond to the rapid expansion, because the company's demand for both training and output will increase for the trainer. The final and greatest disadvantage of classical OJT is the possibility that a trainee can learn unfavorable behaviors from the trainer due to the lack of a standardized training system. A trainer, on the other hand, may feel that the entire training process has been imposed on him or her (Filipczak, 1993).

Goldstein (1993) also asserts that although standard OJT is one of the most widely used training methods and although OJT appears to work, it is usually unsuccessful when it is not clearly defined to serve specific training objectives. The demand for objective skills training, as a result, increases when new technologies and methods of manufacturing develop rapidly (Chamot & Baggett, 1979). According to Kelley (1989), "the

capacity to exploit a new technology depends in reality on the technological know-how and versatility of the workers who are expected to use that equipment" (p. 303). As technologies advance rapidly and industries become more sophisticated and skill intensive, organizations that use OJT more systematically (Harper, 1987) can increase their ability to compete in the world markets substantially (Kusterer, 1987).

Peer training is an emerging systematic approach to OJT. The objective of this training method is to utilize expert peers as trainers where their primary function is to train. Contrary to the classical OJT, peer trainers usually do not produce while they are training. Therefore, training takes priority over production (Filipczak, 1993). In contrast, Goldstein (1993) states that most OJT programs are not planned and peers are utilized as trainers because it is cheap and easy to implement, lacking an instructional foundation. As a result, OJT training programs (e.g., peer training) must consider the effectiveness of these training methods to ensure transfer of expected skills and behaviors to the real job environment (Duvall, 1983; Rumberger, 1981).

Fredericksen, Meyers, and Riley (1986) asserted that structured OJT methods such as peer training should involve training and learning processes with set objectives and specific planning. Filipczak (1993) stated

that, for instance, the peers involved in peer training should be selected based on certain skill and competency criteria, on previous successful performance, and on their supervisors' recommendation. After the selection process, there should be curriculum courses that the peer trainers must accomplish before they are certified to train. He adds that some of these courses should focus on adult learning behaviors, effective listening, effective communication, and facilitation skills. Peer trainers should also attend training courses that focus on training skills and behavioral role modeling aspects of training (Filipczak, 1993).

This vastly increasing demand for competent and skilled workers has forced companies to try new methods of training. Peer training is one of the latest of these attempts. Although there are some anecdotal reviews reporting success of this new method, there has been no systematic empirical research conducted to evaluate such claims. Therefore, the purpose of this study is to evaluate the effectiveness of a peer training system (PTS) as a training method in a high-tech manufacturing environment.

Training Evaluation

Despite the tremendous amount of advancement in the development of training methods by most companies, evaluations of training program

effectiveness have been rare (Goldstein, 1991). Developments and progress in training programs and methods do not guarantee any real change in the skill level, knowledge, and abilities of the trainee if the program lacks a thorough evaluation process. Latham (1988) asserts that in order to insure that the training objectives of a training program have been achieved, the training program must consider the evaluation of the effectiveness of that program. He adds that the evaluation must focus on measuring changes in the observable performance of the trainees once the training has taken place. By measuring changes in performance, the organization can verify that the training has been successful in achieving the training objectives.

Goldstein (1993), however, reports that most research studies in training evaluation have focused on trainee reaction to the training rather than on evaluating subsequent behavior and performance of the trainee in the real job environment. He alleges that over 90% of evaluations performed in organizations focus only on trainee reaction to the training programs rather than on evaluating whether the transfer of skills has taken place and whether on-the-job performance of the individual trainee has been enhanced. Lack of management emphasis on training, lack of proper skill to conduct evaluation, confusion of training personnel about

the purpose and procedure of a training evaluation, and fears of failure of a training program by training staff have constituted the obstacles to training evaluations (Goldstein, 1993).

To measure the effectiveness of a training program, Goldstein (1993) suggests that a set of learning objectives, based on the needs assessment, must be determined to achieve the desired training goals. This set of learning objectives has to meet certain levels of training criteria to be effective (Goldstein, 1993). These levels of training criteria have been delineated by Kirkpatrick (1959).

Kirkpatrick (1959) categorizes the four levels of training criteria (reaction, learning, behavior, and results) that a training evaluation must consider to meet the organizational learning objectives. According to Kirkpatrick (1959), employee reaction can be determined by evaluating what employees think of a specific training program. Learning, the second level of criteria, is the goal and objective of any training program and must be measured by a quantifiable method. At the third level, behavior, Kirkpatrick suggests that an evaluation of the trainee's on-the-job behavior must take place to assess whether the transfer of skills and learning from the training environment to the actual job setting has occurred. In the end, he concludes that training programs should assess

the impact of training on the overall organizational objectives (results), the fourth level of training criteria. This level emphasizes that training results must consider the effects of training on organizational goals such as reducing costs, enhancing quality, increasing productivity, lowering turnover, increasing job satisfaction, and enhancing the overall well being of the organization (Kirkpatrick, 1959). A systematic evaluation of a training method based on these levels of training criteria, therefore, allows for better decisions in planning, selection, and implementation. This systematic approach also helps training organizations to modify their training programs just in time, increasing the impact of training on the overall organizational objectives and output through adequate training (Tannenbaum & Yukl, 1993).

The present study will explore the effectiveness of a Peer Training System (PTS) which is a form of on-the-job peer training, using reaction, behavior, and results criteria. A PTS has been implemented in a manufacturing environment to enhance the trainee reaction, trainee on-the-job performance, and organizational outcomes.

Published literature on peer training presumes positive outcomes and benefits of this method of training by presenting mostly anecdotal evidence of its effectiveness. For example, Fredericksen et al. (1986)

claimed that peer training has been a very successful method for some insurance companies in transforming a traditional paper-processing assembly into an efficient, effective, and integrated unit. One insurance company used peer training by creating 6-person work groups who learned to do all the jobs for which the team was responsible. The employees then went back and trained other peers. The authors claim that the objectives of peer training of achieving 100% performance level, motivating peers to cross-train, developing "How-to-train" courses, and relying on actual skills practice were successfully met. These authors also believed that transforming a traditional training program into a peer training program helps in developing an efficient and integrated unit, simplifies introduction of new products, and offers employees a more rewarding and satisfying job experience (Fredericksen et al., 1986).

Heise (1990) also claims that decentralizing the information system and encouraging peer training in a worldwide manufacturer of electronic components resulted in savings of about $3 million the same year and a projection of a doubling in savings for the year after. He reported that the company obtained an IS (information systems) needs assessment for each business unit. Project plans were designed for each plant. Project teams including IS employees and computer users were created and were

provided with 2-weeks of training by contracted trainers. Encouraging project teams to train peers after the training period was completed enabled the company to decrease costs and increase savings.

Obenshain (1992) reports that 1,500 members of a company's sales force were able to use peer training and learn how to use new laptop computers in just five weeks, leading to a 25% increase in sales in that year. She noted that the company developed a 21-member task force, consisting of MIS (Management of Information Systems) and marketing professionals that spent six months researching and selecting a specific brand of laptop computer. The team then developed a customized software to accompany the hardware. Afterwards, the team used laptop computers to train their co-workers in the use of the new technology (laptop and software) when making sales calls. Obenshain claims that the high training capability of peer training, in training the new technology to the sales force, resulted in continuous increases of sales. In the end, Obenshain (1992) concludes that the key underlying success of the peer training is that, working together, peers can achieve reasonable goals in just about any time.

To summarize, Adkins (1994) reports that some of the advantages of peer training include: 1) creating a just-in-time training system, 2)

reducing training and development time, 3) offering the employees the opportunity to learn and to gain experience, and 4) capitalizing on the technical and skills of the employees of the organization. Rickett (1993) adds that, "The genius of peer training as an instructional method is that it mirrors the way people actually learn in the workplace" (p. 72). He reports that when in need of training, people in reality are apprehensive about using manuals and self-instructional books; they prefer to use their fellow peers as a source of learning. Peers usually present a non-threatening source of information as opposed to managers and supervisors or even instructors and formal trainers. "Peer training is not a superficial teaching method: people learn what they need when they need it. Peer training provides timely help to learners in the workplace because it matches the flow of work requirements" (Rickett, 1993, p. 72). Rickett concludes that the market's constant change, the high rate of turnover, the influx of new hires, the constant upgrade of software and hardware, and the demand for continuous improvement in a high tech environment makes peer training the most appealing choice.

Peer Training System in the Present Study

In the present study, the effectiveness of a peer training program, referred to as Peer Training System (PTS), will be evaluated in a high-tech

company. PTS is a specialized and improved version of peer training. PTS has been developed and implemented by this company to take advantage of expert and dedicated peers (peers whose primary function is to train) in the training of new employees. PTS integrates a simulation environment and the training process to reinforce the instructional basis that is lacking in other OJT techniques. The training usually takes place in a training environment with similar characteristics to the real work setting. For instance, if there are eight assembly lines in a factory floor, two of them may constitute the training lines. In training lines the same activities such as assembling, testing, and quality inspection take place but there is no production. In this study, PTS focuses on achieving skills and behaviors tailored to the needs of the organization in the short run. It also emphasizes the development of the peer trainers' skills and competencies in the long run. In this study, PTS is thought to be effective because it utilizes existing high-performing peers to do the training, retraining, and cross training in a setting that stimulates the real job environment free of pressure of production. PTS uses extensive resources and requires considerable planning. It has been designed to possess a strong instructional foundation completely conducive to both training and learning.

Tannenbaum and Yukl (1992) have developed guidelines for an effective training program with an emphasis on the training environment. The PTS explored in this study is presumed to meet these guidelines. These guidelines are as follows:

1. The training method should be congruent with cognitive, physical, or psychomotor processes that guide the trainee to the most effective retention of information in the memory, that is to achieve mastery of that task (Tannenbaum & Yukl, 1992). In this study, PTS provides such an environment with simulation assembly lines (lines that emulate the real assembly lines closely) for practice and mastery and dedicated peer trainers who are expert in the field and in training skills.

2. The learner should practice, recall, and apply the task frequently for retention and transfer purposes (Tannenbaum & Yukl, 1992). In this study, PTS provides simulation assembly lines that offer all the necessary opportunities for the trainees to practice sufficiently, utilizing job-specific information to learn and retain.

3. The trainee must be given constructive, relevant, precise, and immediate feedback (Tannenbaum & Yukl, 1992). In this study, PTS creates the ideal environment for feedback since highly skilled peers are

present at all times to deliver constructive, relevant, precise, and immediate feedback.

4. The training method must increase the self-efficacy of the trainees (trainee's perception of what they can do with the skills they learn) and increase their expectations of positive outcomes (Tannenbaum & Yukl, 1992). In this study, training is initiated with small and simple steps that lead to more complex and sophisticated processes in PTS, insuring the enhancement of trainee's self-efficacy and his or her positive outcome expectancy.

5. An effective training method has to take into consideration the different knowledge, job skills, capacity, potential and aptitude levels of trainees (Tannenbaum & Yukl, 1992). In PTS, peer trainers attend courses to learn about individual differences in learning styles and are taught to take them into account when training.

In addition to the guidelines mentioned above, Berets and Thompsett (1992) have emphasized that environmental conditions can enhance learning and retention or adversely affect it by hampering this process. They have identified punishment, fear of failure, boredom, and anxiety as obstacles to learning and retention. They claim that most educational institutions and organizations have created environments that

promote barriers to learning. In this study, PTS eliminates many obstacles to learning. Barriers such as punishment, fear of failure, and anxiety will be minimal when the learning occurs in a simulated work setting that encourages the trainees to practice without worrying about failure or punishment. The non-threatening work environment that is taught by peers, instead of mangers or instructors, can also lower the fear and anxiety levels. Trainees are free to ask questions whenever necessary and interact with one another without fear of being judged as incompetent by their peers whose job is to train.

Filipczak (1993), Fredericksen et al. (1986), Heise (1990), and Obenshain (1992), in their anecdotal reviews, reported that peer training has been a very successful training technique. Virtually no systematic empirical study, however, has examined the effectiveness of peer training.

The Present Study

The goal of this research was to conduct an empirical evaluation of a PTS in a high-tech manufacturing environment. The objective of this training program was to train and certify peer trainers and utilize them in three levels of training. At the first level, expert peers were certified to operate and to teach all operations in manufacturing. In addition, they attended courses to learn how to use effective communication, problem

solving, and conflict resolution skills to appropriately develop newly-hired trainees' skills and knowledge and to successfully certify the trainees at the end of the new-hire training period. The main function of peer trainers at this level was to train and certify new hires.

At the second level, peer trainers were certified to perform and teach the factory processes and procedures, to troubleshoot the equipment, to teach factory courses (e.g., safety, quality, and testing PC software), to tailor and adjust the training for different learning styles, and to develop training packages (e.g., one-on-one and small group training lessons). This level usually takes an average of one to two years to accomplish because it requires a great deal of training and development.

After finishing the second level, peer trainers are certified to go to the manufacturing lines and retrain and cross train senior operators. At the third level, expert peers are certified to teach at all stations in the factory, identify multi-functional problems and assume responsibility for the resolution, and organize PTS while facilitating the team development towards long-range organizational objectives. At this level, peer trainers are considered training specialists and, in addition to the level 1 and 2 duties, can identify and train new peer trainers. In this study, PTS was newly implemented and peer trainers had begun their new roles as peer

trainers recently. However, peer trainers were currently certified to train only new hires, thus, only level 1 of PTS was evaluated.

In the present study, subjects were assigned to either a control (classical OJT) or an experimental (PTS) group and their performance was rated by three different sources (supervisor, peers, and participants themselves). The analyses compared posttest mean rating scores by the employee's peers, supervisor, and employees themselves on ratings of four dimensions of performance (operations, technical, training, and teamwork) to determine whether any significant difference existed between the PTS and the control groups.

The control group included employees who had been hired and received standard OJT six months prior to the implementation of PTS. The experimental group was the first group of employees in the company who received PTS. Thus, this study constituted a quasi-experiment in which subjects could not be randomly assigned to conditions. However, both groups had been hired based on the same criteria: job experience (no technical experience), education (no technical education or degree higher than high school diploma), and results from initial interviews. Thus, both groups had been matched to some degree, making the results interpretable and causal inferences possible to some extent despite the lack of pretest

scores (Cook & Campbell, 1976). The disadvantage of this design was the absence of pretest scores.

Research Questions

Filipczak (1993), Fredericksen et al. (1986), Heise (1990), and Obenshain (1992), in their anecdotal reviews, present some of the advantages of peer training over other OJT methods. They claim that peer training has achieved successful results for the companies that implemented this method.

Accordingly, the present study examined the PTS in terms of its effects on training outcomes. In particular, effects on reaction, behavior, and results criteria described by Kirkpatrick (1959) were explored. At the behavior level, it was hypothesized that employees who had received PTS would obtain higher ratings than the control group on four dimensions of performance (operations, technical, training, and teamwork).

In addition, to measure reaction criteria, informal focus groups of five employees for both PTS and control groups were formed. Group discussions on the levels of employee satisfaction with the type of training received, levels of perceived learning, on-the job behavior change, and the levels of skills transferred, were conducted. This study attempted to explore the advantages and disadvantages of both training methods, as

well as whether the PTS group had a more favorable reaction to the training as compared to the control group.

To measure results criteria, PTS and the control group were compared in terms of their current job status (temporary, contractor, or regular employee). All employees were hired through a temporary agency; therefore, their status was temporary, and they were not considered direct employees of the company. This temporary assignment would have changed to a contractor employee status within six months, normally, if the employee met the performance requirements of the company. Then, the contractor employees would have stayed contractors for an additional six months before their status changed to a regular company employee upon meeting the performance expectations of the organization. Even though the normal period for evaluation and change of status to a regular employee was a minimum of six months, a high-performing employee may have received offers of contract or full-time employee status at a much faster rate. Employment data for the PTS and the control groups were compared to explore whether they had been promoted to a contractor or regular employee status within the first six months of their employment. It was hypothesized that the PTS group would receive offers of contract or regular employee status faster than the control group.

This study explored the effectiveness of PTS: (1) by comparing the experimental and control groups on the four dimensions of performance (technical, operations, training, and teamwork) measured by the company's performance appraisal system; (2) by comparing qualitative data from the informal focus groups to explore the employee reactions to the training process; and (3) by comparing the participants' employment status to determine the impact of the training method on the organization. This study constituted the foundation for future empirical studies on this topic.

Method

Participants and Procedure

Participants were 40 current employees working for a computer systems production division of a high technology corporation. Participants were selected on the basis of the date that they started their current position in the company (i.e., their hire date). The 40 participants were the only employees who were hired for the months selected for the study; six months before and six months after the implementation of PTS. The participants, therefore, were not randomly selected (their selection was based on the available number of new hires for this study's time line.) The control group was composed of 20 employees whose hire date was October,

1994. The control group was assigned to the assembly lines at the time of hire and received standard OJT from a senior employee and no additional training. Six months after hire, the control group was rated by peers, supervisors, and themselves on the company's performance appraisal system, using the organization's standard Skills Evaluation Form (SEF). The experimental group consisted of 20 employees whose date of hire was April, 1995. Training of the experimental group took place on designated training lines for the duration of two weeks by peer trainers before they were released to the assembly lines. They received training on how to read safety, quality, and assembly documents and practiced hands-on assembly of the same products that would be built on the real assembly lines. Hiring criteria such as job experience (no technical experience), education (no technical education or degree higher than high school diploma), and results of the initial interviews at the time of hire were the same for both the control and the PTS groups.

To evaluate the reaction criteria, focus groups were conducted at the same time for both groups which occured eight months after the PTS group was hired. Focus groups for the control and the PTS groups, therefore, were conducted at 14 months and 8 months, respectively, after their hire date due to the fact that there was a six month time lag between

evaluation of the control group and the PTS group. The evaluation at the behavioral criteria level of the PTS and the control group took place six months after they were hired (see Figure 1). To evaluate the results criteria, the current job status (temporary, contractor, or regular) of both the PTS and the control group were compared six months after they were hired by the company, using employees' personnel files.

Measures

A standard organizational performance evaluation form, "Skills Evaluation Form" (SEF), was used to measure the performance of the participants on four different dimensions: operation, technical, teamwork, and training. SEFs were developed using a company-wide manufacturing job analysis as well as manufacturing technician competency matrix commonly used for annual performance appraisals by management. There were a number of competencies within each performance dimension. Furthermore, SEFs included specific criteria that defined each competency to provide a more objective measure of the competencies (see Appendix A). The technical and operations dimensions included seven competencies, the training dimension included ten competencies, and teamwork dimension included eleven competencies. Raters responded on a 3-point-scale: 1= "does not demonstrate the skill," to 3= "consistently and reliably

demonstrates the skill" for each competency within each performance dimension. The SEFs were rated by five peers, a supervisor, and the employees themselves. For the five peer ratings, the average of the five was calculated.

The reliability coefficient $\underline{\alpha}$ of the SEFs on the four performance dimensions for supervisors were calculated as $\underline{\alpha}$ (operation) = .85, $\underline{\alpha}$ (technical) = .83, $\underline{\alpha}$ (training) = .88, and $\underline{\alpha}$ (teamwork) = .92; for peers were calculated as $\underline{\alpha}$ (operation) = .65, $\underline{\alpha}$ (technical) = .71, $\underline{\alpha}$ (training) = .61, and $\underline{\alpha}$ (teamwork) = .63; and for the participants themselves were calculated as $\underline{\alpha}$ (operation) = .58, $\underline{\alpha}$ (technical) = .62, $\underline{\alpha}$ (training) = .75, and $\underline{\alpha}$ (teamwork) = .80, showing adequate reliability of measurement only for supervisory rating with all alphs greater than .70. The reliability coefficient on the overall performance (four dimensions of performance were collapsed into one dimension) for supervisors was calculated as $\underline{\alpha}$ = .94. Due to the low reliability coefficients ($\underline{\alpha}$s) for peer and self ratings, these ratings were eliminated from the analyses. Efforts to raise the reliability coefficients for peer and self ratings were unsuccessful. As a result, only supervisory ratings on the four dimensions of performance and the overall performance for the control and the experimental groups were compared in this study.

To evaluate and explore reaction criteria, informal focus groups of five employees each from both the PTS and the control groups were held. To conduct more structured discussions and receive more objective qualitative data, a set of pre-written questions was presented to the groups (see Appendix B). Due to strict organizational policies, the use of a tape recorder was prohibited in recording the actual discussions in the focus groups. Notes from the discussions in the focus groups were recorded.

Results

Analyses

To answer the research question regarding the effects of PTS on the subsequent performance of new employees, a correlation matrix of the four dimensions of performance for the supervisory ratings was calculated. This correlation matrix measured the intercorrelation among the four dimensions of performance (technical, operations, training, and teamwork) for supervisors. The correlation matrix indicated that the four dimensions of performance were highly intercorrelated (see Table 1). One-way multivariate analysis of variance (MANOVA), therefore, was conducted. These analyses tested the difference between PTS and control groups on the four different dimensions of performance (operation, technical,

training, and teamwork) for supervisors. Using MANOVA, it could be determined whether any of the dimensions of performance would differentiate the PTS and the control group more than others. In these analyses, the independent variable was the training groups (control and PTS). The four dependent variables were the four dimensions of performance (operations, technical, training, and teamwork). The use of four different dimensions of performance measures was to test whether the dimensions of performance were relatively independent measures of performance.

The high intercorrelation of the four dimensions of performance for the supervisory ratings suggested that the four dimensions of performance were measuring the same variable. As a result, the four dimensions of performance were collapsed into one variable, overall performance. A one-way analysis of variance (ANOVA), therefore, was conducted to further test the difference between PTS and control groups on their overall performance. In this analysis, the independent variable was the training groups (control and PTS). The overall performance constituted the dependent variable.

To evaluate employee reactions to the training process, focus groups of five employees from both the experimental and the control groups were

conducted. Overall focus groups explored the advantages and the disadvantages of both the PTS and the OJT training methods. In addition, possible training alternatives were discussed. To assess the impact of PTS at the organizational results level, the employment status of employees (temporary, contractor, or regular company employment) in both groups was compared, using a $\chi 2$ statistic.

Behavior Criteria

Means and standard deviations of supervisory ratings for each training condition and performance dimension are summarized in Table 2. In all four performance dimensions, the PTS group received higher mean ratings compared to the control group (see Table 2).

To measure the behavior criteria and to answer the first research question, whether receiving PTS affected the subsequent performance of the new employees on the four dimensions of performance, a one-way multivariate analysis of variance was conducted. The training condition (control or PTS) was the independent variable and the four dimensions of performance constituted the dependent variables. The significance level for this statistical test was set at .05. MANOVA was used to examine whether there were any significant differences between the supervisory ratings for the control and the PTS groups on any of the four dimensions of

performance. The results revealed that there were not any significant differences between the supervisory ratings for the control and the PTS groups on any of the dimensions of performance (see Table 3). The PTS group did not receive significantly higher ratings by the supervisors on any of the dimensions in comparison to the control group.

The effect sizes for the training condition on the four performance dimensions were calculated in the MANOVA analyses as follows: operations ($\underline{R}^2 = .067$), technical ($\underline{R}^2 = .034$), training ($\underline{R}^2 = .046$), and teamwork ($\underline{R}^2 = .074$). The training condition apparently had slightly more effect on the teamwork dimension of performance, but not considerable enough to be significant. The observed low statistical power ($1-\beta = .23$) of this analysis was not surprising due to the small sample size in this study and may explain why these result did not achieve statistical significance. The univariate and multivariate tests of homogeneity of the variance for the training condition were also not significant.

Because no significant effect for the supervisory ratings on any of the four dimensions of performance were found, and because the intercorrelations among the four dimensions of performance were high for the supervisory ratings, the four dimensions of performance (technical, operations, training, and teamwork) were collapsed into one dimension

(overall performance). Therefore, a one-way analysis of variance (ANOVA) was conducted to further explore the effects of training. The training condition (control or PTS) constituted the independent variable and the overall performance constituted the dependent variable. The significance level for this statistical test was set at .05. The results did not indicate any significant difference between the two groups on overall performance (see Table 4). The supervisors rated both the control and the PTS groups similarly and did not distinguish the groups on their overall performance.

It was also found that the training condition had a slight effect on the overall performance dimension ($R^2 = .065$). This effect size is not so surprising, considering that the control group was not really a non-trained group; the control group actually received some training from senior peers while working on the assembly lines. The observed low statistical power ($1-\beta = .355$) of this analysis, due to the small sample size in this study, limited the chances of finding statistically significant results.

Reaction Criteria

To evaluate and explore reaction criteria, informal focus groups for both the PTS and the control groups were held. Notes form the discussions in the focus groups were recorded. The aggregated results of

the focus groups have been summarized in Table 5 for the PTS group and in Table 6 for the control group.

The results of the focus groups indicated that the PTS group reacted to this method of training more favorably even after months of working on the job. Overall, trainees who received PTS were more satisfied with their training program. They felt that working with their peers positively affected their performance. They were able to practice and gain mastery of operations and to transfer their learnings to the real job situation. They also felt that having a non-threatening peer as trainer facilitated their learning by lessening their anxiety and stress level, consistent with the findings of Bertz and Thompsett (1992) that have emphasized anxiety, stress, and fear of failure as the main components hampering learning processes.

The PTS group also reported that their familiarity with the documents and procedures helped them to excel in their learning on the real job. For instance, by reviewing the manuals and procedures they could learn new operations on their own. They felt that as team members on the job they participated in more team oriented activities because of their initial training in groups. The reports are consistent with

Obenshain's (1992) findings that peers cooperating as a team could accomplish reasonable goals in a short period of time.

Overall, the PTS group was satisfied with PTS. To minimize the PTS disadvantages, the PTS group suggested that the operators on the lines and supervisors be educated about the PTS and its content. This would reduce their peers' and supervisors' exaggerated expectations from the new trainees. The control group was dissatisfied with their training program and recommended the need for a more systematic approach to training.

Results Criteria

Due to the changes in organizational policies, most temporary employees in the PTS group had received contractor status after three months of their employment. This policy was inconsistent with the policy used for the control group, which had to receive the contractor status based on their performance evaluations. Therefore, the number of employees who have received contractor or regular, full-time status within the first six months of their employment was no longer an appropriate basis for comparison. Due to these changes in organizational polices for converting temporary and contract employees to regular, full-time

employee status for the experimental group, collecting data and conducting $\chi 2$ analyses were not possible for result criteria.

Discussion

The purpose of this study was to investigate the effects of a PTS on the subsequent performance of new employees in a high-tech manufacturing environment. The PTS in terms of its effects on training outcomes, specifically, effects on reaction, behavior, and results criteria were measured.

Behavior Criteria

Due to the low reliability measures for peers and self ratings, these ratings were discarded from the analyses. A low reliability coefficient (α) indicated that peers and trainees themselves have not rated the SEF dimensions reliably and consistently. The low reliability could limit the possibility of finding significant differences between the two groups. To eliminate this possibility, peers and self ratings were eliminated and only supervisory ratings were used to test the behavior criteria.

The results of the MANOVA and ANOVA for the supervisory ratings, however, did not support the hypothesis that PTS would affect the behavioral measures of performance. The performance of new trainees on the measures of technical, operations, training and teamwork and overall

performance was not statistically different for the two training groups. The new employees who received PTS were not perceived as being better performers based on composite ratings by supervisors on the four dimensions of performance (technical, operations, training, and teamwork). These results may have been due to the fact that the sample size was too small to show significant variation between the two groups (i.e., low power to detect significant differences between the groups). The effect size (R^2 = .065) for training method for the overall performance dimension indicated that a larger sample size may have led to statistially significant differences between the two groups. As seen in Table 2, the means were all in the expectated direction.

The four dimensions of performance may also have required longer training and more work experience to develop. The SEFs used to evaluate the control and the PTS group were the standard evaluation forms used by management for yearly performance appraisals, indicating that developing the competencies in the SEFs usually would have required a minimum of one year. The control and the PTS groups were evaluated after only six months, and as a result may not have gained sufficient experience or skills to demonstrate these competencies.

Overall, the results of this study, overall, were not congruent with the findings of Filipczak (1993), Fredericksen et al. (1986), Heise (1990), and Obenshain (1992). PTS did not appear to have a positive effect on the on-the-job performance of the new trainees compared to standard OJT, although low statistical power may have limited the chances of finding statistically significant results.

Reaction Criteria

Overall, trainees who received PTS were more satisfied with their training program. The advantages of the PTS were consistent with the beliefs stated by Adkins (1994). The PTS provided a just-in-time training system which reduced training and development time by capitalizing on the existing employees' technical and training skills. PTS also offered the new trainees the opportunity to learn and to gain experience and work with their peers. PTS was organized to encourage retention and transfer of skills, and taught trainees to systematically use the manuals and procedures as reference guides, tutorials, and training opportunities. PTS offered a consistent step-by-step training program to optimize practice, give immediate feedback to produce effective behavior, and facilitate learning for trainees with different styles of learning. PTS also educated the new trainees by introducing critical concepts in the procedures and the

process to maximize understanding and retention. Congruent with Tannenbaum and Yukl's 1992 assertions on training requirements, PTS built in a reinforcement mechanism, by giving sufficient time, practice, and feedback, that may have increased trainee's self-efficacy (perception of success in a task) due to a training environment that simulated the real job.

The advantages cited by the classical OJT consisted of having one senior operator as coach and mentor, establishing a working relationship between the trainee and the senior operator. The disadvantages of the classical OJT, however, were many: lack of any systematic training and evaluation; the stress of production during the training; fear of making mistakes and having a negative impact on the production process; fear of being judged as a slow learner; pressure of learning through trial and error; lack of individual initiative in problem solving; and relying on the senior operator's judgment in resolving issues.

A key implication of this study is that having a PTS may make the training a more effective and favorable organizational function. Future research should be conducted in an attempt to understand peer training programs as an alternative to traditional training methods.

Limitations

The current study was not without its limitations. The first major limitation of this study was related to the presence of threats to internal validity (Goldstein, 1993). Diffusion, testing, and differential selection were variables other than the PTS that may have affected the results of this study.

Diffusion could have played a significant role in determining the outcome of this study. The control group and PTS groups both could have access to the content of SEFs through their peers and/or supervisors. Being familiar with the content of the SEFs to some degree may have affected the ratings of the control and the PTS groups, affecting the results.

Testing may have also had an effect on the results of this study. The SEFs were the standard performance appraisal tools used by managers for evaluation purposes. The groups may have been exposed to the SEFs through their supervisors as a part of their pre-discussions for yearly evaluations. The control and the PTS groups may have attended these pre-review sessions and became familiar with the SEFs and other performance review documentation. This exposure to the content of SEFs

and performance review process may have affected ratings of both groups , impacting the results of this study.

Differential selection of participants may have been another important variable that could have affected the results of this study. The PTS group was hired six months after the control group. The available labor pool also was continually shrinking at the time the PTS group was hired. As a result, the PTS group may have been hired under less stringent criteria and, therefore, could have differed from the control group.

The lack of pretest was the second major limitation. Without pretest ratings it was difficult to measure the differences in both the control and the PTS groups against a baseline. Even though the control and the PTS groups were matched to minimize the variability between the two groups, the lack of pretest scores constituted a major limitation in this study because the inherent differences between both groups were impossible to estimate. In addition, because the participants were not selected randomly the lack of pretest scores increased the possibility that critical differences in both groups were not revealed by the post-test ratings, intensifying the differential selection of participants. The samples in this study were naturally assembled and were not random samples.

The third major limitation of this study was that the control group was the first group to receive the training evaluation. This perception could have affected the supervisors leading them to give higher ratings to the control group. This perception effect is closely associated with the concept of the Hawthorne effect. The supervisors who were vested in the organizational process and knew that the control group constituted the first group receiving SEFs may have over-rated the group's abilities and skills.

The fourth limitation was the limited variace in the scale used in the SEFs to evaluate the performance. The SEF's rating scale included three measurements of performance: good, average, or poor. As a result the scale's limited variance, to be conservative most of the supervisors may have chosen the average in most cases. A more sensitive scale, ranging from one to five, could have given the raters a wider range of choices and, therefore, could have captured more precise responses and led to greater variance.

The fifth limitation of this study noted already was the small sample size. A larger sample size could decrease the sampling errors, as well as, increase the chance of finding real differences between the groups. Therefore, a larger sample could have more power to detect the real

differences between the control and the PTS groups. As it was mentioned before, the means were all in the expected directions.

The sixth limitation of this study was that the criteria used to match the control and the PTS groups were very general, including: not having a formal education, not having a vocational degree in computers, and not having computer assembling experience. These criteria did not consider the trainees' previous job skills and life experiences. For instance, a mechanic without a formal education, an electronic degree, and computer assembly work experience was matched with a female home maker who met the same criteria. A mechanic who did not have computer assembly experience was, nonetheless, more experienced in acquiring the necessary skills at a faster pace due to his work experiences than a female homemaker who recently joined the workforce.

The final limitation of this study was the inability to examine results level data. Due to the organizational changes, the comparison of the PTS and the control groups on the results level of training criteria was not possible.

Future Research

Future research needs to consider a more appropriate time line that matches the organization's performance appraisal time lines. In this study

the time line for the study was six months. The SEFs used in this study, however, were the standard performance evaluation forms normally used by supervisors and managers for yearly reviews. Some of the criteria in the SEFs, as a result, were expected to develop in one year and could not have been met in six months. The future research, thus, must consider the context of performance appraisals and environment of the organization under study and adjust the time line for the study accordingly.

Future research must assure that the samples will be random despite the fact that in organizations participants of any study may be grouped naturally and the randomness of the samples may be difficult to obtain. In addition to sample randomness, future research must consider larger samples for evaluation in order to increase power to more accurately judge the effectiveness of a training program.

Future research should design a separate performance appraisal form which not only reflects a wider range on the response scale, but also will not be perceived as a performance measurement tool. In addition, the evaluation method should focus on measuring the transfer of specific skills that the trainees are expected to learn during the training. A general performance appraisal evaluation form measures the collective expectations that organizations have from an individual employee. A

training evaluation must consider evaluating only the specific skills targeted at the training needs analysis and to measure those specific skills, accordingly.

Future research must consider more stringent criteria to match the control and experimental groups. Demographics including: gender, age, education, past work experiences, and any other criteria must be more specifically defined. Pretests, large samples, and random selection would lessen the inherent variability between the control and experimental groups in organizations.

Extensions and replications would be useful in determining both the internal and external validity of this study's results. The present study was conducted in a manufacturing environment. The design of this study can be extended to service-oriented organizations. Future research should study the effects of peer training on service-oriented organizations. It would be intriguing to find whether the service-oriented organizations would yield different results.

Conclusion

A peer training system is a customized training method that uses the existing skilled workforce to train new hires and retrain and cross-train the current employees. This method of training is flexible enough to

meet the demands of the changing work place in a short period of time. A peer training system implies having a workforce that is skilled, not only in technical know-how, but also in training technologies. It also implies that training is an integrated part of that specific industry. In manufacturing, PTS implies that training and production are integrated as one function because peers who train are also a part of the team that produces.

Although the results of the behavior criteria of this study were nonsignificant, they may have been due to low power. Because of other advantages of the PTS this method may still hold some promises. PTS is not only a training method. It is a business and organizational strategy to utilize the best available resources for training, development, and production. Peer training, basically, is inexpensive, efficient, and effective. The interaction of trainees with peer trainers in a simulated training environment appears to be a very powerful method in training strategies, reflecting the natural way of human learning. All organizations need to take advantage of internal resources rather than relying on external resources for training their workforce. Peer training is a natural resource for use by any organization, should the organization expect to meet the skills demand and competitive requirements of the coming century.

References

Adkins, K. E. (1994). Tapping the power of peers. Human Resources Professional, 7, 12-14.

Arvey, R. D. & Cole, D. A. (1989). Evaluating change due to training. In I. L. Goldstein (Ed.) Training and Development in Organizations. San Francisco: Jossey-Bass.

Berets, R. D. & Thompsett, R. E. (1992). Comparing traditional and integrative learning methods in organizational training programs. Journal of Applied Psychology, 77, 941-951.

Chamot, D., & Baggett, J. M. (1979). Silicon, satellites and robots: The impact of technological change on the workplace. Washington, DC: Department for Professional Employees, AFL-CIO.

Cole, R. E. (1989). Strategies for learning: Small-group activities in America, Japanese, and Swedish industry. Berkeley: University of California Press.

Cook, T. D., & Campbell, D. T. (1976). The design and conduct of quasi-experiments and true experiments in field settings. In M.D. Dunnette (Ed.), Handbook of industrial and organizational psychology (pp. 223-326). New York: John Wiley & sons, Inc.

Danziger, J. N. (1985). Social science and the social impacts of computer technology. Social Science Quarterly, 66, 3-21.

Denison, E. (1984). Trends in American economic growth, 1929-1982. Washington, DC: Brookings Institution.

Duvall, M. (1983). A report on quick-start economic development programs. Washington, DC: U.S. Office of Vocational and Adult Education.

Fandt, P. M. (1991). The relationship of accountability and interdependent behavior to enhancing team consequences. Group and Organizational Studies, 16, 300-312.

Fredericksen, L. W., Meyers, B. J. & Riley, W. A. (1986). A case for cross-training. Training, 23, 37-43.

Filipczak, B. (1993). Frick teaches frack. Training, 30, 30(5).

Goldstein, I. L. (1991). Training in work organizations. In M.D. Dunnette & L. M. Hough (Eds.), Handbook of industrial and organizational psychology (Vol. 2, pp. 507-620). Palo Alto, CA: Consulting Psychologists Press.

Goldstein, I. L. (1993). Training in organizations (3rd ed.). Pacific Grove, CA: Brooks/Cole.

Gordon, J. (1988). Who is being trained to do what? Training, 25, 51-60.

Harper, D. (1987). Working knowledge: Skill and community in a

small shop. Chicago: University of Chicago Press.

Heise, B. (1990). Technology transfer. CIO, 3, 8-10.

Hodson, R., Hooks, G., & Rieble, S. (1992). Customized training in the workplace. Work and Occupations, 19, 272-292.

Kelley, M. R. (1989). An assessment of the skill upgrading and training opportunities for blue-collar workers under programmable automation. In Industrial Relations Research Association: Proceedings of the Thirty-Ninth Annual Meeting (pp. 301-308).

Kirkpatrick, D. L. (1959, 1960). Techniques for evaluating training programs. Journal of the American Society of Training Directors, 13, 3-9, 21-26; 14, 13-18, 28-32.

Kusterer, K. C. (1987). Know-how on the job: The important working knowledge of unskilled workers. Boulder, CO: Westview.

Latham, G. P.(1988). Human Resource training and development. Annual Review of Psychology, 39, 545-582.

Lillrank, P., & Kano, N. (1989). Continuous improvement: Quality control circles in Japanese industry. Ann Arbor: University of Michigan Center for Japanese Studies.

Lippert, R. C. (1989). Expert systems: tutors, tools and tutees. Business Psychology, 2, 60-73.

London, M. (1989). Managing the Training Enterprise. San

Francisco: Jossey-Bass.

Milkovich, G. T., & Boudreau, J. W. (1991). Human resource management. Homewood, IL: Irwin.

Nilson, C. (1990). How to use peer training. Supervisory Management, 35, 8-14.

Obenshain, V. (1992). Peer training yields speedy results. Personnel Journal, 71, 107(3).

Rao, T. V., & Abraham, E. (1986). Human resource development: practices in Indian industries-a trend report. Manual Labor Studies, 2, 73-85.

Pursell, E. D. (1991). Employee development. In K. N. Wexley (Ed.), Developing Human Resources, Washington, DC: BNA Books.

Ralphs, L. T., & Stephen, E. (1986). HRD in the Fortune 500. Training and Development Journal, 40, 69-76.

Rickett, D. (1993). Peer training: not just a low-budget answer. Training, 30, 70(3).

Rumberger, R. W. (1981). The changing skill requirements of jobs in the U.S. economy. Industrial and Labor Relations Review, 34, 578-589.

Saari, L. M., Johnson, T. R., McLaughlin, S. D., & Zimmerle, D. M. (1988). A survey of management training and education practices in U.S.

companies. Personnel Psychology, 41, 731-743.

Sackett, P. R., & Mulien, E. J. (1993). Beyond formal experimental design: Towards an expanded view of the training evaluation process. Personnel Psychology, 46, 613-627.

Spencer, K. I. (1983). Deciphering Prometheus: Temporal change in the skill level of work. American Sociological Reviews, 48, 824-837.

Swezey, R. W., & Salas, E. (Eds.) (1991). Guidelines for use in team training development. In Teams: Their Training and Performance. Norwood, NJ: Albex.

Tannenbaum, S. I., Mathieu, J. E., & Martineau, J. W. (1993). Individual and situational influences on the development of self-efficacy: Implications for training effectiveness. Personnel Psychology, 46, 125-147.

Tannenbaum, S. I., & Yukl, G. (1992). Training and development in work organizations. Annual Review of Psychology, 43, 399-441.

Wexley, K. N., & Latham, G. P. (1981). Developing and Training Human Resources in Organizations. Glenview, IL: Scott, Foresman.

Figure Caption

Figure 1. Time Line to Conduct Study and Collect Behavior Criteria Data.

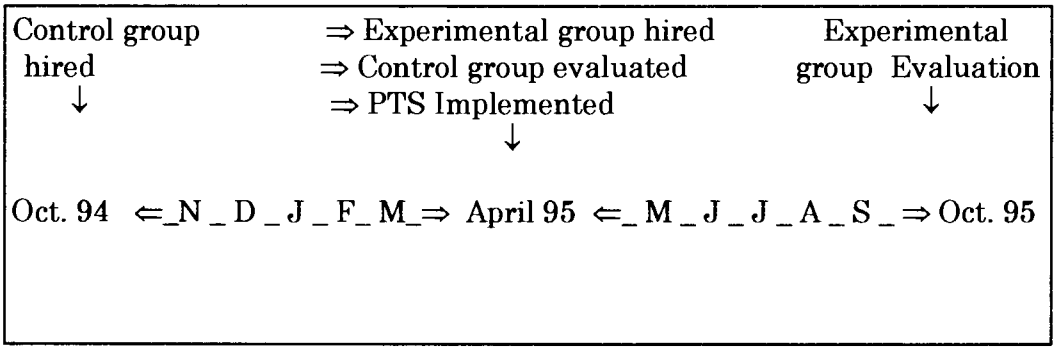
Control group hired
⇒ Experimental group hired
⇒ Control group evaluated
⇒ PTS Implemented
Experimental group Evaluation
Oct. 94 ⇐_N _ D _ J _ F_ M_⇒ April 95 ⇐_ M _ J _ J _ A _ S _ ⇒ Oct. 95

Figure Caption

Figure 2. Measures and Tests to Evaluate Levels of Training Criteria.

Dependent Variable	Measure	Test	Kirpatrick's Levels of Training Criteria
Dimensions of Performance	SEFs	One-way MANOVA One-way ANOVA	Behavior
Employee Satisfaction with Training Type	Focus Groups	Qualitative Comparison	Reaction
Employee Status	Temporary, Contract, or Regular	χ 2	Results

Table 1

Correlation Matrix for the Four Criteria in the SEF for Supervisory Ratings

	Operation	Technical	Training	Teamwork
Operation	1.000			
Technical	.7911	1.000		
Training	.8656	.7212	1.000	
Teamwork	.8160	.7145	.8269	1.000

Note: $N = 40$, $p \leq .001$ for all performance dimensions.

Table 2

Means and Standard Deviations for Each Dimension of Performance for Supervisory Ratings

Performance Dimension	Control Group		PTS Group	
	M	SD	M	SD
Operations	2.54	.47	2.73	.33
Technical	2.67	.40	2.78	.20
Training	2.51	.48	2.68	.30
Teamwork	2.57	.43	2.76	.27

Table 3

Multivariate Analysis of Variance for Effect of Training Method on Four Dimensions of Performance for Supervisory Ratings

Performance Dimension	SS	MS	F	Sig of F
Operations	.62	.63	2.73	.11
Technical	.18	.18	1.35	.25
Training	.36	.36	1.84	.18
Teamwork	.53	.53	3.03	.09

Note. F tests were conducted with (1,38) df.

Table 4

Analysis of Variance for Overall Performance for Supervisory Ratings of control and PTS group

Effect	SS	DF	MS	F	Sig of F
Training Methods	.41	1	.41	2.65	.112
Within Group Error + Residuals	5.82	38	.15		
Total	6.23	39	.16		

Table 5

Advantages and Disadvantages of PTS Reported by PTS Group

Advantages

1. PTS gave priority to training rather than production and learning was the goal. Therefore, trainees did not have to worry about production.
2. PTS was less stressful and anxiety provoking because the trainees were trained by peers not supervisors, instructors, or formal trainers. Working with peer trainers made the training fun.
3. The simulation line allowed for mistakes. It also allowed for practice to resolve the mistakes, therefore, building trainee confidence.
4. Trainees learned how to read and understand the manuals and operational documents and had a chance to practice their understanding of the operation.
5. Trainees worked together in teams to promote learning and resolve issues, and fast learners were encouraged to work with slow learners to facilitate the training.
6. Trainees became familiar with all the equipment, PC requirement, work stations, manuals, and operations in training. Therefore, when the

Table 5. (continued)

trainees joined the production lines they focused on production not training.

7. Trainee felt that they were less of an imposition on the senior operators when they joined the lines. The new trainees started production independently and when needed they could train themselves without much help from other operators by following operational documents.

8. Trainees felt competent and confident enough that they even could check the performance of the more senior operators against the documents and manuals and suggest improvement where needed.

9. Trainees believed that they worked better as team members on the production lines because they had already practiced working with one another on the training line.

Disadvantages

---

1. On production lines everyone including supervisors expected more from new trainees. The trainees, therefore, were left alone to operate without being mentored to complete their training.

Table 5. (continued)

2. Line operators were more sensitive to the mistakes the new trainees were making. They were expected to be as fast and precise as the senior operators in the production.

3. Trainees had difficulty assimilating and establishing relationship with the senior operators in the beginning because the traditional apprenticeship which worked as an initiation mechanism did not exits.

4. Trainees believed that the issues raised in the production lines (low quality and/or production) were attributed to their performance when they were new in the production lines.

5. Trainees were rotated faster in different operations on a line before they attained mastery in a certain operation.

6. Senior operators did not value PTS highly because they were conducted by peers like themselves and, therefore, demonstrated difficulties to accept the new training method as effective.

Table 6

Advantages and Disadvantages of Classical OJT Reported by Control Group

Advantages
1. Trainees were assigned to senior operators for training. The senior operator would train in a coach/mentor role. A working relationship would be established between new trainees and senior operators.
2. New trainees were treated as new and there were fewer expectations from them.
3. Senior operators would value their own work more because they were training and producing simultaneously. Seniority was respected because it was a source of helping to train new hires.
4. Fast learners and aggressive trainees excelled rapidly and assimilated faster in the teams and made more progress.
Disadvantages
1. Trainees were thrown into production lines without any basic knowledge of what to do.

Table 6. (continued)

2. Trainees were at the mercy of the senior operators as to how they would be trained. Senior operators, usually, did not have sufficient time to explain details thoroughly, therefore, demonstrated less tolerance for questions.

3. Trainees felt great deals of anxiety and stress because any mistake were counted against them and their teams.

4. The phrase "sink or swim" were often repeated by senior operators who were not dedicated to training the new hires.

5. Slow learners and shy trainees had limited chances to succeed because production could not be stopped for their sake. Slow learners and less aggressive trainees were treated as such and were pushed to do simple and little jobs.

6. Senior operators usually would not follow procedure and would train short cuts and devalue the use of documentation and manuals. Training was not standard across the factory. New hires had to learn by trial and error and not through standard procedure.

8. Senior operators would convey a sense of superiority due to their seniority and training responsibilities.

Table 6. (continued)

9. New trainees had to sometimes overlook problems and issues because they were afraid that they would be blamed for it. In addition, new hires had to heavily rely on the judgment of the senior operators and lacked the personal initiative themselves to solve problems or recommend resolution.

APPENDIX A

Skills Evaluation Form (SEF)

Skills Evaluation Form

Employee's Name:	Date:
Manger/Management:	Shift: Area:
SSN:	Job Description:

Please take a few minutes to review this evaluation and check the appropriate option box.
1 = Does not demonstrates the skill *2 = Poor demonstration of skill* *3 = Consistently and reliably demonstrates the skill*

Operations:

Level	Competencies	1	2	3	Criteria
	Maintains a safe, clean and organized environment				• Keeps station clean at all times • Adheres to safety procedures
	Has basic knowledge of process flow and paperwork				• Recognizes discrepancies between documents • Has intra-station process flow knowledge
	Has basic knowledge of ISO 9000				• Participates in audits and quality issues • Analyzes the data and prepare reports
	Operates with limited supervision				• Effectively works with minimal guidance in a structured environment • Ensures balance of line, product mix, and throughput optimization by being aware of priority WIP
	Has basic product and quality knowledge				• Monitors the product for defects • Can explain frequent problems with products
	Deals with change in a constructive manner				• Readily accepts and supports change • Suggests positive changes
	Knows quality indicators and other business indicators and strives to correct problems				• Participates in audits and quality meetings • Actively provides information on team goals, area strategies, equipment and operational issues and changes

Technical (Equipment):

Level	Competencies	1	2	3	Criteria
	Understands area equipment requirements including calibration				• Understands all safety issues with respect to equipment in area • Uses the daily start up checklist consistently
	Recognizes and identifies discrepant material and quality problems				• Monitors the product for defects • Can explain frequent problems with product quality
	Understands area process flow				• Follows spec's and RFC's • Has intra-station process flow knowledge
	Follows documented processes and procedures				• Knows how to use various tools such as RFC's, logs, and passdown's • Enters/reads area pass downs
	Follows process improvement techniques and methods				• Communicates problems/issues appropriately • Follows BKM's
	Knows where to find information and or where to go for help				• Gives/receives verbal pass downs to peers • Enter/reads data in vax and pass downs
	Understands and maintains proper				• Adheres to proper moving and lifting procedures

	material handling				• Obeys general safety guide-lines in material handling

Training:

Level	Competencies	1	2	3	Criteria
	Accesses appropriate materials to ensure correct procedures and instructions are followed				• Identifies inconsistencies between existing documents and actual operation procedures • Provides inputs to training materials and spec's
	Uses training system to advance own skills and knowledge and desire to learn				• Participates in improvement teams • Uses IU and self paced training material
	Demonstrates good communication and listening skills				• Openly accepts/gives feedback • Demonstrates active listening skills
	Actively pursues operational/technical skills, knowledge and terminology				• Engages in cross training • Continually asks questions to increase understanding and knowledge
	Works effectively with peer trainer to ensure competency in new skills				• Gives appropriate feedback • Evaluates/monitors training
	Is willing to give feedback or to suggest changes to training programs				• Gives/receives feedback on training system • Prepares training indicators
	Shares knowledge willingly and readily				• Actively provides information on team goals, area strategies, equip. issues, operational status, operational changes, etc • Acts as a mentor for new employees
	Understands quality and output expectations				• Plans activities according to operation priorities and BKM's • Communicates area status -equip., WIP, performance goals
	Is responsible to maintain quality systems				• Know Intel quality standards • Responds to quality issues effectively
	Is responsible for being prepared for audits				• Works collaboratively with team members, addressing personal concerns/needs for overall maintenance of quality • Models positive team behavior

Teamwork:

Level	Competencies	1	2	3	Criteria
	Actively participates to achieve organizational goals				• Ensures that the operations are continually covered • Adheres to policies and procedures (breaks, attendance, cleanroom, etc.)
	Communicates and works effectively with team members				• Demonstrates active listening skills and checks for understanding • Adjusts behavior based on constructive feedback
	Actively participates in team meetings				• Discusses problems with team members and supervisor • Negotiates to win/win
	Accepts constructive feedback from ther team members				• Takes time to listen to others point of view • Adjusts behavior based on constructive feedback

	Works with individuals to resolve conflicts				• Negotiates to win/win • Communicates view points effectively
	Asks for help as needed				• Communicates problems/issues appropriately • Discusses problems with team members and supervisor
	Responds correctly to quality feedback reports				• Follows supervisor's direction • Writes reports, pass downs, etc.
	Demonstrates Intel values through behavior				• Understands Intel culture • Role models Intel values
	Applied learning to meet/exceed factory goals				• Ensures that operations are continuously covered • Revises basic improvement/development plans supplied by supervisor
	Understands own role in team performance				• Understands how the team works • Works together with individuals of diverse cultures and styles
	Utilizes 7 step problem solving				• Writes a clear problem statement • Finds root cause

APPENDIX B

Focus Groups Questions

Focus Group Questions

Your training department has provided you with an opportunity to express your feelings, thoughts, and experiences about the training you have received. Please provide and share relevant information to the following questions.

1. Do you feel that your training was adequate for your overall job duties?

2. Were you able to use the concepts and skills you learned back on the job?

3. Were you satisfied with the training you received?

4. Do you feel that hands-on practice can enhance your learning?

5. Do you feel that the training time was well spent?

6. Did you feel that a training plan can help enhance your learning?

7. Do you feel that peers are valuable trainers?

8. Do you think that training off -the-line with the coaching of peer trainers can be helpful?

9. What is you overall experience with your training?

10. If given a chance, how would you change the training process?

11. Did you get a chance to evaluate the training process?

12. Do you think evaluating the training process is important?

13. What are the specific disadvantages of peer training system?

14. What are the potential barriers to implement peer training system?