# THE EFFECT OF LEADERSHIP TRAINING ON MANUFACTURING PRODUCTIVITY OF INFORMAL LEADERS

Donald W. Knox, Jr., B.S., M.A.

Dissertation Prepared for the Degree of

DOCTOR OF PHILOSOPHY

UNIVERSITY OF NORTH TEXAS

December 2000

APPROVED:

J. Michelle Walker, Major Professor
Michael M. Beyerlein, Minor Professor
Roger Ditzenberger, Committee Member
Randall E. Schumacker, Committee Member
Jon I. Young, Chair of the Department of Technology and Cognition
M. Jean Keller, Dean of the College of Education
C. Neal Tate, Dean of the Robert B. Toulouse School of Graduate Studies

Knox, Donald W. Jr., The effect of leadership training on manufacturing productivity of informal leaders. Doctor of Philosophy (Applied Technology, Training and Development), December, 2000. 103 pp., 18 tables, 4 appendices, bibliography, 44 titles.

The purpose of this study was to determine if leadership training, given to informal leaders, had a positive effect on manufacturing productivity. The leadership attributes of informal leaders were assessed using the Leader Attributes Inventory (LAI). Furthermore, the performance of informal leaders was measured using the Leader Effectiveness Index (LEI). Non-management employees from various departments in a manufacturing facility were placed in one of four experimental groups. A Solomon four-group experimental design was employed. A one-group pretest–posttest design was used to control threats to internal validity. The one-way analysis of variance procedure (ANOVA) was used to determine if there were statistically significant increases in manufacturing productivity of informal leaders.

Findings suggested that training increased the manufacturing productivity of informal leaders. The increased productivity indicated that leadership training could help manufacturing facilities increase their productivity without capital expenditures. Findings did not indicate a statistically significant difference in leadership attributes. Findings also suggested there were no significant differences in the manufacturing productivity between employees with high leader attributes and low leader attributes.

Based on this study, leadership training, given to non-management employees, may yield gains in manufacturing productivity.

Copyright 2000

by

Donald W. Knox, Jr.

TABLE OF CONTENTS

Page

Page

TABLES

Page

Page

# CHAPTER 1

## Introduction

Today's corporate climate faces a fast moving, increasingly global structure. This environment has caused companies to react to the situation in which they are currently faced with, and that climate or situation may change as soon as the company adapts to the new challenge (Johnson, 1998).

Miller (1997) describes the successful organization of the future as a "chameleon," one that adapts to the environment as the environment changes. Miller (1997) further characterized the organization of the future as one that has "great flexibility, commitment to the individual, superior use of teams, strong core competencies, and a taste for diversity"(p. 120).

An organization that can successfully integrate all of these competencies will succeed in any business environment, past, present or future. The role of a leader and the qualities of leadership must be defined for all levels of an organization in order to accept the ever-changing role we all have in business today.

Research has shown the benefits of leadership training for executives and middle managers in increased worker productivity (Bass, 1990; Barling, Weber, & Kelloway, 1996). Leadership development training will have the same benefits if given to the rest of the workforce (IIE Solutions, 1999). This study focused on the effect of leadership-skills

training and its direct effect on the productivity of individuals in non-management positions in a manufacturing environment.

## Background

Reducing the levels of middle management is one of the reactions to the increasingly competitive and global economy. Efforts termed "streamlining," "work smarter, not harder," "do more with less," "downsizing," "right sizing" or "reengineering," "smarter, not harder," "do more with less," "downsizing," "right sizing" or "reengineering" all point in the same direction; namely, a smaller, seemingly more efficient organization (Wellins and Murphy, 1995).

With this smaller and organizationally flatter group, other employees must assume new and/or increased roles. Specialists are becoming generalists, with the understanding they are still specialists (Drucker, 1998). For example, a person in an accounting department primarily responsible for production department budgets may have an expanded job scope. This expanded scope may include other accounting duties as well as helping out in the purchasing department or scheduling group.

However, these reorganization efforts must recognize the human elements involved. Reengineering, a process that redesigns a company's processes from scratch, can have a profound effect on the overall bottom line of a company (Hammer & Champy, 1993; Wellins & Murphy, 1995). The effect, however, may be quite costly in terms of the human element. Jobs are lost and people are not replaced, causing others to fill the roles vacated by those that left (Wellins & Murphy, 1995).

A new understanding must be developed between the company and the individual (Wellins and Murphy, 1995; Miller, 1997). Miller (1997) suggested that this understanding should be centered on the individual. The organization and the individual both must agree on the terms of this understanding. The organization needs positive bottom line results from the efforts of the individual. The individual needs to be adequately compensated for his or her effort. This compensation goes beyond the paycheck to include work that is both rewarding and produces results that can be seen by the individual.

One of the key ideas of most restructuring or corporate reengineering efforts is the empowerment of employees. Employees need to be able to make their own decisions in the best interest of the company (Hammer & Champy, 1993). This concept is true whether the company is working in a traditional setting or a progressive self-directed work team. Champy and Hammer further suggested that empowerment is a necessary by-product of reengineering, and a reengineered process will not work without empowerment.

Wellins and Murphy (1995) pointed out that most failed reengineering attempts centered around a management group that would not accept the transition from a traditional management setting to a new empowered culture. Training should be initiated for both the management group and the working group. The concept of the business structure and the need for management support must be clearly presented to all groups (Senge, 1999).

In contrast to Hammer and Champy's concept that a company must rely solely upon its core competency for success, Miller (1997) and Johnson (1998) offered the suggestion that for an organization to be successful in the future the organization must be willing to adapt and change competencies, as the situation requires. An organization incorporating learning into its core competency enables its employees to obtain the necessary flexibility change will require of them. Johnson stated that this increased flexibility will result in a "strategic competitive advantage" for the company, which will result in a greater sense of security and satisfaction for the employee (Johnson, 1998 p. 143). This advantage comes from the ability of all employees to contribute to the company's goals regardless of the change.

Employees may change roles, new competencies may be required, and new leaders may be needed to meet these new challenges (Kapp, 1999). An organization that places an emphasis in learning will be able to adapt to change much faster and with less turmoil than an organization that does not place an emphasis on learning (Johnson, 1998). Most organizations attempt to force change rather than create the culture necessary to promote successful change. Change should be internal and started in small groups or isolated locations (Senge, 1999).

In the non-management ranks of a company, there exists a strong core of individuals with leadership potential whose influence may be exerted on others (Mohrman, Cohen, & Mohrman, 1995). This group of individuals often receives little or no leadership development training.

## Problem Statement

In 1998, private companies in the United States budgeted over $60.7 billion on formal training. The amount budgeted for management was $14.1 billion. Professionals received $19 billion in budgeted training. All other employees received $19 billion in budgets (Training, October 1998).

The Federal Government budgeted $524 million in 1998 to help improve learning in schools and the workplace, and $6.8 billion was appropriated for training and employment services (Budget of the United States, FY 1999). These training programs were specifically designed to enhance the abilities of managers, supervisors, and other professionals.

The bulk of the labor force receives very little formal training (Training, October 1998). Senge stated that the more successful change efforts start at the individual level and branch out (Senge, 1999). Kapp (1999) stated that manufacturing firms implementing training programs can expect an average gain of 17% in manufacturing productivity.

A leadership development program aimed at hourly employees would bring new tools for success to an untapped resource. New challenges to change would be met with a workforce armed with the same tool set managers and supervisors have traditionally been given (IIE Solutions, 1999). If gains in manufacturing productivity are assisted by delivering leadership training to traditional leadership groups, can similar gains be achieved by providing the same training to hourly employees?

## Purpose of the Study

The purpose of this study was to determine whether leadership training, given to employees considered informal leaders, would have a positive effect on manufacturing productivity.

## Research Questions

The following research questions were developed for this study:

1. Is there a positive gain in manufacturing productivity, as measured by molds per employee, after the completion of the leadership training program?
2. Is there an increase in average Leader Attributes Inventory (LAI) scores from participants in the leadership training program?
3. Is there a significant difference in manufacturing productivity, as measured by molds per employee, after completion of the leadership training program between the employees with high LAI scores and those with low LAI scores?

## Limitations

This study was limited to a single factory located in Northwest Texas. The employee base was not representative of the entire population of factory workers in the world or even in the United States. This study can be replicated at other locations where the company may have leadership training courses in place. This study did not endorse a specific leadership style as the correct approach; rather each location must utilize courses that adhere to their particular corporate culture. This study focused on the effects of leadership training on manufacturing productivity of informal leaders.

## Delimitations

This study was delimited by using a curriculum unique to each corporation. The outline for the curriculum used in this study is included as Appendix C. This study was further delimited by the purchase of this company by another corporation. This purchase resulted in a change of corporate philosophy.

## Definition of Terms

For the purposes of this study, the following definitions were adopted:

Behavior. Actions of an effective leader, rather than what makes a leader effective (Reiner and Morris, 1987).

Business center. Group of production departments grouped together by product line within the company that participated in the study.

Core competencies of leaders. Core competencies include leadership style, appreciation for diversity, conflict resolution, work teams, and business practices (Brocksmith, 1997 & Sogunro, 1997).

Empowerment. A process that allows decision making possible at the lowest levels of an organization.

Formal leaders. Individuals that hold positions such as chief executive officer, vice president, management, superintendent, supervisor, or foreman.

Informal leaders. Individuals who find their base of power from others and receive no official recognition of position from management.

Leader Attributes Inventory (LAI). An instrument designed to assess the

attributes of individuals that indicate probable success as a leader (Moss, Lambrecht, Jensrud, and Finch, 1994).

Leader Effectiveness Index (LEI). An instrument designed to measure the performance of an individual as a leader (Moss, Lambrecht, Jensrud, and Finch, 1994).

Leadership. Leadership is the ability of a person to influence "human behavior in an environment of uncertainty." (Sherman, 1995, pg. 90).

Leadership development program. A systematic training program designed to provide an individual with the skills necessary to be an effective leader.

Leadership roles. A simplification of leadership roles can be broken down into two categories: the formal leader and the informal leader.

Leadership theory. A grouping of many categories or schools of thought about the concept of leadership.

Manufacturing productivity. The effectiveness of an operation to transform material from one stage to the next stage during a manufacturing process.

Power and influence. How a person uses persuasive skills. Power comes from two major sources, position and personal (Northouse, 1997). Influence is the degree of use of power.

Situational. The circumstances in which a leader works, resulting in different approaches based on the maturity level of the leader and the follower.

Trait theory. A belief that leaders are born and not made (Bass, 1990; Northouse, 1997 & Reiner & Morris, 1987).

## Significance of the Study

Leadership development, supervisory skills, and teamwork training often rank as the most important and most frequently offered training topics in corporations (Training, March 1998). With the sums of money budgeted for training increasing every year and the marketplace becoming more global and competitive every year, it is imperative that the money spent on training is utilized to the fullest extent possible (IIE Solutions, 1999).

Companies have to understand that training is portable, that is, the knowledge imparted to employees will leave with the employee thus benefiting another company. This also allows new employees hired into an organization to bring with them knowledge from previous training programs. It is from this line of logic that a company must actively manage its training program to identify the skill sets needed to increase problem solving for the needs of the business, as they exist at that time (Miller, 1997).

Mohrman, Cohen, & Mohrman (1995), suggested a core group of leaders exists at the hourly level in U.S. corporations. Yet at that level, little or no leadership training is provided. A review of literature revealed that few studies have been conducted about the effects of leadership training provided to those in non-management positions. This study, therefore, investigated whether leadership training could facilitate improvements to manufacturing efficiencies by providing a new skill set for hourly employees.

# CHAPTER 2

## Review of Literature

Leadership development, supervisory skills, and teamwork training often rank as the most important and most frequently offered training topics in corporations (Training, March 1998). The United States military has a history of successfully integrating a changing environment with a labor force existing with a large turnover rate. This success stems from the military's leadership training programs (Reimer, 1998). With all the changes that occur within the military and in the world in which it exists, the desire to win and remain a leader in the world has never diminished (Reimer, 1998).

In sharp contrast to the United States military, its competitor -- the military of what used to be the Soviet Union -- has suffered the consequences of not being able to adapt to a changing environment. The nation that emerged with the largest portion of the Soviet military structure, Russia, is seeing the ranks of the military middle management diminish. Officers are leaving for better jobs, causing the military to shorten training cycles for developing new leaders. These training periods are not adequate to properly develop the new officers. These new officers are experiencing job dissatisfaction, which leads to shorter enlistment periods, thereby creating the need for more new officers (Ishchenko, 1998).

Leadership training can be seen as the key to success, as well as the key to failure in both instances. The United States military has a strong leadership development

program and sense of total community (Reimer, 1998). The Russian military is suffering from a large turnover rate and dissatisfaction (Ishchenko, 1998).

The United States Army instills a sense of value-based leadership into its troops. Leaders must lead by example and allow the individual soldier the opportunity to do the same (Reimer, 1998). The Russian military is now shortening officers' leadership-training cycles in order to "turn out officers like hotcakes," though this does not adequately prepare them for the challenges of leadership (Ishchenko, 1998).

The idea of the United States military's leadership-training programs can be easily integrated into the business world (Dillon and Macht, 1998). With the concept of a leadership-training program extending to all levels of an organization, a more empowered workforce will emerge. The United States military understands that to have a truly empowered cadre of leaders, those individuals must be trusted to make the right decision at the right time. The only method to provide that type of empowered leadership is to give individuals the information they need to make sound decisions and be as innovative as the situation warrants (Reimer, 1998).

United States Marine Corps training offers the same idea of empowered leadership that the United States Army offers. Former marines that are now Chief Executive Officers (CEOs) of private companies suggested that their success came from the leadership training they received while members of the Marine Corps. Dillon and Macht (1998) reported that these CEOs learned the power of clear communication,

persuasive leadership skills, and the ability to adapt to changing environments while in the Marine Corps.

Clear and concise communications allowed tasks to be completed faster and with fewer setbacks. Persuasive styles of leadership were more effective in building a team-spirited work place than were dictatorial styles (Bass, 1990; Dillon & Macht, 1998). Adapting to changing environments made for faster decision making and a smaller span of control for the leader. The CEOs have transferred these concepts into their organizational philosophies and were seeing positive results. Interestingly, these individuals were a mix of both officers and enlisted men with prior Marine Corps training (Dillon & Macht, 1998). If transfer of these concepts can be made at the informal leader level, manufacturing productivity should correspondingly increase.

Sixty percent of companies that responded to a 1995 survey, reported in the August 1995 issue of Training and Development, indicated leadership development as a high priority for their training programs. In the same survey, less than twelve percent indicated leadership training as a low or nonexistent priority within their respective organizations. The largest percentage of these training programs was aimed at middle-level managers. The smallest percentage, eleven percent, offered leadership development to employees not in management or supervisory roles (Training and Development, August, 1995).

Introducing transformational leadership skills to bank branch managers was the focus of one study of management training effectiveness (Barling, Weber, & Kelloway,

1996). The managers were assessed before and after the training using a multilevel assessment tool. The trainees, their superiors, and subordinates responded to questionnaires to determine the effectiveness of the training. This training was repeated in the form of refresher training for all managers participating. The overall findings in the study indicated that the employees surveyed believed the managers' leadership behaviors improved with the training (Barling, Weber, & Kelloway, 1996; Smart, 1997).

The study reported by Barling, Weber, and Kelloway in 1996 was based upon a very small sample size and restricted population. The study had a sample size of 20 individuals. These individuals were randomly separated into train and control groups. The sample is, again, somewhat biased. All participants were volunteers and all shared the same status, branch manager, and were employed by the same bank. The authors acknowledged these deficiencies and left those areas open for future research. The group of individuals studied by Barling, Weber and Kelloway were not from the same employment status as the individuals in this study. The desired effect, however, was the same.

A second study, conducted in Alberta, Canada, assessed the effectiveness of a leadership development program over a period of nineteen years (Sogunro, 1997). The study also showed a positive impact on leadership abilities of the participants after the training program. More importantly, this report indicated that the effectiveness of the training program had long-term positive implications for those that attended the training (Sogunro, 1997).

The study by Sogunro (1997) dealt with a rural population trained in civic leadership. The individuals trained were volunteers for the program; thus, somewhat biasing the study. Additionally, the data measured was qualitative in nature. While this is a good indication of how the individuals felt about the effectiveness of the training, there is no quantitative data to help support the claim.

Rodel, Inc. developed a Leadership Intensive Training program in 1990. This program was designed to teach teamwork and leadership skills to employees from all levels of the company. This program has been a cornerstone in the growth of Rodel. In 1993, sales were expected to rise 12%; they actually rose 50%. The company officers cited the graduates of the Leadership Intensive Institute as a major reason for the growth in sales (Finegan, 1997).

Critical to the success of the United States Army's training program is leadership training, which is extended to most members of the Armed Services. The turnover rate in the military necessitates finding and developing new leaders on a continuous basis (Reimer, 1998). Sogunro (1997) suggested that leadership training be extended to all levels of employees with the assertion that all employees are potential leaders and need development. This thought process directly parallels that of the United States military, which has proven successful on a long-term basis. The leadership training provided has to be current, and those that have received training in the past need to have refresher training to update their knowledge, skills, and abilities (KSAs) (Sogunro, 1997).

## Informal Leaders

Recognizing informal leaders in a work force is a challenge. Not all informal leaders have an active presence in the workforce, at least not one recognized by management (Bass, 1990). Assessment instruments can be used to determine which employees may be successful leaders. Evaluations by outside groups could be performed to determine who these individuals are, at a cost to the company. A better method might be to assess job performance and ask employees and supervisors who the informal leaders are in their organization.

Not every informal leader will have a positive impact on an organization. Some informal leaders will have the same effect on an operation that the "mob leader" has on crowds (Bass, 1990). Management may not want these individuals to receive further training. However, these employees could have a positive impact on organizational productivity if the training makes them more productive employees.

Sugonro (1997) suggested that all employees should be given leadership training to help individuals understand the leadership system. Job performance is one area of assessment that can help determine what the employee gives the company. What are the efficiencies associated with their area? What is the individual's attendance rate? What is the employee's disciplinary record? What is the perception of the individual's supervisor? What is the performance evaluation history of the person?

Positive ratings in these areas would be a good starting point for finding the informal leaders in an organization. The United States Army uses a multi-rater system to

evaluate soldiers. This system involves feedback in all directions, from peers, subordinates, and superiors to provide direction for the soldier being evaluated. The rating system gives the soldier a well-rounded assessment of individual performance (Reimer, 1998). This approach is similar to the evaluation utilized by Barling, Weber and Kelloway in the 1996 study of branch bank managers. This type of review will help give a well-rounded evaluation, and also eliminates any biases a few people may have about the person being evaluated.

Whom does the peer group consider leaders? Within all layers of work groups, leaders emerge to assist in guiding their peers (Bass, 1990). Peer reviews or communication pattern assessments can be utilized to find the major conduits of information. Communication patterns that emerge from these studies help to point out where the majority of information comes from. The sources within the peer group may help to establish who the informal leaders are and aid in the identification of true informal leaders. This will be true for any type of communications including unofficial "gossip" or the interpretation of company sponsored statements (Robbins, 1993).

## Training Informal Leaders

There are many studies addressing a core curriculum for leadership development. From the study by Sogunro (1997), the following competencies were ranked high on the survey's "some improvement scale" (3.75 or higher on a 1 to 5 scaling): verbal communication, respecting the abilities of others, listening skills, appreciating the abilities of others, providing leadership in a group, being active in meetings, and

displaying sensitivity to the feelings of others after the completion of the training course (Sogunro, 1997 p. 726).

The competencies are also in line with the attributes desired in senior management at KMPG Peat Marwick LLP (Brocksmith, 1997). Topics desirable in top-management executives should be applied to the training of informal leaders if companies are to tap their potential as leaders (IIE Solutions, 1999). Given the idea that most informal leaders guide or that they are a major influence in the informal communications network, particular attention should be given to effective communication skills. Effective communication is one of the traits often associated with the concept of effective leadership (Bass, 1990). In summation, the desired core curriculum contains training in leadership style, appreciation for diversity, communications (conflict resolution), work teams, and business practices.

There are many different leadership style programs available. The program chosen must be tailored to the organization's specific needs. Needs include the culture and climate of the organization, needs of the individuals, and the applicability of the training intervention to the intended audience. Other leadership styles and theories should be included in the training to help present a balanced program (Bass, 1990).

Transformational leadership inspires both the leader and the follower to reach beyond goals and expectations. Transformational leaders tend to be very charismatic and inspire others to exceed their expectations (Bass, 1990; Northouse, 1997). Transformational leaders also see a higher moral issue and want to show others how to be

leaders (Northouse, 1997). Transformational leaders see the personal relationship side of a group rather than just the end results (Covey, 1989). When training people in transformational leadership techniques, it is important to emphasize education, not skills, and build in feedback systems for constructive growth (Bass, 1990).

Transformational leadership can be adapted for business use. In 1996, a national bank system in Canada trained several branch managers in transformational leadership. Sales of credit cards and other sales indicators increased after the training. Surveys taken after the training indicated the attitudes of the workers towards the managers improved. The survey results also indicated that workers viewed their managers as more effective leaders after the training (Barling, Weber, & Kelloway, 1996).

The leader match program and Hersey and Blanchard's Situational Leadership II program are designed to fit the leader's style with the competence and commitment of the follower. How a leader deals with individuals and groups will differ depending upon the development level of the follower or group. The less skilled or mature the follower, the more direct the style of leadership that is applied by the leader. Within the same work group, two members may have similar problems. One employee who is less skilled but willing to perform may be shown how to perform the task better. The other employee may have their employment terminated, because they are not as diligent in performing the task capably (Bass, 1990; Hersey, Blanchard & Johnson, 1996).

The bulk of most leadership style theories are transactional. Management by objective (MBO), path-goal, and management by exception, are a few popular examples.

Transactional leadership style places a reward for an action. Conversely, this style withholds rewards or even provides a negative incentive for nonperformance (Northouse, 1997). This style is easily adapted into a corporate situation. The corporation has a vision, sets goals, and all employees are expected to contribute to reaching those goals. This is a simplification of these methods, but the reward system does work (Bass, 1990).

Business in the United States will see a net increase of employment availability of 15% for white males from 1985 through 2000. The largest gains in workforce availability are in females, both white and nonwhite. Immigrant males and females make up the next largest gains. This means applicants are more likely to be a female, older, or from another culture (Johnston and Packer, 1987). The changing workforce coupled with increasingly global markets makes diversity and cultural training necessary (Carr-Rufino, 1996). The ability to effectively lead people from a diverse work group is a challenge to be faced by everyone in a leadership position.

Diversity involves dealing effectively with people who differ from the normative culture. The workforce today is rapidly changing. Workforce 2000 (Johnston & Packer, 1987) was a study sponsored by the United States Labor Department. Some of the more interesting statistics offered by this report suggested that the face of tomorrow's labor pool will be older, contain more women, and minorities and immigrants will hold larger portions of the job market. The "new" minority will be white males between 18 and 45 years of age. Available jobs will be increasingly technical and require more skills from the workers. Better education and training will be required for the workforce to succeed

(Johnston & Packer, 1987). Companies will be forced by this changing, available labor pool to change their current hiring practices (Carr-Rufino, 1996).

Bass (1990) listed communication skills as one of the basic interpersonal skills required of an effective leader. Communication skills are a core part of any leadership development program. Important elements in communication are the ability to communicate in verbal and written form, demonstrating care and consideration, active listening, and conflict resolution (Bass, 1990).

Interpersonal communication takes place between two people, groups or public audiences (Capp, Capp & Capp, 1990). Effective verbal communication involves understanding what the audience cares about and an ability to state what you mean (Bass, 1990). Strong verbal communication skills are often associated with the profile of an effective leader. Written communication was not as important in trait surveys as other leadership attributes, but it is essential in communicating in a corporate setting (Bass, 1989).

An effective leader understands the importance of listening to others to find out what matters most to the other person. A co-worker may relate a story to you about an injured or sick child. The active listener may also hear the stress and apprehension in the speaker's tone. The co-worker may be looking for help, advice, or just need someone to talk to. Subtle changes in a person's body language may indicate the level of receptiveness of the listener.

Covey lists empathic listening as a key habit to develop to be a successful leader (Covey, 1989). Empathic listening is "seek first to understand, then to be understood" (Covey 1989, p. 237). The key to effective communication is to understand what the other person(s) is/are saying. Successful leaders are tuned in to what their followers are saying. This gives the leader a base of understanding to help followers reach goals or accomplish tasks (Bass, 1990; Covey, 1989).

Work teams can be structured differently in a variety of settings (Mohrman, Cohen, & Mohrman, 1995). A team leader may be assigned or elected by the team members. A work team may also function, collectively, as a manager or leader using the team leader as a spokesperson (Wellins, Byham, & Wilson, 1991). All team members need leadership skills. However, these skills may be more developed in some members. As the work team absorbs managerial functions, leadership tools need to be provided to the team (Mohrman, Cohen, & Mohrman, 1995).

A leader can empower the work group to make decisions. Empowerment allows the group to find their own resources to accomplish tasks. If a leader truly empowers a subordinate work group, the leader is free to focus on other tasks (Bass, 1990). Empowered work teams may evolve into self-directed or even self-managed teams (Wellins, Byham, & Wilson, 1991). Leaders need to allow others to perform tasks without the fear of negative consequences from failure. Leaders can stress a "win/win" situation and improve performance of the group (Bass, 1990). Shared goals and allowing greater autonomy and decision making are keys to a leader's success in an enabling and

empowering culture. Leaders are those individuals that are successful in motivating their companies and other employees to succeed (Rosen, 1997).

Where are we going? As a leader the essential question is one of vision and purpose. Before you can effectively articulate and guide toward the corporate or group vision, you must first understand your internal goals and motivation (Covey 1989). Once you understand your motivation you can then move toward the group's goal.

In a business sense, a vision is the ideal position for the corporation. That vision may be one of increasing market share, providing the best product at the lowest cost, or simply becoming the best provider of the product being produced. Typically the vision comes from the top of the organization and works its way down with each level supplying objectives or goals that integrate the overall vision (Block, 1996). A leader needs to know where the group needs to go to be effective.

A leader needs to know and understand the climate the corporation or group works within. If the climate is competitive, the leader needs to understand the implications of decision making. If the decision has an impact on the end product or bottom line, results may not be in line with the corporation's vision. Training programs need to fall in line with the organization's culture and mission to be effective for that organization. (Eastburn, 1987).

Leaders must also understand the corporation's measurement systems. Which style of cost accounting does the corporation use? Budget practices and variance issues as well as efficiency measurements need to be part of the curriculum.

Companies can better utilize an informal leader and develop future leaders, or the informal leader themselves can use the process of mentoring. Mentoring, utilizing the informal leader as a peer mentor or as the mentor for a manager in training, can be established (McGill & Slocum, 1995).

The use of the informal leader as a mentor for a manager in training allows a company the ability to use the skills and abilities the informal leader has learned throughout their career. The manager in training receives valuable insight to both the processes of the company as well as the workings of the hourly ranks of employees. The benefits from this relationship can be a win/win situation. The informal leader receives company recognition for their contributions and knowledge, and the manager receives an education that cannot be put into a lesson plan. As a peer mentor, the informal leader can transfer process knowledge to the peer. This is usually done utilizing the on-the-job training method (Shea, 1994).

With all of the restructuring taking place in the workforce, retention of good employees is difficult. Promotions to the ranks of management have declined. Management positions themselves have declined in number, making the competition for those slots very competitive (Wellins & Murphy, 1995). Payscales are based upon position within a company in most settings. Individual performance is not always an indicator of worth to a company.

A company must focus on those employees that have substantial impact on the organization and find ways to retain them (Goldsmith, 1997). This recognition and

reward system must also apply to the informal leader. Often times the impact of these employees is lost, because they do not hold a "position" within the structure of the company. A good system of evaluation needs to be effectively implemented. Not only does an individual's contribution to the common cause need to be rewarded, so does the potential that person brings to the group (Wellins & Murphy, 1995).

The reward system to repay employees for their services needs to have some basis in the merit of the employee. This merit should include individual performance as well as the performance measures of the success of the group the individual works in. This will allow for the reward of individual performance as well as for the overall success of the group. Profit sharing is a good example of a group reward. Companies need to establish recognition systems and let valued employees know they are appreciated and that the company desires to retain them (Goldsmith, 1997).

# CHAPTER 3

## Methods and Procedures

This experimental study was designed to determine whether leadership training had a positive effect on the manufacturing productivity of informal leaders. The null hypotheses for this study were:

$H_{O1}$: $\mu_{\text{pre molds}} \geq \mu_{\text{post molds}}$

There is no statistical significant increase in manufacturing productivity of informal leaders after receiving leadership training.

$H_{O2}$: $\mu_{\text{pre LAI}} \geq \mu_{\text{post LAI}}$

There is no statistically significant increase in average *Leader Attributes Inventory* (LAI) scores of informal leaders after receiving leadership training.

$H_{O3}$: $\mu_{\text{low LAI}} = \mu_{\text{high LAI}}$

There is no statistically significant difference in manufacturing productivity between those informal leaders with high LAI scores and informal leaders with low LAI scores.

The dependent variable in this study was manufacturing productivity. The company in this study used a manufacturing productivity measurement called molds per employee. This measurement was based upon the number of molds that complete a process in each production department. Molds can be scrapped at any stage in the

process. The measurement used was derived from the total number of molds handled during the workweek divided by the number of labor hours logged per standard employee day.

The independent variable was the experimental group versus the control group. The treatment variable was the leadership training, which was assumed to be of sufficient duration and intensity.

This chapter contains information about the population, sample, research design, instrumentation and the procedures employed in collecting and treating data. Non-exempt employees from the participating manufacturing facility comprised the population.

Documents regarding permission to conduct this study are in Appendix A. Data collected were analyzed using the Statistical Package for the Social Sciences (SPSS®) version 8.02 for Windows®. This data included a *Leader Attributes Inventory* (LAI) score (Moss, Lambrecht, Jensrud & Finch, 1994), *Leadership Effectiveness Index* (LEI) score (Moss, Lambrecht, Jensrud & Finch, 1994) and the established company manufacturing productivity measurement, molds per employee, as defined previously. The treatment, leadership training, was conducted on two separate occasions. The LAI and LEI instruments are contained in Appendix B.

## Population

The population consisted of non-exempt employees in a manufacturing facility in the Northwest Texas area. The facility in this study had five hundred non-exempt

employees in the manufacturing area (N=500). These employees had various levels of experience and performed tasks in various manufacturing departments contained within Business Centers. Those individuals selected came from various departments and shifts contained within the Business Centers. Each department had a unique manufacturing portfolio and product mix. A stratified sample of employees was selected based upon the shift and department the employee was assigned. The employees were then placed in one of four treatment groups using a random number generator. The employee badge number was recorded to allow the researcher to track the proper productivity measurements. Each department had a unique productivity measurement.

To allow comparisons to be made between departments, a common measurement was devised using the productivity data for each department and shift within that department. The productivity of each shift and department was tracked on a weekly basis and each employee was trained to operate the assigned equipment. The data used were the productivity data averaged for the three weeks prior to the treatment and the week of the initial treatment for each department. The productivity number used was the base productivity measurement as shown in Equation 1.

[(Week1DepartmentxShift1 + Week1DepartmentxShift2…. +

Week4DepartmentxShift3)/12] = Base Productivity (1)

Where x = department number

## Sample

The sample consisted of thirty-seven employees from various production departments and shifts. Each employee was fully trained in an assigned work area. One employee, from treatment group 1, was assigned to the maintenance department. There were no associated productivity measurements in this department. For this individual, only the LAI and LEI scores were utilized. Another employee, from treatment group 4, terminated employment during the second training cycle. Only the LAI and LEI scores obtained from the first training cycle were used for this individual.

## Research Design

The first design employed in this study was a Solomon four-group experimental design (Table 1) and referred to as the first treatment cycle. The Solomon four-group design controlled for threats to internal validity (Campbell and Stanley, 1963; Gall, Borg & Gall, 1996). A secondary result of using this design allowed the researcher to determine if the training enhanced the natural affinity that a person had for leadership. The treatment was repeated one time to establish the validity of the measurements. The second design was a one-group pretest - posttest design (Table 2) and referred to as the second treatment cycle.

The Solomon four-group design was chosen to minimize any threats to internal validity (Campbell and Stanley, 1963; Gall, Borg & Gall, 1996). The individuals with high LAI scores were those employees considered informal leaders. It is statistically possible that no employees with an aptitude for leadership were selected for one of the

training groups. It was expected that efficiencies improved in areas where employees from the trained groups worked. It was further expected that those employees with high LAI scores would experience higher efficiencies after training.

A total of thirty-seven employees received training during this process. Moss, Johansen and Preskill (1991) utilized a three week period of time between pre- and posttest administrations of the LAI and this study utilized the same time period between assessments.

Table 1

Treatment Cycle 1 Research Design (Solomon Four Group)

| Group | Random Design | Pretest (LAI) | Treatment | Posttest (LAI) |
|---|---|---|---|---|
| 1 | R | $O_1$ | X | $O_2$ |
| 2 | R | $O_1$ | | $O_2$ |
| 3 | R | | X | $O_2$ |
| 4 | R | | | $O_2$ |

Note: R=Random selection, $O_1$=Pretest given, X= Treatment received, $O_2$=Posttest given

Table 2

Treatment Cycle 2 Research Design (Pretest – Posttest)

| Pretest (LAI) | Treatment | Posttest (LAI) |
|---|---|---|
| $O_1$ | X | $O_2$ |

The productivity measurement, molds per employee, was tracked in weekly intervals starting three weeks prior to both the first treatment (Table 3) and second treatment (Table 4). A time-series design was used for this data collection.

Table 3

Treatment Cycle 1 Productivity Data Collection

| Group | 5/22/2000 | 5/29/2000 | 6/6/2000 | Treatment 6/12/2000 | 6/19/2000 | 6/26/2000 | 7/3/2000 |
|---|---|---|---|---|---|---|---|
| 1 | $O_1$ | $O_2$ | $O_3$ | X | $O_4$ | $O_5$ | $O_6$ |
| 2 | $O_1$ | $O_2$ | $O_3$ | | $O_4$ | $O_5$ | $O_6$ |
| 3 | $O_1$ | $O_2$ | $O_3$ | X | $O_4$ | $O_5$ | $O_6$ |
| 4 | $O_1$ | $O_2$ | $O_3$ | | $O_4$ | $O_5$ | $O_6$ |

Note: Subscripted O indicates time period of measurement

Table 4

Treatment Cycle 2 Productivity Data Collection

| 6/19/2000 | 6/26/2000 | 7/3/2000 | Treatment 7/10/2000 | 7/17/2000 | 7/24/2000 | 7/31/2000 |
|---|---|---|---|---|---|---|
| $O_1$ | $O_2$ | $O_3$ | X | $O_4$ | $O_5$ | $O_6$ |

## Instrumentation

The *Leader Attributes Inventory* (LAI) initially developed by Moss, Johanssen & Preskill in 1991 and later refined in 1994 by Moss, Lambrecht, Jensrud & Finch was

administered to determine the affinity for leadership an employee possessed. The research performed during the development of the LAI indicated an overall test-retest score reliability of .97 (Moss, Lambrecht, Jensrud & Finch, 1994). The LAI is a two part instrument with the first part being a self-rating and the second part an observer-rating.

A third assessment, the *Leader Effectiveness Index* (LEI), was used in conjunction with the LAI. Both LAI instruments measured thirty-seven leadership attributes. The self-rating questions mirrored the observer-ratings. The comparison between the self-rating and observer rating identified areas for improvement.

The published internal consistency of LAI scores yielded a Cronbach's alpha of .97. The published interrater reliability of scores was measured at .75 to .84 and the coefficient for the average score was measured at .91 (Moss, Lambrecht, Jensrud & Finch, 1994).

The administration of this tool required a self-assessment and five observer assessments. The results of these assessments were averaged and scaled. For the first treatment cycle, the inventory was given to the participants placed in groups 1 and 2 to establish a pretreatment baseline. After the first treatment cycle, participants in all four groups were given the assessment.

The *Leader Effectiveness Index*, also developed by Moss, Lambrecht, Jensrud & Finch in 1994, was used as a predictor of LAI scores. The LEI determined how much the raters believed the ratee possessed leadership qualities. The LEI was given to measure leadership performance over time or to measure leadership qualities at a point in time

(Moss, Lambrecht, Jensrud & Finch, 1994). The LAI had a published test-retest reliability of .94 and the average overall assessment reliability coefficient was .95. The published internal consistency of scores (Cronbach's alpha) was .86 and the interrater reliability was .86. The individuals performing observer-rater assessments of the LAI also completed the LEI assessments. The published correlation coefficient between LAI and LEI scores was .79 (Moss, Lambrecht, Jensrud & Finch, 1994).

## Data Collection

During the first treatment cycle, both the *Leader Attributes Inventory* and *Leader Effectiveness Index* were administered to groups 1 and 2 and the treatment was provided to groups 1 and 3. Pretreatment productivity data were collected for the three weekly periods prior to the treatment for all machines and shifts. The same data were collected for the 3 weekly periods after the treatment. The data were analyzed for each treatment group. Each inventory package contained one LAI self-rating, five LAI observer-ratings and five LEI inventories. The supervisor of the employee passed out the five LAI observer-ratings and LEI rating forms to peers of the employees involved in the study.

The second treatment cycle, the *Leader Attributes Inventory* was administered to all participants for both pre- and post-treatment. Productivity data were collected for the three weekly periods prior to and after the treatment. The same number of forms was utilized for each employee. The total number of forms issued and returned is listed in Table 5.

Table 5

Inventory return rates

| | Issued | Returned | Percent Returned |
|---|---|---|---|
| LAI self-rating | 79 | 78 | 98.7 |
| LAI observer-rating | 395 | 392 | 99.2 |
| LEI observer rating | 395 | 388 | 98.2 |

## Analysis of Data

The data collected and reported had no identifying numbers that could be traced back to the individual. The random selection process precluded any compensatory measurements. The Statistical Package for the Social Sciences version 8.02 for Windows was used to analyze the data using t-tests and ANOVA procedures.

## Treatment

The company that participated in the study covered the following subjects in leadership training: leadership style, appreciation for diversity, conflict resolution, work teams and business practices. The existing training courses were offered only to exempt employees in supervisory and management positions. The treatment was delivered during a three day training program. During the first treatment cycle, designated attendees were given the LAI at the beginning of the training program. Five co-workers of these same employees were selected at random and given LAI and LEI assessments to rate these individuals. This designation was based upon which treatment group the individual was

placed in. Established trainers currently employed or contracted by the company were used to facilitate the courses. The trainers delivered the same sections of training for both treatment cycles. Three weeks after the conclusion of the training program, all employees that had been placed in one of the four groups was given an LAI and five of their co-workers were randomly selected to complete LAI and LEI assessments. The second treatment cycle consisted of those employees selected to participate in the study but who did not receive the treatment (groups 2 and 4). These individuals received the same treatment as those in the first cycle. The only difference was the design of the study, which shifted from a Solomon four-group to a static group pretest – posttest design. Three weeks after the conclusion of this training cycle the LAI was given to the participants and five of their co-workers completed the LAI and LEI assessments. The co-workers were randomly selected and random selection was based upon their employee number. Manufacturing productivity data were collected weekly by the scheduling department and was forwarded to the researcher. The outline of the curriculum employed in the study is contained in Appendix C.

# CHAPTER 4

## DATA ANALYSIS AND DISCUSSION OF RESULTS

### Introduction

This chapter is divided into three sections. The first section provides an overview of the participants in the study. The second section contains a description of the data and statistical analysis. The last section evaluates the null hypotheses for each research question. Detailed statistical tables can be found in Appendix D and are arranged in the same order as the analysis in the chapter.

### Employee Participation

The first treatment cycle design was a Solomon four-group for the *Leader Attributes Inventory*. Manufacturing productivity data were collected using a time-series design for all four experimental groups. Manufacturing productivity data were then transformed into a percent of base productivity using equation 2 for a three week period (i).

$$\sum_{i=1}^{3} (\text{week } X_i \,/\, \text{base productivity } Y_i) = \text{Molds per Employee} \qquad (2)$$

Where X = week of production; Y = department employee assigned to work

The first training cycle took place during the week of June 12, 2000 and that manufacturing data were not used since the individuals receiving the treatment were unavailable for work during that time period. The second treatment cycle was a one-group pretest-posttest design for the *Leader Attributes Inventory* data collection and a time-series design for the collection of manufacturing productivity measurements. The second training cycle took place during the week of July 10, 2000 and that manufacturing data were not used since the individuals receiving the treatment were unavailable for work during that time period. Equation 2 was used to calculate the manufacturing productivity measurement.

Participant assessment sheets were completed to determine participants' reaction to the training. There were no negative comments noted about the appropriateness of the material. Overall the responses were positive from the participants.

## Data Analysis

Research questions 1 and 2 each contain three parts. Part A used a Solomon four-group design and is referred to as treatment cycle 1. The pretreatment manufacturing productivity data were collected during the three weekly periods prior to the training. The post-treatment manufacturing data were collected during the three weekly periods after the training was completed for treatment cycle 1. The pretreatment LAI data were collected the first day of the training program and the post-treatment LAI data were collected the third week after the training program for cycle 1 was completed.

For part B, a pretest-posttest design was utilized. The two experimental groups that did not receive training during treatment cycle 1 were the subjects of treatment cycle 2. The pretreatment data were collected during the first three weekly periods prior to the training and the post-treatment data were collected during the three weekly periods after the training was completed for treatment cycle 2. The LAI data were collected prior to the training for treatment cycle 2 and the third week after the training was completed for treatment cycle 2.

For part C, the data were analyzed using a dependent t-test. The data utilized was the same data collected for parts A and B. Part C measures the overall difference between the pre- and post-treatment means.

The first research question, "there is no statistical significant increase in manufacturing productivity of informal leaders after receiving leadership training" was tested by the following null hypothesis:

$H_{O1}$: $\mu_{\text{pre molds}} \geq \mu_{\text{post molds}}$

Manufacturing productivity data were analyzed using an ANOVA (Table 7) procedure to determine if a statistically significant difference existed after the first treatment cycle was completed at the .05 level of significance. Descriptive data are contained in Table 6.

Table 6

Post-treatment Manufacturing Data – Treatment Cycle 1

| Group | Mold Productivity Mean | Standard Deviation | Observations | n |
|---|---|---|---|---|
| 1 | .95 | .28 | 27 | 9 |
| 2 | 1.00 | .30 | 33 | 11 |
| 3 | 1.24 | .34 | 15 | 5 |
| 4 | 1.14 | .38 | 33 | 11 |
| Totals | 1.07 | .34 | 108 | 36 |

Note: Mold Productivity Mean is a percentage of standard measurement. A measurement of 1.24 would indicate a 24% increase over the base measurement of 1.00.

Table 7

Post-treatment ANOVA Data – Treatment Cycle 1

| | SS | df | MS | F[a] | P |
|---|---|---|---|---|---|
| Group | 1.15 | 3 | .38 | 3.45 | .02 |
| Error | 10.99 | 104 | .11 | | |
| Total | 12.14 | 107 | | | |

Note: (a) $F_{crit\ (3,\ 107)}$, Power .78

The LSD post hoc analyses (Appendix D, p. 89) indicated certain statistically significant differences. Experimental group 3 productivity data were statistically significantly higher than groups 1 and 2 and group 4 data were statistically significantly higher than group 1. Group 4 was the control group for treatment cycle 1. This suggested

some bias on manufacturing productivity was introduced by the pretreatment. The null hypothesis for Part A was rejected.

The production data taken for the second treatment cycle were analyzed using a paired samples t-test. The correlation between pre- and post-treatment scores was .53. The data in Table 8 indicates a statistically significant difference in the pretreatment and post-treatment means for treatment cycle 2. The post-treatment mean (1.21) was significantly higher than the pretreatment mean (.97). This indicates a positive effect on the measured outcome, manufacturing productivity. For part B of research question 1, the null hypothesis was rejected.

Table 8

Post-treatment Manufacturing Data – Treatment Cycle 2 (Groups 2 and 4)

| | Mean | SD | Mean Difference | SE | t | P |
|---|---|---|---|---|---|---|
| Post-treatment cycle 2 | 1.21 | .33 | .24 | .06 | 4.00 | < .01 |
| Pretreatment productivity | .97 | .18 | | | | |

Note: $t_{\alpha=.025} = 2.08$

Data for manufacturing productivity were also analyzed after both treatment cycles were completed using a paired samples t-test and are contained in Table 9. The

correlation between pre- and post-treatment scores was .56. The post-treatment mean was 1.21 and the pretreatment mean was 1.00.

Table 9

Post-treatment Manufacturing Data – Overall (All Groups)

| | Mean | SD | Mean Difference | SE | t | P |
|---|---|---|---|---|---|---|
| Post-treatment 2 productivity | 1.21 | .36 | .21 | .05 | 4.20 | <.01 |
| Pretreatment productivity | 1.00 | .19 | | | | |

Note: $t_{\alpha=.025} = 1.96$

The data indicated an overall positive change in manufacturing productivity in all four groups after treatments were complete. For part C of research question 1, the null hypothesis was rejected.

The first research question predicted there would be no significant increase in manufacturing productivity after the treatment. Based upon the data analysis for the three parts of research question 1, the manufacturing productivity measurement comparison after both treatment cycles, indicated a statistically significant positive change, therefore; the null hypothesis was rejected.

The second research question, "there is no statistically significant increase in average *Leader Attributes Inventory* (LAI) scores of informal leaders after receiving leadership training" was tested by the following null hypothesis:

$H_{O2}$: $\mu_{pre\ LAI} \geq \mu_{post\ LAI}$

An independent samples t-test procedure was performed on groups 1 and 2 LAI pretreatment scores to determine if there was any statistically significant difference prior to treatment. Based upon the results of this test, contained in Table 10, there were no statistically significant differences between groups 1 and 2 LAI scores prior to the first treatment cycle. Group 1 initial LAI score mean was 4.59 and group 2 was 4.47.

Table 10

Pretreatment LAI Scores Comparison Treatment Cycle 1(Groups 1 and 2)

| | Mean | SD | Mean Difference | SE | T | P |
|---|---|---|---|---|---|---|
| Pretreatment LAI Scores Group 1 | 4.59 | .63 | .12 | .29 | .41 | .69 |
| Pretreatment LAI Scores Group 2 | 4.47 | .70 | | | | |

Note: $t_{\alpha=.025} = 2.09$

Post-treatment cycle 1 LAI scores were analyzed using an ANOVA procedure, at the .05 level of significance, comparing the groups that received treatment and the groups that did not receive treatment (see Table 11). The descriptive data are in Table 12. The

data did not indicate a statistically significant difference between experimental groups. The null hypothesis was not rejected for part A of research question 2.

Table 11

Post-treatment LAI Scores ANOVA – Treatment Cycle 1

| | SS | df | MS | F | $F_{crit\ (1,35)}$ | Power | P |
|---|---|---|---|---|---|---|---|
| Group | .48 | 1 | .48 | 1.14 | 4.12 | .18 | .29 |
| Error | 14.60 | 35 | .42 | | | | |
| Total | 15.08 | 36 | | | | | |

Table 12

Post-treatment LAI Scores Descriptive Data – Treatment Cycle 1

| Group | LAI Score Mean | Standard Deviation | n |
|---|---|---|---|
| Trained During First Cycle | 4.69 | .40 | 15 |
| Control Group | 4.46 | .77 | 22 |
| Total | 4.55 | .65 | 37 |

A paired samples t-test was used to analyze the LAI data from the second treatment cycle. The Pearson correlation coefficient, computed as r = .86, indicated a strong linear relationship between the pre and post-treatment scores. Data are in Table 13.

Table 13

LAI Score Paired Samples t-Test – Treatment Cycle 2

| | Mean | SD | Mean Difference | SE | T | P |
|---|---|---|---|---|---|---|
| Pretreatment LAI Scores | 4.53 | .76 | .07 | .09 | .78 | .44 |
| Pretreatment LAI Scores2 | 4.46 | .79 | | | | |

The data indicated that there were no significant differences in the measured data for part B of research question 2. The null hypothesis was not rejected for part B of research question 2.

Pre- and post-treatment LAI score comparisons were analyzed for treatment groups 1, 2 and 4 using a paired samples t-test. The Pearson correlation coefficient computed as r = .74, indicated a strong linear relationship between the pre- and post-treatment scores. The t-test data are in Table 14.

Table 14

Overall LAI Scores Paired Samples t-Test

| | Mean | SD | Mean Difference | SE | t | P |
|---|---|---|---|---|---|---|
| Post-treatment LAI Scores | 4.54 | .66 | .01 | .08 | .13 | .980 |
| Pretreatment LAI Scores | 4.53 | .64 | | | | |

Note: $t_{\alpha=.25} = 1.96$

For part C of research question 2, the data supports not rejecting the null hypothesis.

Overall, the second hypothesis predicted there would be no statistically significant increase in average LAI scores after treatment. There were no statistically significant increases in LAI scores after either treatment. Therefore, the null hypothesis was not rejected.

The third research question, "there is no statistically significant difference in manufacturing productivity between those informal leaders with high LAI scores and informal leaders' was tested by the following null hypothesis:

$H_{O3}$: $\mu_{low\ LAI} = \mu_{high\ LAI}$

The post-treatment LAI scores were aligned in descending order and then placed in one of four groups. Group 1 was the higher LAI scores and group 4 was the lower LAI scores. The manufacturing data from the last measured three week period for the respective groups were analyzed for statistical differences using an ANOVA procedure at

the .05 level of significance. The descriptive data are contained in Table 15 and the ANOVA data are in Table 16.

Table 15

Overall Productivity Measurements Descriptive Data

| Group | Mean | Standard Deviation | n |
|---|---|---|---|
| Upper LAI | 1.15 | .34 | 90 |
| Upper Middle LAI | 1.02 | .32 | 72 |
| Lower Middle LAI | 1.09 | .38 | 81 |
| Lower LAI | 1.10 | .45 | 78 |
| Totals | | | 321 |

Note: A measurement of 1.15 would indicate a 15% increase over the base measurement of 1.00.

Table 16

Overall Productivity by LAI Score Quartile ANOVA

| | SS | df | MS | F | Power | P |
|---|---|---|---|---|---|---|
| Group | .61 | 3 | .20 | 1.43 | .39 | .22 |
| Error | 43.79 | 317 | .14 | | | |
| Total | 44.40 | 320 | | | | |

Note: $F_{crit\ (1,\infty)} = 2.60$

As shown in Table 16, the data did not indicate a significant difference in manufacturing productivity measurements after the treatment. The data indicated that

overall manufacturing productivity increased and that the highest increase occurred with the upper LAI score group, as shown in Table 15. Post hoc data did not indicate any statistically significant differences in the group means (Appendix D, p. 91).

The third hypothesis predicted there would be no statistical difference in manufacturing productivity data between those with high LAI scores and those with low LAI scores. The data collected for manufacturing productivity showed a positive increase for all treatment groups. The largest gain was with the group of individuals who had the higher LAI averages. However, the manufacturing productivity gain was determined not to be significant, therefore; the null hypothesis was not rejected.

The *Leader Effectiveness Index* was designed to have a positive correlation with an individual's LAI score. This pretreatment correlation between pre- and post-treatment LEI scores was .76 and the post-treatment correlation was .88. The data collected indicated a strong positive correlation between the LEI and LAI scores. This correlation indicated that the employees evaluating the leader attributes of the individuals receiving the treatment also had the same perception of the effectiveness of these individuals as leaders.

# CHAPTER 5

# CONCLUSIONS AND RECOMMENDATIONS

## Introduction

Leadership and leadership development continue to be important topics in the field of training and development. As more organizations move toward work teams, the idea of empowered leadership takes on more importance. A large portion of training budgets is aimed at leadership development (Training, October 1998). The majority of these budget dollars are aimed at improving the skills of employees currently in management positions.

## Conclusions

This study investigated the effects of leadership development training on the manufacturing productivity of informal leaders. The difference in this study and the typical training program was the training population. Non-management, hourly employees were given the same training that management employees received. Manufacturing productivity increased after all treatments were completed, for all groups in the study. The *Leader Attributes Inventory* was used to give the employees involved in the training a report that contained feedback from their peers as compared to their own opinions. The *Leader Effectiveness Index* was used to help the employees understand their overall effectiveness as leaders as determined by their peers. The LEI and LAI scores had a strong positive correlation, indicating the results of the LAI were accurate in

the direction of overall effectiveness of these employees as leaders.

The null hypothesis of research questions 1, “there is no statistical significant increase in manufacturing productivity of informal leaders after receiving leadership training” was rejected. The leadership training program was determined to have a statistically significant increase in measured manufacturing productivity.

The absence of statistically significant differences in productivity gains between the high LAI and low LAI groups combined with the increased productivity between the initial treatment and the initial control groups showed that employees seemed to gain from this training. The benefits to a company participating in this type of training can be measured in productivity increases. The results of the training can be measured by the administration of the LAI before and after the training. The LEI was designed to measure the determination of an employee’s leadership effectiveness, as perceived by peers. The increase in correlation between the LAI and LEI scores after treatment may indicate the effectiveness of the employee, as a leader, increased after leadership training.

This research showed that a manufacturing facility gained in productivity when employees were given leadership development training. The overall gain by productivity period was 1.21 or 21% in manufacturing productivity. This measurement was an average of each of the three week periods. The gain after the first week of each treatment was larger than the subsequent two weeks. The final week after all treatments were

completed indicated an overall 17% increase in manufacturing productivity (Appendix D, p. 94). This seems to be typical of what Kapp found in his research (Kapp, 1999).

## Strengths

The strengths of this study were in the robustness of the design and the confirmation of results using the second treatment cycle. The random selection and placement allowed for a generalization of results to the plant population. The second treatment cycle confirmed the results of the first training cycle.

## Limitations

The limitations of this study were confined to the size and population of the participating manufacturing facility. The design of the study and subsequent data collection were very difficult to manage. Each set contained six LAI instruments and five LEI instruments. The productivity data were extracted from mainframe data collection systems and depended upon all employees correctly using the system. The sample size of the experiment was another limitation of the design.

This study identified one area of training that, with improvement, could help increase manufacturing productivity. As previously stated, large proportions of training budgets are used to deliver leadership development training to management employees. The same training, given to non-management employees, may yield gains in productivity.

## Recommendations

The following are recommendations based on this study:

1. The training should be compartmentalized to a single group or department when using the Solomon approach.
2. The largest increase in LAI scores were noticed in male employees yet the largest gain in manufacturing productivity was noticed in female employees further study should be conducted to investigate the perceptions of employees towards female leaders. Females accounted for approximately 50% of the workforce at this facility. However, females accounted for less than 20% of the middle and upper management group and 50% of the first line supervisors.
3. This training program should be extended to other areas of this facility. Newly employed supervisors should attend this training program and be integrated with non-management employees.
4. This training program should also be implemented at another locations within the corporation. The management group of those facilities should attend the training.
5. The LAI/LEI assessments should be used to help develop a $360^{o}$ feedback system for supervisors and hourly employees.
6. Communications, diversity and work teams training should be extended to all employees within the corporation.
7. New manufacturing programs should be introduced simultaneously with communications, diversity and work teams training.

8. Investigate the effects of non-management employees', who receive leadership training, impact on a new culture established by merged companies.

## Summary

Further research is indicated as a follow-up to this study. One important topic is the return on investment from this type of training. The overall gain in manufacturing productivity after the completion of the training program was significant from a continuous improvement aspect. Any gains made in productivity without increased costs are important. Phillips utilized a return on investment formula that placed a quantifiable measurement on cost savings (Phillips, 1997). That analysis is beyond the scope of this study. The participating company has already begun using this training curriculum and inventory sets as part of a leadership development program at another facility. The curriculum will be given to the management group first and then to non-management employees.

The purchase of this company by a larger company has changed the corporate culture. How does leadership training fit within the new culture? The company that emerged from this acquisition would have the identity of both companies and the identity of other purchased groups. This new identity would be formulated from the existing cultures and knowledge from training programs that all of the groups bring to the merger. Each location would have to incorporate the new philosophy within their existing culture. The amount of success of this integration may depend upon the acceptance of the hourly employees. Senge (1999) and Miller (1997) stated that the successful companies of the

future would be those that accept change rapidly. Those that are empowered and believe in the change would accelerate the acceptance of change (Wellins, Byham & Wilson, 1991).

This study showed a statistically significant gain in manufacturing productivity in the production where employees were given leadership training were assigned. Further research is recommended on how non-management employees, who receive leadership training, impact the new culture established by several companies merging.

# APPENDIX A

Permission Forms

UNIVERSITY of NORTH TEXAS

*Office of Research Services*

May 17, 2000

Donald W. Knox, Jr.
5313 Spindletree Drive
Wichita Falls, TX 76310

RE: Human Subjects Application No. 00-109

Dear Mr. Knox,

Your proposal titled "The Effect of Leadership Development Training For Informal Leaders on Manufacturing Productivity," has been approved by the Institutional Review Board and is exempt from further review under 45 CFR 46.101.

The UNT IRB must review any modification you make in the approved project. Federal policy 21 CFR 56.109(e) stipulates that IRB approval is for one year only.

Please contact me if you wish to make changes or need additional information.

Sincerely,

Reata Busby, Chair
Institutional Review Board

RB:sb

P.O. Box 305250 • Denton, Texas 76203-5250 • (940) 565-3940
Fax (940) 565-4277 • TDD (800) 735-2989 • www.unt.edu

# APPLICATION FOR APPROVAL OF INVESTIGATION INVOLVING THE USE OF HUMAN SUBJECTS

University of North Texas Institutional Review Board
For the Protection of Human Subjects in Research (IRB)

1. **Principal Investigator's Name**: Donald W. Knox, Jr.

**Department & Campus Address**: Department of Technology and Cognition, Applied Technology, Training and Development

**Campus Phone No.**: None **Home No**: (940) 691-5669 **Email address**:donandlinda@msn.com

2. If you are a student, provide the following:

**Home Address of Student**: 5313 Spindletree Drive, Wichita Falls, TX 76310

**Name of Faculty Sponsor**: Dr. Michelle Walker Phone **Ext**: 2354

**Email address of Sponsor**: mwalker@unt.edu

3. **Title of Project**: *The Effect of Leadership Development Training for Informal Leaders on Manufacturing Productivity*

4. Total Project Period: From: June 1, 2000 To: June 1, 2001

5. Is a proposal for external support being submitted? Yes__ No_X_

Funding agency:_____

If "Yes," you must submit one complete copy of that proposal as soon as it is available and complete the following:

a) Is this a renewal application? Yes___ No: X_

6) In making this application, I certify that I have read and understand the UNT guidelines and procedures for the protection of human subjects in research. I will comply with the letter and spirit of the University policy and 45 CFR 46. I further acknowledge that I will inform the IRB of any significant changes in the protocol and will refrain from applying any protocol changes until I receive approval for said changes. **I understand that I cannot initiate any contact with human subjects before I have received UNT IRB approval.**

Signature of Principal Investigator _____ Date 5/8/00

7) **Approval by Faculty Sponsor (required for all students): I affirm the accuracy of this application, and I accept the responsibility for the conduct of this research as approved by the UNT IRB.**

Signature of Faculty Sponsor Michelle Walker Date 5/9/00

8) **Applicable Documentation:** I have included copies of all pertinent attachments including, but not limited to: questionnaire/survey instrument, informed consent, letters of approval from cooperating institutions, copy of external support proposal if applicable.

Yes: __X__ No: ____ (If no, explain on an attached sheet)

9) **Subjects:** Subjects are production employees working in a mid-size manufacturing facility. There are approximately 950 employees at this facility. 36 employees will participate in the research study.

10) **Study Procedure:** Employees will be selected and randomly placed into one of four research groups. The research design is an Experimental design based upon a Solomon four group. Groups1 and 3 will use an assessment tool, the Leader Attributes Inventory, to establish the pre-treatment level of leadership ability. Groups 1 and 2 will participate in a training program that will last 40 hours. All four groups will utilize the assessment three weeks after the training program has been completed. Groups 2 and 4 will receive the same training provided to groups 1 and 3 after the second round of assessments are completed. This assures that all participants selected for the research study will be treated equably. Manufacturing productivity will be measured utilizing the number of molds worked per employee. This measurement accounts for the differences in product mix and is utilized by all manufacturing departments and is the established parameter used to gauge manufacturing productivity at this facility.

**Major Hypotheses** of the study:

Hypotheses #1 – There is a positive gain in manufacturing productivity, as measured by molds per employee, after the completion of the leadership training program.

Hypothesis #2 – There is an increase in average *Leader Attributes Inventory* scores from participants in the leadership training program.

11) **Research Consent:** All participants will receive a cover letter stating they are participating in a training program. Their participation will help to determine the effectiveness of leadership training for non-exempt personnel. They will be given the opportunity to critique the course using existing company training evaluation forms. Permission has been granted by the Director of Human Resources for this facility to conduct this study. Written consent from the participants is not necessary, however the cover letter will be given to all participants.

12) **Confidentiality Safeguards**: Participants will not be individually identified in the final report. The completed instruments and final reports will be maintained in a location not accessible by the participating company. Individual reports will be mailed to the subjects and the final report will not contain any identifying information.

13) **Benefits to Subjects**: The intent of this research is to determine the effects of leadership development training for persons not in leadership positions. The training material consists subjects that are beneficial to an increased awareness of working with others.

14) **Potential Risks:** The potential participant risks associated with this study are minimal and can be overcome with the protection of participant data in the final report.

## Don and Linda Knox

**From:** Jerome Moss, Jr.
**Sent:** Wednesday, August 11, 1999 10:23 AM
**To:** donandlinda@email.msn.com
**Subject:** Leadership Tools

There are three publications you might want to obtain. The first is the "Leader Attributes Inventory Manual" (MDS-730). It contains the instrument, and a complete description of its development and psychometric characteristics. The second publication is the "Leader Effectiveness Index Manual" (815). It contains the instrument as well as a description of the developmental process together with its psychometric qualities. The LAI assesses the qualities (attributes) that facilitate leadership behavior; the LEI assesses the effectiveness of a leader's behavior in an educational context.
The third publication is named "Preparing Leaders for the Future' (736). It contains a series of lessons designed to improve the attributes measured by the LAI.

The three publications may be purchased from the National Center for Research in Vocational Education, Materials Distribution Center, Western Illinois University. Toll free telephone is 800-637-7652.

You may duplicate and use both instruments and the lessons for research purposes. You cannot change any items on the instruments except those gathering demographic data. Give proper credit when publishing the results of your work.

Good luck.

1

**Howmet Corporation**
**Wichita Falls Casting**
6200 Central Freeway
Wichita Falls, TX 76307
940 855 6100 Tel
940 855 1479 Fax

**Howmet Castings**
From Cordant Technologies

Donald W. Knox, Jr.
5313 Spindletree Drive
Wichita Falls, TX 76310
Re: IRB Statement of Permission, UNT

May 8, 2000

Permission is given to Donald W. Knox, Jr. to perform a research project at our facility. This research is titled "*the effect of leadership development training for informal leaders on manufacturing productivity*" and involves leadership development training for a randomly selected group of production employees.

We understand that this research involves a curriculum that may enhance an individual's leadership skills. Further, we understand that two assessment instruments will be utilized to help determine the effects of the training. The responses to these assessments are to remain confidential and will not be released to this company. Manufacturing data will be collected in support of this research and given the proprietary nature of this information, the name of the participating company will not be released in the report without expressed written consent of the General Manager of the Wichita Falls facility.

Employees will be selected at random for participation in this research study. Each participant will be given a cover letter stating that they are involved in a research project sponsored by the University of North Texas and this company. There will not be any promotional opportunities that are based upon participation in this research project. We feel the risk to participants is minimal. The curriculum developed for this research project will be proprietary and property of this company.

Lee L. Wood, Jr.
Human Resources Director

Lee L Wood, Jr. 5/05/00
Date

June 1, 2000

Dear Fellow Employee:

You have been selected to participate in training using curriculum designed to enhance employee skills. The training will last approximately 5 workdays and includes classroom time and an assessment. The overall assessment score will help us evaluate the effectiveness of the training and help you identify some of your strengths and weaknesses. The results of the assessment will be kept confidential. You will be given a summary of your individual results. You will not be identified by name or position in the overall assessment of the effectiveness of the training.

There are no risks associated with the completion of this training. You are under no obligation to complete the training and may withdraw at any time. Your participation, however, is vital to the study's accurate and complete results. The information gathered by the assessments will not be stored on Company property and will only be available to me. The data are being used strictly for research purposes in completion of my doctoral studies at the University of North Texas under the guidance of Dr. Michelle Walker, faculty sponsor. This research has the consent of the University's Internal Review Board (IRB 00-109).

Thank you for your time and participation. Your participation is very important and deeply appreciated. If you have any questions, please contact me at extension 128 or at home, (940)691-5669 or Dr. Michelle Walker at (940) 565-2154. I look forward to your participation in the training.

Sincerely,

Don Knox, M.A.
Human Resources Manager
X-128

Michelle Walker, Ph.D.
Major Professor
University of North Texas

APPROVED BY THE UNT IRB
FROM 05/17/01 TO 05/16/01

# APPENDIX B

Data Instruments

# LEADER ATTRIBUTES INVENTORY
## Self-Rating Form

| ID NUMBER |
|---|
| | | | | |

Jerome Moss, Jr.
with the assistance of
Qetler Jensrud, Barry Johansen, Hallie Preskill

Return this completed form by: ___/___/___
Mo Day Yr

### SECTION A: Directions

1. Select the one norm group to which you wish to be compared:

   ○ Vocational Administrators ○ Vocational Teacher Leaders

2. Thirty-seven leader attributes and their definitions have been identified and are listed on this inventory. Reflect carefully about each definition. Then FILL IN the circle that best describes the extent to which the attribute currently describes you using the following scale.

   ① Very Undescriptive
   ② Undescriptive
   ③ Somewhat Undescriptive
   ④ Somewhat Descriptive
   ⑤ Descriptive
   ⑥ Very Descriptive

   *Mark only one Circle.*

### SECTION B: Attributes

| | | Very Undescriptive | Undescriptive | Somewhat Undescriptive | Somewhat Descriptive | Descriptive | Very Descriptive |
|---|---|---|---|---|---|---|---|
| 1. | *Energetic with stamina* - I approach tasks with great energy and work long hours when necessary | ① | ② | ③ | ④ | ⑤ | ⑥ |
| 2. | *Insightful* - I reflect on the relationships among events and grasp the meaning of complex issues quickly | ① | ② | ③ | ④ | ⑤ | ⑥ |
| 3. | *Adaptable, open to change* - I encourage and accept suggestions and constructive criticism from co-workers, and am willing to consider modifying plans | ① | ② | ③ | ④ | ⑤ | ⑥ |
| 4. | *Visionary* - I look to the future and create new ways in which the organization can prosper | ① | ② | ③ | ④ | ⑤ | ⑥ |
| 5. | *Tolerant of ambiguity and complexity* - I comfortably handle vague and difficult situations where there is no simple answer or no prescribed method of proceeding | ① | ② | ③ | ④ | ⑤ | ⑥ |
| 6. | *Achievement-oriented* - I show commitment to achieving goals and strive to keep improving performance | ① | ② | ③ | ④ | ⑤ | ⑥ |

Published by the National Center for Research in Vocational Education,
2150 Shattuck Ave., Suite 1250, Berkeley, CA 94704

© 1989, 1993, University of Minnesota

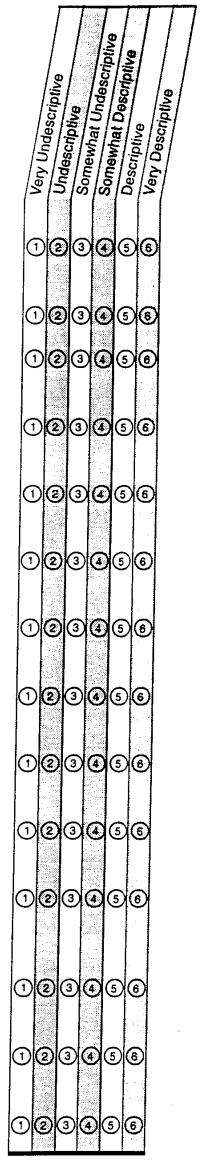
## ATTRIBUTES

| | | Very Undescriptive | Undescriptive | Somewhat Undescriptive | Somewhat Descriptive | Descriptive | Very Descriptive |
|---|---|---|---|---|---|---|---|
| 7. | *Accountable* - I hold myself answerable for work and willingly admit mistakes | 1 | 2 | 3 | 4 | 5 | 6 |
| 8. | *Initiating* - I frequently introduce new ideas | 1 | 2 | 3 | 4 | 5 | 6 |
| 9. | *Confident, accepting of self* - I feel secure about my abilities and recognize personal shortcomings | 1 | 2 | 3 | 4 | 5 | 6 |
| 10. | *Willing to accept responsibility* - I willingly assume higher level duties and functions within the organization | 1 | 2 | 3 | 4 | 5 | 6 |
| 11. | *Persistent* - I continue to act on beliefs despite unexpected difficulties | 1 | 2 | 3 | 4 | 5 | 6 |
| 12. | *Enthusiastic, optimistic* - I think positively, approach new tasks with excitement, and deal with challenges as opportunities | 1 | 2 | 3 | 4 | 5 | 6 |
| 13. | *Tolerant of frustration* - I act calmly and patiently even when things don't go as planned | 1 | 2 | 3 | 4 | 5 | 6 |
| 14. | *Dependable, reliable* - I can be counted on to follow through to get the job done | 1 | 2 | 3 | 4 | 5 | 6 |
| 15. | *Courageous, risk-taker* - I willingly try out new ideas in spite of possible loss or failure | 1 | 2 | 3 | 4 | 5 | 6 |
| 16. | *Even disposition* - I display a sense of humor and a stable temperament even in stressful situations | 1 | 2 | 3 | 4 | 5 | 6 |
| 17. | *Committed to the common good* - I work to benefit the entire organization, not just myself | 1 | 2 | 3 | 4 | 5 | 6 |
| 18. | *Personal integrity* - I speak frankly and honestly and practice espoused values | 1 | 2 | 3 | 4 | 5 | 6 |
| 19. | *Intelligent with practical judgment* - I learn quickly, and know how and when to apply knowledge | 1 | 2 | 3 | 4 | 5 | 6 |
| 20. | *Ethical* - I act consistently with principles of fairness and right or good conduct that can stand the test of close public scrutiny | 1 | 2 | 3 | 4 | 5 | 6 |
| 21. | *Communication (listening, oral, written)* - I listen closely to people at work, and organize and clearly present information both orally and in writing | 1 | 2 | 3 | 4 | 5 | 6 |
| 22. | *Sensitivity, respect* -I show genuine concern for the feelings of others and regard for them as individuals | 1 | 2 | 3 | 4 | 5 | 6 |
| 23. | *Motivating others* - I create an environment in which people want to do their best | 1 | 2 | 3 | 4 | 5 | 6 |



© 1989, 1993, University of Minnesota

## ATTRIBUTES




24. *Networking* - I develop cooperative relationships within and outside of the organization ..... 1 2 3 4 5 6

25. *Planning* - In collaboration with others, I develop tactics and strategies for achieving organizational objectives ..... 1 2 3 4 5 6

26. *Delegating* - I appropriately and effectively assign responsibility and authority ..... 1 2 3 4 5 6

27. *Organizing* - I establish effective and efficient procedures for getting work done in an orderly manner ..... 1 2 3 4 5 6

28. *Team building* - I facilitate the development of cohesiveness and cooperation among the people at work ..... 1 2 3 4 5 6

29. *Coaching* - I help people develop knowledge and skills for their work assignments ..... 1 2 3 4 5 6

30. *Conflict management* - I bring conflict into the open and use it to arrive at constructive solutions ..... 1 2 3 4 5 6

31. *Time management* - I schedule my work activities so that deadlines are met and work goals are accomplished in a timely manner ..... 1 2 3 4 5 6

32. *Stress management* - I effectively deal with the tension of high pressure work situations ..... 1 2 3 4 5 6

33. *Appropriate use of leadership styles* - I use a variety of approaches to influence and lead others ..... 1 2 3 4 5 6

34. *Ideological beliefs are appropriate to the group* - I model and demonstrate belief in the basic values of the organization ..... 1 2 3 4 5 6

35. *Decision-making* - I make timely decisions that are in the best interest of the organization by analyzing all available information, distilling key points, and drawing relevant conclusions ..... 1 2 3 4 5 6

36. *Problem-solving* - I effectively identify, analyze, and resolve difficulties and uncertainties at work ..... 1 2 3 4 5 6

37. *Information management* - I identify, collect, organize, and analyze the essential information needed by the organization ..... 1 2 3 4 5 6

**Thank you for completing this survey!**

Please return the completed survey directly to:

© 1989, 1993, University of Minnesota

# LEADER EFFECTIVENESS INDEX

Jerome Moss, Jr.

| ID NUMBER |
|---|
| | | | | |

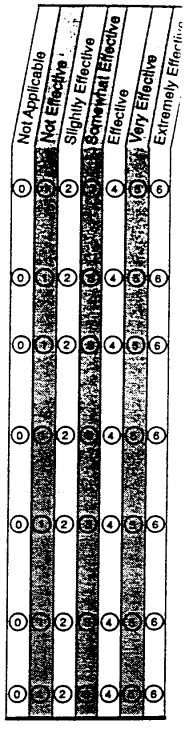
Return this completed form by: ___/___/___
Mo Day Yr

**SECTION A**

We are seeking your opinion about how effectively an individual is performing as a leader. You will return this form directly to the Coordinator of this assessment activity so the person you are rating will not be able to identify your responses. Therefore, we urge you to reflect carefully about each statement and select the rating that best describes the person.

*For each of the statements which follow, fill in the circle that best describes the person you are rating.*

**SECTION B**




1. Inspires a shared vision and establishes standards that help the organization achieve its next stage of development. For example, creates a sense of purpose, defines reality in the larger context, instills shared values and beliefs ..... 0 1 2 3 4 5 6

2. Fosters unity, collaboration and ownership, and recognizes individual and team contributions. For example, creates a climate of community, builds morale, sets a positive tone, resolves disagreements ..... 0 1 2 3 4 5 6

3. Exercises power effectively and empowers others to act. For example, facilitates change, shares authority, nurtures the skills of group members ..... 0 1 2 3 4 5 6

4. Exerts influence outside of the organization in order to set the right context for the organization. For example, serves as a symbol for the group, secures resources, builds coalitions, acts as an advocate ..... 0 1 2 3 4 5 6

5. Establishes an environment conducive to learning. For example, provides intellectual stimulation, creates a supportive climate for learners, facilitates the professional development of staff ..... 0 1 2 3 4 5 6

6. Satisfies the job-related needs of members of the organization as individuals. For example, respects, trusts, and has confidence in members, adapts leadership style to the situation, creates a satisfying work environment ..... 0 1 2 3 4 5 6

7. Overall, how effective is the leadership performance of the person you are rating? ..... 0 1 2 3 4 5 6

Please Return the Completed Survey to:

Published by the National Center for Research in Vocational Education,
2150 Shattuck Ave., Suite 1250, Berkeley, CA 94704

© 1989, 1993, University of Minnesota

# LEADER ATTRIBUTES INVENTORY
## Observer-Rating Form

| ID NUMBER |
|---|
| | | | | |

Jerome Moss, Jr.
with the assistance of
Qetler Jensrud, Barry Johansen, Hallie Preskill

Return this completed form by: ____/____/____
Mo Day Yr

### SECTION A: Directions

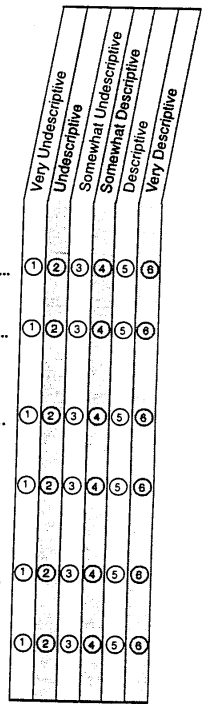
You have been asked to rate the leadership characteristics (attributes) of another person (usually the person who gave you this form). The purpose is to assist in improving the leadership capabilities of the individual by identifying the relative strengths and development needs of her/his leader attributes, so please be as discriminating in your rating as possible.

You will return this form directly to the Coordinator of this assessment activity so the person you are rating will not be able to identify your responses. All feedback to the person being rated will be in the form of averages from a group of raters. We urge you to reflect carefully about each statement. Then rate the person on each statement using the following scale.

① Very Undescriptive
② Undescriptive
③ Somewhat Undescriptive
④ Somewhat Descriptive
⑤ Descriptive
⑥ Very Descriptive

*For each of the statements, fill in the circle that best describes the person you are rating.*

### SECTION B: Attributes




1. *Energetic with stamina* - Approaches tasks with great energy and works long hours when necessary ..... ① ② ③ ④ ⑤ ⑥
2. *Insightful* - Reflects on the relationships among events and grasps the meaning of complex issues quickly ..... ① ② ③ ④ ⑤ ⑥
3. *Adaptable, open to change* - Encourages and accepts suggestions and constructive criticism from co-workers, and is willing to consider modifying plans ..... ① ② ③ ④ ⑤ ⑥
4. *Visionary* - Looks to the future and creates new ways in which the organization can prosper ..... ① ② ③ ④ ⑤ ⑥
5. *Tolerant of ambiguity and complexity* - Comfortably handles vague and difficult situations where there is no simple answer or no prescribed method of proceeding ..... ① ② ③ ④ ⑤ ⑥
6. *Achievement-oriented* - Shows commitment to achieving goals and strives to keep improving performance ..... ① ② ③ ④ ⑤ ⑥

Published by the National Center for Research in Vocational Education,
2150 Shattuck Ave., Suite 1250, Berkeley, CA 94704

© 1989, 1993, University of Minnesota

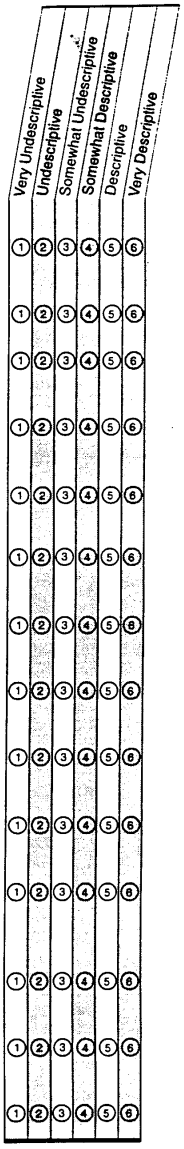
## ATTRIBUTES

| | | Very Undescriptive | Undescriptive | Somewhat Undescriptive | Somewhat Descriptive | Descriptive | Very Descriptive |
|---|---|---|---|---|---|---|---|
| 7. | *Accountable* - Holds self answerable for work and willingly admits mistakes | 1 | 2 | 3 | 4 | 5 | 6 |
| 8. | *Initiating* - Frequently introduces new ideas | 1 | 2 | 3 | 4 | 5 | 6 |
| 9. | *Confident, accepting of self* - Appears secure about abilities and recognizes personal shortcomings | 1 | 2 | 3 | 4 | 5 | 6 |
| 10. | *Willing to accept responsibility* - Willingly assumes higher level duties and functions within the organization | 1 | 2 | 3 | 4 | 5 | 6 |
| 11. | *Persistent* - Continues to act on beliefs despite unexpected difficulties | 1 | 2 | 3 | 4 | 5 | 6 |
| 12. | *Enthusiastic, optimistic* - Thinks positively, approaches new tasks with excitement, and deals with challenges as opportunities | 1 | 2 | 3 | 4 | 5 | 6 |
| 13. | *Tolerant of frustration* - Acts calmly and patiently even when things don't go as planned | 1 | 2 | 3 | 4 | 5 | 6 |
| 14. | *Dependable, reliable* - Can be counted on to follow through to get the job done | 1 | 2 | 3 | 4 | 5 | 6 |
| 15. | *Courageous, risk-taker* - Willingly tries out new ideas in spite of possible loss or failure | 1 | 2 | 3 | 4 | 5 | 6 |
| 16. | *Even disposition* - Displays a sense of humor and a stable temperament even in stressful situations | 1 | 2 | 3 | 4 | 5 | 6 |
| 17. | *Committed to the common good* - Works to benefit the entire organization, not just self | 1 | 2 | 3 | 4 | 5 | 6 |
| 18. | *Personal integrity* - Speaks frankly and honestly and practices espoused values | 1 | 2 | 3 | 4 | 5 | 6 |
| 19. | *Intelligent with practical judgment* - Learns quickly, and knows how and when to apply knowledge | 1 | 2 | 3 | 4 | 5 | 6 |
| 20. | *Ethical* - Acts consistently with principles of fairness and right or good conduct that can stand the test of close public scrutiny | 1 | 2 | 3 | 4 | 5 | 6 |
| 21. | *Communication (listening, oral, written)* - Listens closely to people at work, and organizes and clearly presents information both orally and in writing | 1 | 2 | 3 | 4 | 5 | 6 |
| 22. | *Sensitivity, respect* - Shows genuine concern for the feelings of others and regard for them as individuals | 1 | 2 | 3 | 4 | 5 | 6 |
| 23. | *Motivating others* - Creates an environment in which people want to do their best | 1 | 2 | 3 | 4 | 5 | 6 |



© 1989, 1993, University of Minnesota

## ATTRIBUTES




24. *Networking* - Develops cooperative relationships within and outside of the organization ..... ① ② ③ ④ ⑤ ⑥

25. *Planning* - In collaboration with others, develops tactics and strategies for achieving organizational objectives ..... ① ② ③ ④ ⑤ ⑥

26. *Delegating* - Appropriately and effectively assigns responsibility and authority ..... ① ② ③ ④ ⑤ ⑥

27. *Organizing* - Establishes effective and efficient procedures for getting work done in an orderly manner ..... ① ② ③ ④ ⑤ ⑥

28. *Team building* - Facilitates the development of cohesiveness and cooperation among the people at work ..... ① ② ③ ④ ⑤ ⑥

29. *Coaching* - Helps people develop knowledge and skills for their work assignments ..... ① ② ③ ④ ⑤ ⑥

30. *Conflict management* - Brings conflict into the open and uses it to arrive at constructive solutions ..... ① ② ③ ④ ⑤ ⑥

31. *Time management* - Schedules own work activities so that deadlines are met and work goals are accomplished in a timely manner ..... ① ② ③ ④ ⑤ ⑥

32. *Stress management* - Effectively deals with the tension of high pressure work situations ..... ① ② ③ ④ ⑤ ⑥

33. *Appropriate use of leadership styles* - Uses a variety of approaches to influence and lead others ..... ① ② ③ ④ ⑤ ⑥

34. *Ideological beliefs are appropriate to the group* - Models and demonstrates belief in the basic values of the organization ..... ① ② ③ ④ ⑤ ⑥

35. *Decision-making* - Makes timely decisions that are in the best interest of the organization by analyzing all available information, distilling key points, and drawing relevant conclusions ..... ① ② ③ ④ ⑤ ⑥

36. *Problem-solving* - Effectively identifies, analyzes, and resolves difficulties and uncertainties at work ..... ① ② ③ ④ ⑤ ⑥

37. *Information management* - Identifies, collects, organizes, and analyzes the essential information needed by the organization ..... ① ② ③ ④ ⑤ ⑥

**Thank you for completing this survey!**

Please return the completed survey directly to:

© 1989, 1993, University of Minnesota

# APPENDIX C

Training Outline

Leadership

Discuss leadership definitions

Leadership Theories:

- Trait approach (Great Man, Theory X, Theory Y)
- Situational (Hersey-Blanchard SLII and Blake-Mouton)
- Transactional (Path-Goal, MBO)
- Transformational

Power:

- Reward
- Coercive
- Legitimate
- Referent
- Expert
- Positional
- Personal

Duties, Scope, and Definition of:

- Manager
- Supervisor
- Administrator
- Leader

Discussion of use of leadership skills and persuasion

Discussion of personality types and differences

Time Management

Goals

- Life Goals
- Goal Handout
- Discuss handout using goal notes and class input
- Goal Development Sheets
- Assignment
- Take one goal and write out on goal development sheet
- Reviewing goals

Summary

- Determine goals
- Make a plan
- Live the plan
- Review and adjust

Time Log

Day Planning

Planning Handout

Delegation

Discuss what can/cannot be delegated

Discuss the advantages of delegating (list on chart)

Discuss the disadvantages of delegating (list on chart)

Discuss what must be done for delegation to go well

Delegation Handout

Go through Seven Dimensions of Delegation

Time Wasters:

- Management by Crisis
- Telephone Interruptions
- Inadequate Planning
- Attempting Too Much
- Drop-in Visitors
- Ineffective Delegation
- Personal Disorganization
- Lack of Self-Discipline
- Inability to Say “No”
- Procrastination
- Meetings
- Paperwork
- Leaving Tasks Unfinished
- Inadequate Staff
- Socializing
- Confused Responsibility or Authority
- Poor Communication
- Inadequate Controls and Progress Reports
- Incomplete Information
- Travel

Discuss how to “solve” these time wasters

Conflict Resolution

Common Views of Conflict:

- Traditional
- Behavioral
- Interactions

Sources of Conflict

Ask class about sources of conflict

Which sources can be eliminated?

Which do you have control of?

Self-fulfilling Prophecies

Dealing with Conflict

Always are good and bad?

Dichotomy:  Assertiveness, Cooperativeness

Competing, accommodating, avoiding, collaborating, compromising (for each)

Ask for an example

Ask for advantages

Ask for disadvantages

Summary

Managing Diversity

Introduction

Video

What is delivery?

Groups:

- Gender
- Racial
- Ethnicity
- Age
- Physical Attributes
- Personality
- Sexual Orientation
- Religious/Spiritual
- Military Experience
- Marital Status/Experience
- Geography
- Work Experience
- Income
- Parental Status
- Education

Group Membership

Break into groups (pick “fun” groups like military, left-handers, own a rowboat, etc.). Later, using the same groups, list assumptions/generalities. Make lists of both from group feedback.

What are benefits?

What are costs?

Group Think

Stereotyping

What am I?

What stereotypes can you make of me?

Male vs. Female

Not Old…Wise

Fundamentals of Working with Diversity

Developing people

Developing

Feedback

Discussion:  Are you reluctant to give feedback to people different than you?

Case Study

Equitable Development

Diversity outside of work

What should it matter?

Work Teams

Game:  Zin Obelisk

Teams

Definition

At least two people

Interact regularly and coordinate their work

Share a common objective

Types

Formal vs. Informal

Vertical vs. Horizontal

Vertical:  manager and subordinates

Horizontal:  members drawn from different departments

Motivation

Maslow's Hierarchy of Needs

Basic Principles

Needs

Physical Needs

- Food
- Clothing
- Shelter
- Comfort
- Self-preservation

Safety Needs

- Security for self and possessions
- Avoidance of risks
- Avoidance of harm
- Avoidance of pain

Social Needs

- Companionship
- Acceptance
- Love and affection
- Group membership

Esteem Needs

- Responsibility
- Self-respect
- Recognition
- Sense of accomplishment

Self-realization Needs

- Reaching your potential
- Independence
- Creativity
- Self-expression

Examples:

- Employee has two children entering college next year.
- Worker feels concern about a competitor's purchase of the firm.
- Worker feels uncomfortable as a new addition in a closely-knit work group

- Employee feels unappreciated.

Herzberg's Two-Factor Theory

- Describe hygiene and motivation. Have people come up with list of both; then compare to Herzberg's Theory.

Hygiene Factors:

Lack leads to dissatisfaction

- Salary
- Job security
- Working conditions
- Status
- Company policies
- Quality of technical supervision
- Quality of interpersonal relations among peers

Motivation Factors:

Presence of leads to satisfaction

- Achievement
- Recognition
- Responsibility
- Advancement
- The work itself

Possibility of growth

Ways we keep people from growing

Not all them to make mistakes

Not allowing them to experience the consequences of their mistakes

Not allowing them to try again because they made a mistake

Teambuilding Considerations

Process vs Content Member Roles

Task

Contributor

- Supplies needed information.  Pushes performance standards.

Challenger

- Questions goals, methods, and ethics.

Initiator

- Purposes new solutions, methods, and systems.

Social

Collaborator

- Urges team to stay with its vision and achieve it.

Communicator

- Listens well, facilitates well.

Cheerleader

- Encourages and praised efforts.

Compromiser

- Shifts opinions to maintain harmony.

Development Stages

- Forming
- Storming
- Norming

- Performing
- Cohesiveness

Benefits

- Synergy
- Increased skills and knowledge
- Flexibility
- Commitment

Costs

- Power-realignment
- Team-training
- Lost productivity
- Free-riding
- Loss of productive workers

Guidelines Team Challenge Game

Puzzle creation

Earning respect

Summary

## Business Practices

This module contained proprietary information that included pricing and cost accounting data.

# APPENDIX D

Statistical Output

Univariate Analysis of Variance of Pre-treatment Productivity (Differences in output due to rounding by SPSS)

Descriptive Statistics Dependent Variable: Mold Productivity

| Experimental Group | Mean | Std. Deviation | N |
|---|---|---|---|
| 1 | 1.00 | .26 | 27 |
| 2 | .98 | .21 | 33 |
| 3 | 1.13 | .23 | 15 |
| 4 | .95 | .26 | 33 |
| Total | 1.00 | .24 | 108 |

Tests of Between-Subjects Effects Dependent Variable: Mold Productivity

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Eta Squared | Noncent. Parameter | Observed Power(a) | $F_{crit}$ |
|---|---|---|---|---|---|---|---|---|---|
| Corrected Model | .34 (b) | 3 | .11 | 1.98 | .12 | .05 | 5.93 | .50 | 2.76 |
| Intercept | 100.30 | 1 | 100.30 | 1751.26 | .01 | .94 | 1751.26 | 1.00 | |
| GROUP | .34 | 3 | .11 | 1.98 | .12 | .05 | 5.93 | .50 | |
| Error | 5.96 | 104 | .01 | | | | | | |
| Total | 113.60 | 108 | | | | | | | |
| Corrected Total | 6.30 | 107 | | | | | | | |

a Computed using alpha = .05
b R Squared = .05 (Adjusted R Squared = .03)

Estimated Marginal Means

Grand Mean Dependent Variable: Mold Productivity

| | | 95% Confidence Interval | |
|---|---|---|---|
| Mean | Std. Error | Lower Bound | Upper Bound |
| 1.02 | .02 | .97 | 1.06 |

Experimental Group Dependent Variable: Mold Productivity

| Experimental Group | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|
| | | | Lower Bound | Upper Bound |
| 1 | 1.00 | .05 | .91 | 1.10 |
| 2 | .98 | .04 | .90 | 1.06 |
| 3 | 1.13 | .06 | 1.01 | 1.25 |
| 4 | .95 | .04 | .87 | 1.03 |

Univariate Analysis of Variance of Productivity after Treatment Cycle 1

Descriptive Statistics Dependent Variable: Mold Productivity

| Experimental Group | Mean | Std. Deviation | N |
|---|---|---|---|
| 1 | .95 | .28 | 27 |
| 2 | 1.00 | .30 | 33 |
| 3 | 1.24 | .34 | 15 |
| 4 | 1.14 | .38 | 33 |
| Total | 1.07 | .34 | 108 |

Tests of Between-Subjects Effects Dependent Variable: Mold Productivity

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Eta Squared | Noncent. Parameter | Observed Power(a) | $F_{crit}$ |
|---|---|---|---|---|---|---|---|---|---|
| Corrected Model | 1.15 (b) | 3 | .38 | 3.64 | .02 | .10 | 10.91 | .78 | 2.76 |
| Intercept | 114.49 | 1 | 114.49 | 1083.06 | <.01 | .91 | 1083.06 | 1.00 | |
| GROUP | 1.15 | 3 | .38 | 3.64 | .02 | .10 | 10.91 | .78 | |
| Error | 10.99 | 104 | .11 | | | | | | |
| Total | 134.74 | 108 | | | | | | | |
| Corrected Total | 12.15 | 107 | | | | | | | |

a Computed using alpha = .05
b R Squared = .10 (Adjusted R Squared = .07)

Estimated Marginal Means

Grand Mean Dependent Variable: Mold Productivity

| | | 95% Confidence Interval | |
|---|---|---|---|
| Mean | Std. Error | Lower Bound | Upper Bound |
| 1.08 | .03 | 1.02 | 1.2 |

Experimental Group Dependent Variable: Mold Productivity

| Experimental Group | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|
| | | | Lower Bound | Upper Bound |
| 1 | .95 | .06 | .83 | 1.08 |
| 2 | 1.00 | .06 | .89 | 1.11 |
| 3 | 1.24 | .08 | 1.08 | 1.41 |
| 4 | 1.14 | .06 | 1.03 | 1.26 |

Post Hoc Tests

Scheffe

Experimental Group Dependent Variable: Mold Productivity

| (I) Experimental Group | (J) Experimental Group | Mean Difference (I-J) | Std. Error | Sig | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| 1 | 2 | -.05 | .08 | .96 | -.29 | .20 |
| | 3 | -.29 | .10 | .06 | -.59 | .01 |
| | 4 | -.19 | .08 | .17 | -.43 | .05 |
| 2 | 1 | .05 | .08 | .96 | -.19 | .29 |
| | 3 | -.24 | .10 | .13 | -.53 | .05 |
| | 4 | -.14 | .08 | .36 | -.37 | .08 |
| 3 | 1 | .29 | .11 | .06 | -.08 | .59 |
| | 2 | .24 | .10 | .13 | -.05 | .53 |
| | 4 | .1 | .10 | .81 | -.19 | .39 |
| 4 | 1 | .19 | .08 | .17 | -.05 | .43 |
| | 2 | .14 | .08 | .36 | -.08 | .37 |
| | 3 | -.10 | .10 | .81 | -.39 | .19 |

LSD

Experimental Group Dependent Variable: Mold Productivity

| (I) Experimental Group | (J) Experimental Group | Mean Difference (I-J) | Std. Error | Sig | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| 1 | 2 | -.05 | .08 | .58 | -.21 | .12 |
| | 3 | -.29 (*) | .15 | .01 | -.50 | -.08 |
| | 4 | -.19 (*) | .08 | .03 | -.36 | -.02 |
| 2 | 1 | .05 | .08 | .58 | -.12 | .21 |
| | 3 | -.24 (*) | .10 | .02 | -.44 | -.04 |
| | 4 | -.14 | .08 | .08 | -.30 | .02 |
| 3 | 1 | .29 (*) | .15 | .01 | .08 | .50 |
| | 2 | .24 (*) | .10 | .02 | .04 | .44 |
| | 4 | .10 | .10 | .33 | -.10 | .30 |
| 4 | 1 | .19 (*) | .08 | .03 | .02 | .36 |
| | 2 | .14 | .08 | .08 | -.02 | .30 |
| | 3 | -.1 | .10 | .33 | -.30 | .10 |

Based on observed means.
* The mean difference is significant at the .05 level.

t-Test Comparing Pre-treatment Productivity Average and Post-treatment Productivity For Groups 2 and 4

Paired Samples Statistics

| | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| Post-treatment Productivity | 1.21 | 22 | .33 | .07 |
| Pre-treatment Productivity | .97 | 22 | .18 | .04 |

Paired Samples Correlations

| | N | Correlation | Sig |
|---|---|---|---|
| Post-treatment 2 Productivity & Pre-treatment Productivity | 22 | .53 | .01 |

Paired Samples Test Post-treatment 2

| | Mean | Std. Deviation | Std Error Mean | 95% Confidence Interval of the Difference | | t | df | Sig. (2-tailed) | $t_{crit}$ ($\alpha$=.025 one tail) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Lower | Upper | | | | |
| Post-treatment 2 Productivity & Pre-treatment Productivity | .25 | .29 | .06 | .13 | .37 | 4.18 | 21 | .000 | 2.08 |

t-Test Pre-treatment LAI Scores For Experimental Groups 1 and 2

Paired Samples Statistics

| | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| Experimental Group 1 | 4.59 | 10 | .63 | .20 |
| Experimental Group 2 | 4.47 | 11 | .70 | .21 |

Independent Samples Test

| | | Levene's Test for Equality of Variances | | | | | | | 95% Confidence Interval of the Difference | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | F | Sig | t | df | Sig (two-tailed) | Mean Difference | Std Error Difference | Lower | Upper |
| Groups 1 &2 Initial LAI Score | Equal variances assumed | .19 | .67 | .41 | 19 | .69 | .12 | .29 | -.49 | .73 |
| | Equal variances not assumed | | | .41 | 19 | .68 | .12 | .29 | -.49 | .73 |

t-Test to Compare Groups 1 and 2 Post-treatment LAI Scores

Paired Samples Statistics

| | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| Pre-treatment Group 1 & 2 LAI Score | 4.50 | 21 | .65 | .14 |
| Post-treatment Group 1 & 2 LAI Score | 4.49 | 21 | .70 | .15 |

Paired Samples Correlations

| | N | Correlation | Sig |
|---|---|---|---|
| Pre-treatment Group 1 & 2 LAI Score & Post-treatment Group 1 & 2 LAI Score | 21 | .76 | <.01 |

Paired Samples Test Post-treatment 2

| | Mean | Std. Deviation | Std Error Mean | 95% Confidence Interval of the Difference Lower | Upper | t | df | Sig. (2-tailed) | $t_{crit}$ ($\alpha$=.025 one tail) |
|---|---|---|---|---|---|---|---|---|---|
| Pre-treatment Group 1 & 2 LAI Score & Post-treatment Group LAI Score | .04 | .48 | .10 | -.18 | .26 | .38 | 20 | .72 | 2.09 |

t-Test to compare pre-treatment LAI scores and post-treatment LAI scores for groups 2 and 4

Paired Samples Statistics

| | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| Pre-treatment Group 2 & 4 LAI Score | 4.46 | 21 | .79 | .17 |
| Post-treatment Group 2 & 4 LAI Score | 4.53 | 21 | .76 | .17 |

Paired Samples Correlations

| | N | Correlation | Sig |
|---|---|---|---|
| Pre-treatment Group 2 & 4 LAI Score & Post-treatment Group 2 & 4 LAI Score | 21 | .86 | <.01 |

Paired Samples Test Post-treatment 2

| | Mean | Std. Deviation | Std Error Mean | 95% Confidence Interval of the Difference Lower | Upper | t | df | Sig. (2-tailed) | $t_{crit}$ ($\alpha$=.025 one tail) |
|---|---|---|---|---|---|---|---|---|---|
| Pre-treatment Group 2 & 4 LAI Score & Post-treatment Group 2 & 4 LAI Score | -.07 | .41 | .09 | -.25 | .11 | -.79 | 20 | .44 | 2.09 |

Univariate Analysis Of Variance To Compare Upper LAI Scores Productivity With Lower LAI Scores Productivity

Descriptive Statistics Dependent Variable: Mold Productivity

| Groups in LAI Quartiles | Mean | Std. Deviation | N |
|---|---|---|---|
| Lower 25% | 1.10 | .45 | 78 |
| Lower Middle 25% | 1.09 | .38 | 81 |
| Upper Middle 25% | 1.02 | .32 | 72 |
| Upper 25% | 1.15 | .34 | 90 |
| Total | 1.09 | .37 | 321 |

Tests of Between-Subjects Effects Dependent Variable: Mold Productivity

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Eta Squared | Noncent. Parameter | Observed Power(a) | $F_{crit(3,\infty)}$ |
|---|---|---|---|---|---|---|---|---|---|
| Corrected Model | .61 (b) | 3 | .20 | 1.43 | .22 | .01 | 4.43 | .39 | 2.60 |
| Intercept | 377.61 | 1 | 377.61 | 2733.73 | <.01 | .90 | 2733.73 | 1.00 | |
| GROUP | .61 | 3 | .20 | 1.43 | .22 | .01 | 4.43 | .39 | |
| Error | 43.79 | 317 | .14 | | | | | | |
| Total | 426.84 | 321 | | | | | | | |
| Corrected Total | 44.40 | 320 | | | | | | | |

a Computed using alpha = .05
b R Squared = .01 (Adjusted R Squared = .004

Estimated Marginal Means

Grand Mean Dependent Variable: Mold Productivity

| | | 95% Confidence Interval | |
|---|---|---|---|
| Mean | Std. Error | Lower Bound | Upper Bound |
| 1.09 | .02 | 1.05 | 1.13 |

Groups in LAI Quartiles Dependent Variable: Mold Productivity

| Experimental Group | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|
| | | | Lower Bound | Upper Bound |
| Lower 25% | 1.10 | .04 | 1.01 | 1.18 |
| Lower Middle 25% | 1.09 | .04 | 1.01 | 1.17 |
| Upper Middle 25% | 1.02 | .04 | .94 | 1.11 |
| Upper 25% | 1.15 | .04 | 1.07 | 1.22 |

Post Hoc Tests

Scheffe

Quartile Group Dependent Variable: Mold Productivity

| (I) Quartile Group | (J) Quartile Group | Mean Difference (I-J) | Std. Error | Sig | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| Lower 25% | Lower Middle 25% | .03 | .06 | 1.00 | -.16 | .18 |
| | Upper Middle 25% | .07 | .06 | .71 | -.10 | .24 |
| | Upper 25% | -.05 | .06 | .84 | -.21 | .11 |
| Lower Middle 25% | Lower 25% | <-.01 | .06 | 1.00 | -.17 | .16 |
| | Upper Middle 25% | .07 | .06 | .74 | -.10 | .24 |
| | Upper 25% | -.06 | .06 | .81 | -.22 | .10 |
| Upper Middle 25% | Lower 25% | -.07 | .06 | .71 | -.24 | .10 |
| | Lower Middle 25% | -.07 | .06 | .74 | -.24 | .10 |
| | Upper 25% | -.12 | .06 | .22 | -.29 | .04 |
| Upper 25% | Lower 25% | .05 | .06 | .84 | -.11 | .21 |
| | Lower Middle 25% | .05 | .06 | .81 | -.10 | .22 |
| | Upper Middle 25% | .12 | .05 | .22 | -.04 | .29 |

LSD

Quartile Group Dependent Variable: Mold Productivity

| (I) Quartile Group | (J) Quartile Group | Mean Difference (I-J) | Std. Error | Sig | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| Lower 25% | Lower Middle 25% | .03 | .06 | .96 | -.11 | .12 |
| | Upper Middle 25% | .07 | .06 | .24 | -.05 | .19 |
| | Upper 25% | -.05 | .06 | .36 | -.17 | .06 |
| Lower Middle 25% | Lower 25% | -.03 | .06 | .96 | -.12 | .11 |
| | Upper Middle 25% | .06 | .06 | .26 | -.05 | .19 |
| | Upper 25% | -.05 | .06 | .33 | -.17 | .06 |
| Upper Middle 25% | Lower 25% | -.07 | .06 | .24 | -.19 | .05 |
| | Lower Middle 25% | -.07 | .06 | .26 | -.19 | .05 |
| | Upper 25% | -.12 (*) | .06 | .04 | -.24 | -.08 |
| Upper 25% | Lower 25% | .05 | .06 | .36 | -.06 | .17 |
| | Lower Middle 25% | .05 | .06 | .33 | -.06 | .17 |
| | Upper Middle 25% | .12 (*) | .06 | .04 | .01 | .24 |

Based on observed means.

* The mean difference is significant at the .05 level.

Univariate Analysis of Variance of Overall Productivity by Time Period

Descriptive Statistics Dependent Variable: Mold Productivity

| Time Period | Mean | Std. Deviation | N |
|---|---|---|---|
| Pre-treatment | 1.00 | .24 | 108 |
| Post-treatment Cycle 1 | 1.07 | .34 | 108 |
| Post-treatment Cycle 2 | 1.22 | .47 | 105 |
| Total | 1.09 | .37 | 321 |

Tests of Between-Subjects Effects Dependent Variable: Mold Productivity

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Eta Squared | Noncent. Parameter | Observed Power(a) | $F_{crit}$ |
|---|---|---|---|---|---|---|---|---|---|
| Corrected Model | 2.67 (b) | 2 | 1.33 | 10.16 | <.01 | .06 | 20.31 | .99 | 3.00 |
| Intercept | 383.18 | 1 | 383.18 | 2919.76 | <.01 | .90 | 2919.76 | 1.00 | |
| TIMEPERI | 2.67 | 2 | 1.33 | 10.16 | <.01 | .06 | 20.31 | .99 | |
| Error | 41.73 | 318 | .13 | | | | | | |
| Total | 426.84 | 321 | | | | | | | |
| Corrected Total | 44.40 | 320 | | | | | | | |

a Computed using alpha = .05
b R Squared = .060 (Adjusted R Squared = .054)

Estimated Marginal Means

Estimated Marginal Means

Grand Mean Dependent Variable: Mold Productivity

| | | 95% Confidence Interval | |
|---|---|---|---|
| Mean | Std. Error | Lower Bound | Upper Bound |
| 1.09 | .02 | 1.05 | 1.13 |

Mold Productivity by Time Period Dependent Variable: Mold Productivity

| Time Period | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|
| | | | Lower Bound | Upper Bound |
| Pre-treatment | 1.00 | .04 | .93 | 1.07 |
| Post-treatment Cycle 1 | 1.07 | .04 | 1.00 | 1.13 |
| Post-treatment Cycle 2 | 1.21 | .04 | 1.15 | 1.30 |

Post Hoc Tests

Scheffe

Time Period Dependent Variable: Mold Productivity

| (I) Quartile Group | (J) Quartile Group | Mean Difference (I-J) | Std. Error | Sig | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| Pre-treatment | Post-treatment Cycle 1 | -.06 | .05 | .38 | -.19 | .05 |
| | Post-treatment Cycle 2 | -.22 (*) | .05 | .00 | -.34 | -.10 |
| Post-treatment Cycle 1 | Pre-treatment | .07 | .05 | .38 | -.05 | .19 |
| | Post-treatment Cycle 2 | -.15 (*) | .05 | .01 | -.27 | -.03 |
| Post-treatment Cycle 2 | Pre-treatment | .22 (*) | .05 | .00 | .10 | .34 |
| | Post-treatment Cycle 1 | .15 (*) | .05 | .01 | .03 | .27 |

Based on observed means.
* The mean difference is significant at the .05 level.

LSD

Time Period Dependent Variable: Mold Productivity

| (I) Time Period | (J) Time Period | Mean Difference (I-J) | Std. Error | Sig | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| Pre-treatment | Post-treatment Cycle 1 | -.07 | .05 | .17 | -.17 | .03 |
| | Post-treatment Cycle 2 | -.22 (*) | .05 | <.01 | -.32 | -.12 |
| Post-treatment Cycle 1 | Pre-treatment | .07 | .05 | .17 | -.03 | .17 |
| | Post-treatment Cycle 2 | -.15 (*) | .05 | <.01 | -.25 | -.05 |
| Post-treatment Cycle 2 | Pre-treatment | .22 (*) | .05 | <.01 | .12 | .32 |
| | Post-treatment Cycle 1 | .15 (*) | .05 | <.01 | .05 | .25 |

Based on observed means.

Univariate Analysis Of Variance Of Overall Productivity By Week

Mold Productivity by Production Week Variable: Mold Productivity

| Production Week | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|
| | | | Lower Bound | Upper Bound |
| May 22, 2000 | 1.06 | .06 | .94 | 1.18 |
| May 29,2000 | .95 | .06 | .84 | 1.07 |
| June 5, 2000 | .98 | .06 | .86 | 1.10 |
| June 19, 2000 | 1.11 | .06 | 1.00 | 1.23 |
| June 26, 2000 | 1.03 | .06 | .91 | 1.14 |
| July 3, 2000 | 1.06 | .06 | .94 | 1.18 |
| July 17, 2000 | 1.32 | .06 | 1.20 | 1.44 |
| July 24, 2000 | 1.16 | .06 | 1.04 | 1.28 |
| July 31, 2000 | 1.17 | .06 | 1.05 | 1.29 |

Tests of Between-Subjects Effects Dependent Variable: Mold Productivity

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Eta Squared | Noncent. Parameter | Observed Power(a) | $F_{crit}$ |
|---|---|---|---|---|---|---|---|---|---|
| Corrected Model | 3.57 (b) | 8 | .45 | 3.41 | <.01 | .08 | 27.24 | .98 | 2.51 |
| Intercept | 383.18 | 1 | 383.18 | 2927.80 | <.01 | .90 | 2927.80 | 1.00 | |
| PROWEEK | 3.57 | 8 | .45 | 3.41 | <.01 | .08 | 27.24 | .98 | |
| Error | 40.83 | 312 | .13 | | | | | | |
| Total | 426.84 | 321 | | | | | | | |
| Corrected Total | 44.40 | 320 | | | | | | | |

a Computed using alpha = .05
b R Squared = .060 (Adjusted R Squared = .054)

Scheffe

Production Week Dependent Variable: Mold Productivity

| (I) Production Week | (J) Production Week | Mean Difference (I-J) | Std. Error | Sig | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| May 22, 2000 | May 29,2000 | .11 | .09 | .99 | -.23 | .44 |
| | June 5, 2000 | .08 | .09 | 1.00 | -.26 | .42 |
| | June 19, 2000 | -.05 | .09 | 1.00 | -.39 | .29 |
| | June 26, 2000 | .03 | .09 | 1.00 | -.30 | .37 |
| | July 3, 2000 | .02 | .09 | 1.00 | -.34 | .34 |
| | July 17, 2000 | -.06 | .09 | .35 | -.60 | .08 |
| | July 24, 2000 | -.10 | .09 | .99 | -.44 | .24 |
| | July 31, 2000 | -.11 | .09 | .99 | -.45 | .23 |
| May 29,2000 | May 22, 2000 | -.11 | .09 | .99 | -.44 | .23 |
| | June 5, 2000 | -.02 | .09 | 1.00 | -.36 | .32 |
| | June 19, 2000 | -.16 | .09 | .90 | -.50 | .18 |
| | June 26, 2000 | -.07 | .09 | 1.00 | -.41 | .27 |
| | July 3, 2000 | -.10 | .09 | .99 | -.44 | .24 |
| | July 17, 2000 | -.36 (*) | .09 | .03 | -.70 | -.02 |
| | July 24, 2000 | -.21 | .09 | .65 | -.55 | .13 |
| | July 31, 2000 | -.21 | .09 | .63 | -.56 | .13 |
| June 5, 2000 | May 22, 2000 | -.08 | .09 | 1.00 | -.42 | .26 |
| | May 29,2000 | .02 | .09 | 1.00 | -.32 | .36 |
| | June 19, 2000 | -.14 | .09 | .96 | -.48 | .20 |
| | June 26, 2000 | -.05 | .09 | 1.00 | -.39 | .29 |
| | July 3, 2000 | -.08 | .09 | 1.00 | -.42 | .26 |
| | July 17, 2000 | -.34 | .09 | .05 | -.68 | 0.00 |
| | July 24, 2000 | -.19 | .09 | .78 | -.53 | .15 |
| | July 31, 2000 | -.19 | .09 | .76 | -.53 | .15 |
| June 19, 2000 | May 22, 2000 | .05 | .09 | 1.00 | -.29 | .40 |
| | May 29,2000 | .16 | .09 | .90 | -.18 | .50 |
| | June 5, 2000 | .14 | .09 | .96 | -.20 | .48 |
| | June 26, 2000 | .09 | .09 | 1.00 | -.25 | .43 |
| | July 3, 2000 | .06 | .09 | 1.00 | -.28 | .39 |
| | July 17, 2000 | -.20 | .09 | .69 | -.54 | .14 |
| | July 24, 2000 | -.05 | .09 | 1.00 | -.39 | .29 |
| | July 31, 2000 | -.05 | .09 | 1.00 | -.40 | .29 |
| June 26, 2000 | May 22, 2000 | -.03 | .09 | 1.00 | -.37 | .30 |
| | May 29,2000 | .07 | .09 | 1.00 | -.27 | .41 |
| | June 5, 2000 | .05 | .09 | 1.00 | -.29 | .39 |
| | June 19, 2000 | -.09 | .09 | 1.00 | -.43 | .25 |
| | July 3, 2000 | -.03 | .09 | 1.00 | -.37 | .31 |
| | July 17, 2000 | -.29 | .09 | .18 | -.63 | .05 |
| | July 24, 2000 | -.14 | .09 | .96 | -.48 | .20 |
| | July 31, 2000 | -.14 | .09 | .95 | -.48 | .20 |

| | | | | | | |
|---|---|---|---|---|---|---|
| July 3, 2000 | May 22, 2000 | -.02 | .09 | 1.00 | -.34 | .34 |
| | May 29,2000 | .10 | .09 | .99 | -.24 | .44 |
| | June 5, 2000 | .08 | .09 | 1.00 | -.26 | .42 |
| | June 19, 2000 | -.06 | .09 | 1.00 | -.39 | .28 |
| | June 26, 2000 | .03 | .09 | 1.00 | -.31 | .37 |
| | July 17, 2000 | -.26 | .09 | .34 | -.60 | .08 |
| | July 24, 2000 | -.11 | .09 | .99 | -.45 | .24 |
| | July 31, 2000 | -.11 | .09 | .99 | -.45 | .23 |
| July 17, 2000 | May 22, 2000 | .26 | .09 | .35 | .08 | .60 |
| | May 29,2000 | .36 (*) | .09 | .03 | .02 | .70 |
| | June 5, 2000 | .34 | .09 | .05 | 0.00 | .68 |
| | June 19, 2000 | .20 | .09 | .69 | -.14 | .54 |
| | June 26, 2000 | .29 | .09 | .18 | -.05 | .63 |
| | July 3, 2000 | .26 | .09 | .34 | -.08 | .60 |
| | July 24, 2000 | .15 | .09 | .93 | -.19 | .50 |
| | July 31, 2000 | .15 | .09 | .94 | -.19 | .49 |
| July 24, 2000 | May 22, 2000 | .10 | .09 | .99 | -.24 | .44 |
| | May 29,2000 | .21 | .09 | .65 | -.13 | .55 |
| | June 5, 2000 | .19 | .09 | .78 | -.15 | .53 |
| | June 19, 2000 | .05 | .09 | 1.00 | -.29 | .39 |
| | June 26, 2000 | .14 | .09 | .96 | -.20 | .48 |
| | July 3, 2000 | .11 | .09 | .99 | -.24 | .45 |
| | July 17, 2000 | -.15 | .09 | .93 | -.50 | .19 |
| | July 31, 2000 | -.04 | .09 | 1.00 | -.35 | .34 |
| July 31, 2000 | May 22, 2000 | .11 | .09 | .99 | -.23 | .45 |
| | May 29,2000 | .21 | .09 | .63 | -.13 | .55 |
| | June 5, 2000 | .19 | .09 | .76 | -.15 | .53 |
| | June 19, 2000 | .05 | .09 | 1.00 | -.29 | .40 |
| | June 26, 2000 | .14 | .09 | .95 | -.20 | .48 |
| | July 3, 2000 | .11 | .09 | .99 | -.23 | .45 |
| | July 17, 2000 | -.15 | .09 | .94 | -.49 | .20 |
| | July 24, 2000 | .04 | .09 | 1.00 | -.34 | .35 |

a Computed using alpha = .05

b R Squared = .060 (Adjusted R Squared = .054)

LSD

Production Week Dependent Variable: Mold Productivity

| (I) Production Week | (J) Production Week | Mean Difference (I-J) | Std. Error | Sig | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| May 22, 2000 | May 29,2000 | .16 | .09 | .22 | -.06 | .27 |
| | June 5, 2000 | .08 | .09 | .33 | -.09 | .25 |
| | June 19, 2000 | -.05 | .09 | .53 | -.22 | .12 |
| | June 26, 2000 | .03 | .09 | .68 | -.13 | .20 |
| | July 3, 2000 | .02 | .09 | .98 | -.17 | .17 |
| | July 17, 2000 | -.26 (*) | .09 | .003 | -.43 | -.09 |
| | July 24, 2000 | -.10 | .09 | .23 | -.27 | .07 |
| | July 31, 2000 | -.11 | .09 | .21 | -.28 | .06 |
| May 29,2000 | May 22, 2000 | -.11 | .09 | .22 | -.27 | .06 |
| | June 5, 2000 | -.02 | .09 | .80 | -.19 | .15 |
| | June 19, 2000 | -.16 | .09 | .06 | -.33 | .01 |
| | June 26, 2000 | -.07 | .09 | .41 | -.24 | .10 |
| | July 3, 2000 | -.10 | .09 | .23 | -.27 | .06 |
| | July 17, 2000 | -.36 (*) | .09 | .000 | -.53 | -.19 |
| | July 24, 2000 | -.21 (*) | .09 | .02 | -.38 | -.04 |
| | July 31, 2000 | -.21 (*) | .09 | .01 | -.38 | -.04 |
| June 5, 2000 | May 22, 2000 | -.08 | .09 | .33 | -.25 | .08 |
| | May 29,2000 | .02 | .09 | .80 | -.15 | .19 |
| | June 19, 2000 | -.14 | .09 | .11 | -.35 | .03 |
| | June 26, 2000 | -.05 | .09 | .57 | -.22 | .12 |
| | July 3, 2000 | -.08 | .09 | .34 | -.25 | .09 |
| | July 17, 2000 | -.34 (*) | .09 | <.00 | -.51 | -.17 |
| | July 24, 2000 | -.19 (*) | .09 | .03 | -.36 | -.02 |
| | July 31, 2000 | -.19 (*) | .09 | .03 | -.36 | -.02 |
| June 19, 2000 | May 22, 2000 | .05 | .09 | .53 | -.12 | .22 |
| | May 29,2000 | .16 | .09 | .06 | -.01 | .33 |
| | June 5, 2000 | .14 | .09 | .11 | -.03 | .31 |
| | June 26, 2000 | .09 | .09 | .30 | -.08 | .26 |
| | July 3, 2000 | .06 | .09 | .52 | -.11 | .22 |
| | July 17, 2000 | -.20 (*) | .09 | .02 | -.37 | -.03 |
| | July 24, 2000 | -.05 | .09 | .56 | -.22 | .12 |
| | July 31, 2000 | -.05 | .09 | .53 | -.22 | .12 |
| June 26, 2000 | May 22, 2000 | -.04 | .09 | .68 | -.20 | .13 |
| | May 29,2000 | .07 | .09 | .41 | -.10 | .24 |
| | June 5, 2000 | .05 | .09 | .57 | -.12 | .22 |
| | June 19, 2000 | -.09 | .09 | .30 | -.26 | .08 |
| | July 3, 2000 | -.04 | .09 | .70 | -.20 | .14 |
| | July 17, 2000 | -.29 (*) | .09 | <.01 | -.46 | -.13 |
| | July 24, 2000 | -.14 | .09 | .11 | -.31 | .03 |
| | July 31, 2000 | -.14 | .09 | .10 | -.31 | .03 |

| | | | | | | |
|---|---|---|---|---|---|---|
| July 3, 2000 | May 22, 2000 | -.02 | .09 | 1.00 | -.17 | .17 |
| | May 29,2000 | .10 | .09 | .23 | -.06 | .27 |
| | June 5, 2000 | .08 | .09 | .34 | -.08 | .25 |
| | June 19, 2000 | -.05 | .09 | .52 | -.22 | .11 |
| | June 26, 2000 | .03 | .09 | .70 | -.14 | .20 |
| | July 17, 2000 | -.26 (*) | .09 | <.01 | -.43 | -.10 |
| | July 24, 2000 | -.11 | .09 | .22 | -.28 | .06 |
| | July 31, 2000 | -.11 | .09 | .20 | -.28 | .06 |
| July 17, 2000 | May 22, 2000 | .26 (*) | .09 | <.01 | .09 | .43 |
| | May 29,2000 | .36 (*) | .09 | <.01 | .19 | .53 |
| | June 5, 2000 | .34 (*) | .09 | <.01 | .17 | .51 |
| | June 19, 2000 | .2033(*) | .09 | .02 | .03 | .37 |
| | June 26, 2000 | .29 (*) | .09 | <.01 | .12 | .46 |
| | July 3, 2000 | .26 (*) | .09 | <.01 | .08 | .43 |
| | July 24, 2000 | .15 | .09 | .08 | -.17 | .32 |
| | July 31, 2000 | .15 | .09 | .09 | -.02 | .32 |
| July 24, 2000 | May 22, 2000 | .10 | .09 | .23 | -.07 | .27 |
| | May 29,2000 | .21 (*) | .09 | .02 | .04 | .38 |
| | June 5, 2000 | .19 (*) | .09 | .03 | .02 | .36 |
| | June 19, 2000 | .05 | .09 | .56 | -.12 | .22 |
| | June 26, 2000 | .14 | .09 | .11 | -.03 | .31 |
| | July 3, 2000 | .11 | .09 | .22 | -.06 | .28 |
| | July 17, 2000 | -.15 | .09 | .08 | -.32 | .02 |
| | July 31, 2000 | -.04 | .09 | .97 | -.17 | .17 |
| July 31, 2000 | May 22, 2000 | .11 | .09 | .21 | -.06 | .28 |
| | May 29,2000 | .21 (*) | .09 | .01 | .04 | .38 |
| | June 5, 2000 | .19 (*) | .09 | .03 | .02 | .36 |
| | June 19, 2000 | .05 | .09 | .53 | -.12 | .22 |
| | June 26, 2000 | .14 | .09 | .10 | -.03 | .31 |
| | July 3, 2000 | .11 | .09 | .20 | -.06 | .28 |
| | July 17, 2000 | -.15 | .09 | .09 | -.32 | .02 |
| | July 24, 2000 | .04 | .09 | .97 | -.17 | .17 |

a Computed using alpha = .05

b R Squared = .060 (Adjusted R Squared = .054)

Correlations Pre-treatment LAI/LEI Scores

Descriptive Statistics

| | Mean | Std. Error | N |
|---|---|---|---|
| Pre-Training LAI (Groups 1,2 & 4) | 4.53 | .63 | 32 |
| Pre-Training LEI (Groups 1, 2 &4) | 3.64 | .88 | 32 |

Correlations Pre-treatment LAI/LEI Scores

| | | Pre-treatment LAI (Groups 1,2 & 4) | Pre-treatment LEI (Groups 1, 2 &4) |
|---|---|---|---|
| Pre-treatment LAI (Groups 1,2 & 4) | Pearson Correlation | 1.00 | .78 (**) |
| | Sig. (2-tailed) | | <.01 |
| | Sum of Squares and Cross-products | 12.36 | 13.37 |
| | Covariance | .40 | .43 |
| | N | 32 | 32 |
| Pre-treatment LEI (Groups 1, 2 &4) | Pearson Correlation | .78 (**) | 1.00 |
| | Sig. (2-tailed) | <.01 | |
| | Sum of Squares and Cross-products | 13.37 | 24.01 |
| | Covariance | .43 | .78 |
| | N | 32 | 32 |

** Correlation is significant at the 0.01 level (2-tailed).

Correlations Post-treatment LAI/LEI Scores

Descriptive Statistics

| | Mean | Std. Error | N |
|---|---|---|---|
| Post-treatment LAI (All Groups) | 4.58 | .64 | 32 |
| Post-treatment LEI (All Groups) | 3.90 | .80 | 32 |

Correlations Pre-treatment LAI/LEI Scores

| Pre-treatment LAI (Groups 1,2 & 4) | | Pre-treatment LAI (Groups 1,2 & 4) | Pre-treatment LEI (Groups 1, 2 &4) |
|---|---|---|---|
| | Pearson Correlation | 1.00 | .78 (**) |
| | Sig. (2-tailed) | | <.01 |
| | Sum of Squares and Cross-products | 12.36 | 13.37 |
| | Covariance | .40 | .43 |
| | N | 32 | 32 |
| Pre-treatment LEI (Groups 1, 2 &4) | Pearson Correlation | .78 (**) | 1.00 |
| | Sig. (2-tailed) | <.01 | |
| | Sum of Squares and Cross-products | 13.37 | 24.01 |
| | Covariance | .43 | .78 |
| | N | 32 | 32 |

** Correlation is significant at the 0.01 level (2-tailed).

Correlations Post-treatment LAI/LEI Scores

| Post-treatment LAI (Groups 1,2 & 4) | | Post-treatment LAI (Groups 1,2 & 4) | Post-treatment LEI (Groups 1, 2 &4) |
|---|---|---|---|
| | Pearson Correlation | 1.00 | .88 (**) |
| | Sig. (2-tailed) | | <.01 |
| | Sum of Squares and Cross-products | 14.25 | 15.63 |
| | Covariance | .41 | .45 |
| | N | 36 | 36 |
| Post-treatment LEI (Groups 1, 2 &4) | Pearson Correlation | .88 (**) | 1.00 |
| | Sig. (2-tailed) | <.01 | |
| | Sum of Squares and Cross-products | 15.63 | 22.29 |
| | Covariance | .45 | .64 |
| | N | 36 | 36 |

** Correlation is significant at the 0.01 level (2-tailed).

Univariate Analysis Of Variance Of Change In LAI Scores Based On Gender

Descriptive Statistics Dependent Variable: Mold Productivity

| Gender | Mean | Std. Deviation | N |
|---|---|---|---|
| Male | 1.03 | .11 | 18 |
| Female | .97 | .12 | 13 |
| Total | 1.00 | .12 | 31 |

Tests of Between-Subjects Effects Dependent Variable: Change in LAI scores

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Eta Squared | Noncent. Parameter | Observed Power(a) | $F_{crit}$ |
|---|---|---|---|---|---|---|---|---|---|
| Corrected Model | .03 (b) | 1 | .03 | 2.25 | .15 | .07 | 2.25 | .31 | 4.17 |
| Intercept | 29.96 | 1 | 29.96 | 2290.70 | <.01 | .99 | 2290.70 | 1.00 | |
| GENDER | .03 | 1 | .03 | 2.25 | .15 | .07 | 2.25 | .31 | |
| Error | .38 | 29 | .01 | | | | | | |
| Total | 31.48 | 31 | | | | | | | |
| Corrected Total | .41 | 30 | | | | | | | |

a Computed using alpha = .05
b R Squared = .07 (Adjusted R Squared = .04)

Mold Productivity by Gender Dependent Variable: Mold Productivity

| Gender | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|
| | | | Lower Bound | Upper Bound |
| Male | 1.09 | .06 | .97 | 1.22 |
| Female | 1.35 | .06 | 1.22 | 1.47 |

Mold Productivity by Gender Dependent Variable: Change in LAI scores

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Eta Squared | Noncent. Parameter | Observed Power(a) | $F_{crit}$ (1,60) |
|---|---|---|---|---|---|---|---|---|---|
| Corrected Model | 1.68 (b) | 1 | 1.68 | 8.02 | .01 | .07 | 8.02 | .80 | 7.08 |
| Intercept | 156.01 | 1 | 156.01 | 743.67 | <.01 | .88 | 2290.70 | 1.00 | |
| GENDER | 1.68 | 1 | 1.68 | 8.02 | .01 | .07 | 8.02 | .801 | |
| Error | 21.62 | 103 | .21 | | | | | | |
| Total | 178.50 | 105 | | | | | | | |
| Corrected Total | 23.29 | 104 | | | | | | | |

a Computed using alpha = .05
b R Squared = .07 (Adjusted R Squared = .06)

# BIBLIOGRAPHY

Barling, J., Weber, T. & Kelloway, E. K. (1996). Effects of transformational leadership training on attitudinal and financial outcomes: a field experiment. Journal of Applied Psychology, 81, (6): 827-832.

Bass, B. M. (1990). Bass & Stogdill's handbook of leadership: Theory, research & managerial applications (3rd ed.). New York: Free Press.

Block, P. (1996). Stewardship: Choosing service over self-interest. San Francisco: Berrett-Koehler Publishers.

Brocksmith, J. G., Jr. (1997). Passing the baton: Preparing tomorrow's leaders. In F. Hesselbein, M. Goldsmith, & R. Beckhard (Eds.), The organization of the future (pp. 251-258).

Budget of the United States Government, Fiscal Year 1999. Available http://www.access.gpo.gov/su_docs/budget99/

Campbell, D. T. & Stanley, J. C. (1963). Experimental and quasi-experimental designs for research. Chicago: Rand McNally College Publishing.

Capp, G. R., Capp, C. C., & Capp, G. R., Jr. (1990). Basic oral communication (5th ed.). Englewood Cliffs, NJ: Prentice Hall.

Carr-Ruffino, N. (1996). Managing diversity: People skills for a multicultural workplace. Thompson Executive Press.

Covey, S. R. (1989). The seven habits of highly effective people. New York: Simon and Schuster.

Dillon, K. & Macht, J. (1998, April). The few, the proud, the CEOs. Inc., 20, (5): 60.

Drucker, Peter F. (1998, October 5). Management's new paradigms. Forbes, 162, (7):152-177.

Eastburn, R. A. (1987). Management development. In R. L. Craig (Ed.) Training and development handbook: A guide to human resource development (3rd edition) (pp. 580-598). McGraw-Hill: New York.

Finegan, J. (1995, March). Ready, aim, focus. Inc., 19, (3): 44-55.

Gall, M., Borg, W. & Gall, J. (1996). Educational research: An introduction (6th ed.). White Plains, NY: Longman Publishers.

Goldsmith, M. (1997). Retaining your top performers. In F. Hesselbein, M. Goldsmith, & R. Beckhard (Eds.), The organization of the future (pp. 259-263).

Hammer, M. & Champy, J. (1993). Reengineering the corporation: A manifesto for business revolution. New York: HarperCollins.

Hersey, P., Blanchard, D. E., & Johnson, D. E. (1996). Management of organizational behavior: Utilizing human resources (7th ed.). Upper Saddle River, NJ: Prentice Hall.

IIE Solutions. (1999, March). Leadership skills make a difference on the line. IIE Solutions, 31, (3): 16.

Ishchenko, S. (1998, May 27). Turning out officers like hotcakes. Current Digest of the Soviet Press, 50, (17): 18-19.

Johnson, J. R. (1998). Embracing change: a leadership model for the learning organization. International Journal of Training and Development, 2, (2): 141-150.

Johnston, W. B. and Packer, A. E. (1987). Workforce 2000: Work and workers for the 21st century. Indianapolis, IN: Hudson Institute.

Kapp, K. M. (1999). Transforming your manufacturing organization into a learning organization. Hospital Material Management Quarterly, 20, (4): 46-54.

McGill, M. E. & Slocum, J. W. Jr. (1995). Executive development in learning organizations. American Journal of Management Development, 1,(2): 23-30.

Miller, D. (1997). The future organization: A chameleon in all its glory. In F. Hesselbein, M. Goldsmith, & R. Beckhard (Eds.), The organization of the future (pp. 119-125). San Francisco: Jossey-Bass.

Mohrman, S. A., Cohen, S. G. & Mohrman, A. M., Jr. (1995). Designing team-based organizations. San Francisco: Jossey-Bass.

Moss, J., Johansen, B. C. & Preskill, H. (1991). Developing the leadership attributes inventory: An odyssey. Journal of Industrial Teacher Education, 28, (2): 7-22.

Moss, J., Lambrecht, J. J., Jensrud, Q. & Finch, C. R. (1994). Leadership Attributes Inventory manual, Macomb, IL: National Center for Research in Vocational Education Materials Distribution Service Western Illinois University.

Northouse, P. G. (1997). Leadership; theory and practice, Sage Publications: Thousand Oaks, CA.

Phillips, J. J. (1997). Handbook of training evaluation and measurement methods (3rd edition). Houston, TX: Gulf Publishing.

Reimer, D. J. (1998, January). Developing great leaders in turbulent times. Military Review, 78, (1): 5-12.

Reiner, C. A. & Morris, H. (1987). Leadership development. In R. L. Craig (ed.) Training and development handbook: A guide to human resource development (3rd edition) (pp. 519-536). McGraw-Hill: New York.

Robbins, S. P. (1993). Organizational behavior: Concepts, controversies and applications. Englewood Cliffs, N.J.: Prentice Hall.

Rosen, R. H. (1997). Learning to Lead. In F. Hesselbein, M. Goldsmith, & R. Beckhard (Eds.), The organization of the future (pp. 303-312). San Francisco: Jossey-Bass.

Senge, Peter M. (1999). Beyond the bottleneck. Executive Excellence, 16, (5): 20.

Shea, G. F. (1994). Mentoring: Helping employees reach their full potential. New York: American Management Association Membership Publications Division.

Sherman, S. (1995, November 27). How tomorrow's leaders are learning their stuff. Fortune, 132, (11), 90-102.

Smart, S. (1997). Leadership training can improve sales. Worklife Report, 10, (3): 13.

Sogunro, O. A. (1997). Impact of training on leadership development: lessons from a leadership training program. Evaluation Review, 21, (6): 713-737.

Statistical Package for the Social Sciences (1998). SPSS® 8.02 for Windows® graduate pack. Chicago: Author. License number 3390994.

Training. (1998, March). Measuring training's contribution to intellectual capital. Training, 35, (3): 14-15.

Training. (1998, October). Industry Report 1998. Training, 35, (10): 43-56.

Training and Development. (1995, August). Developing leaders. Training and Development, 49, (8): 13.

Wellins, R. S., Byham, W. C. & Wilson, J. M. (1991). Empowered teams: Creating self-directed work groups that improve quality, productivity and participation. San Francisco: Jossey-Bass.

Wellins, R. S. & Murphy, J. S. (1995, January). Reengineering: Plug into the human factor. Training and Development, 49, (8): 33-37.