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The University of Southern Mississippi

AN ASSESSMENT OF A JUST-IN-TIME TRAINING INTERVENTION IN A
MANUFACTURING ORGANIZATION

by

Barry James Wilkie

Abstract of a Dissertation
Submitted to the Graduate School
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

December 2013

ABSTRACT

AN ASSESSMENT OF A JUST-IN-TIME TRAINING INTERVENTION IN A MANUFACTURING ORGANIZATION

by Barry James Wilkie

December 2013

High Performance Work Practices (HPWP) is part of an area of human resource systems growing in interest among performance improvement experts. This research paper assesses the degree to which job-training-intervention programs, a type of HPWP, contribute to organizational performance in a manufacturing environment. The literature review reveals that while there is a growing body of evidence supporting an association between HPWP and organizational performance, limited research exists on the association. This research provides a literature review of previous studies, which show different ways that HPWP help to achieve the optimization of employees' skill sets. The relationship between one type of high performance work practice, Just-in-Time Training (JITT), and its effect on employees' performance is the primary focus.

The purpose of the study was to explore the effect of JITT on job performance in a manufacturing organization. The researcher conducted the study in a manufacturing organization located on the central Gulf Coast of the U.S. and employed a quasi-experimental cohort control group design with nonequivalent groups (Shadish, Cook, & Campbell, 2002) to explore the effectiveness of JITT at the subject company. The researcher employed a mixed method approach, including a cohort control group comparison for the quantitative phase of the research and a focus group for the qualitative phase of the research. The researcher collected error rate data from the company's

database and compared the error rates of JITT and control groups of cohorts by type of error made as well as by work station. Through analysis of the proportion of errors made by the control and JITT groups of cohorts, this dissertation investigated the effects of Just-in-Time Training on job performance. This study found that groups of employees receiving JITT would have statistically significant improvements in job performance, as measured by proportion of manufacturing error rates when compared to groups of employees receiving regularly scheduled training.

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CHAPTER I

INTRODUCTION

Manufacturing industries in the twenty-first century face ever-increasing competition in a rapidly changing world. Many factors such as globalization, technological innovations, and deregulation eliminate competitive barriers among manufacturing companies. Friedman (2007) refers to this phenomenon as the flattening of the world. Organizations must rethink acquisition of competitive advantage as success depends on the ability to continually improve performance by reducing costs, improving products and processes, improving quality and productivity, and reducing the amount of time it takes to move a product to market (Luthans & Sommer, 2005).

Although one in six United States private-sector jobs is directly linked to manufacturing, the industry suffered declines in the 2000s and many companies went out of business. The United States' share of worldwide manufacturing value dropped from 26 percent in 1998 to less than 20 percent in 2007. The United States has transitioned from a net exporter of manufactured goods in the 1960s to a net importer in the 2000s (Ettlinger & Gordon, 2012). Manufacturing as a share of U.S. gross domestic product (GDP) declined from more than 15 percent in 1998 to 11 percent in 2009 (Bloom, 2011). According to the United States Department of Labor (DOL, 2012), jobs in manufacturing declined from 17.6 million in January 1998 to 11.5 million in January 2010. Manufacturing lost 3 million jobs during its most recent downturn (August 2004 to February 2010) and through December 2012 had only recovered 491,000 of them. Although the manufacturing sector has steadily gained jobs since 2010, its share of total employment is down from 16.8 percent in 1998 to 10.8 percent in 2012 (DOL, 2012). The trends matter because manufacturing provides stable, middle-class jobs and propels

United States leadership in technology and innovation, which is critical to economic growth and vitality, essential to balancing the trade deficit, and necessary for the nation's long-term national security (Ettliger & Gordon, 2012).

One approach manufacturing organizations use to gain a competitive advantage is through the effective management of human resources, which is increasingly viewed as a vital means of influencing organizational performance. The Human Resource Management (HRM) approach suggests that an investment and improvement in the capabilities of an organization's members will result in a source of sustained competitive advantage to the organization (Combs, Yongmei, Hall, & Ketchen, 2006). Improving the capabilities of an organization's human capital generates increased knowledge, motivation, synergy, and commitment (Luthans & Sommer, 2005).

According to Sung and Ashton (2005), high performance work practices (HPWP) are a type of HRM approach that focus on developing a high performance workforce by linking strategy and skills to performance outcomes. High Performance Work Practices include skills development to increase productivity (Datta, Guthrie, & Wright, 2005) and may include practices that enhance and align the involvement and development of employees with business processes and organizational goals (Combs et al., 2006). Rapid change in the world creates a faster working pace in most organizations (Jones, 2001). One of the most prominent aspects of the rapid rate of change in the work environment is the need to have immediate access to information when and where needed (Jones, 2001). From increased and emerging changes in organizations evolves the concept of *Just-in-Time Training* (Jones, 2001).

Just-in-Time Training (JITT) is a term widely used but with no generally agreed-upon definition. The term is often used to describe a unique form of planned training

delivered on the job (Jones, 2001). Expressions such as *just-in-time knowledge* or *delivering the right knowledge at the right time* are often used to describe JITT. The Just-in-Time Training concept describes the group of training approaches and media that present a defined set of information, most of the time on the job, to be used by employees immediately following training (Jones, 2001; Kopp & Burkle, 2010). This definition suggests three key points about JITT.

First, similar to other planned training programs, Just-in-Time Training requires the same attention to the design process (Jacobs & Jones, 1995; Jones, 2001). Second, the definition suggests that the training will include only the information necessary to perform at a particular point in time and at a specific location (Kopp & Burkle, 2010). It is this feature of Just-in-Time Training that makes clear the relationship with Just-in-Time (JIT). Information is provided to the worker at the time of need and not any sooner (Jones, 2001; Kopp & Burkle, 2010). The JITT is a relatively short unit of instruction with defined boundaries. Just-in-Time Training assumes that in the course of doing work, the employee realizes that he cannot complete the work because of a lack of competence in which a training program is provided at that exact point in time to address the need (Jones, 2001; Kopp & Burkle, 2010). It is conceivable that other training approaches or even a job performance guide (Gery, 1991) may also be used to address the issues of timing and location. However, Just-in-Time Training is designed specifically for use when job performance suffers because of a lack of competence (Burkle & Meredith, 2008; Derek, 2006; Jones, 2001). Such emphasis is a major part of the uniqueness of JITT. Specific performance issues can be addressed strategically, without unnecessary information. Finally, the definition suggests that JITT can combine differing training approaches and training media. For instance, in terms of training approaches, JITT may

use a self-paced or a trainer-driven approach. In terms of training media, JITT may use printed text materials, visual media, or electronic devices to deliver the training.

The advantages of Just-in-Time Training include eliminating the need for refresher training due to subject knowledge loss experienced if training precedes use over an extended period of time. The JITT prevents decay if the learner cannot use the material upon returning to the job. Research shows that 70% of the information learned in training courses is forgotten by the time the student needs it (Burkle & Meredith, 2008). Another advantage of JITT is that it prevents wasting training on employees who leave the job before the training they received is used on the job (Burkle & Meredith, 2008). The JITT also allows the personnel to receive training on demand, not weeks or months later. To be considered Just-in-Time Training, the personnel must receive JITT when they need it or right before performing the work tasks (Burkle & Meredith, 2008; Jones, 2001).

The immediate purpose of JITT is to support and enhance users' performance by providing the knowledge required by the task performed at the time the employee actually performs the task (Jones, 2001). This knowledge can be explicit, as in the case of information retrieved from a database and delivered to the user. It can also be implicit, such as knowledge considered when designing a graphical user-training curriculum that guides the users efficiently through the task performed.

Thus, JITT knowledge delivery takes place as soon as a user needs to apply it to the appropriate situation and just prior to use so that the user does not have to go through training unless there is an immediate need for the skills. The JITT concept targets only the skills and information needed in the near future and eliminates overloading the employees with too much information before it is needed. This is a major paradigm shift

for training organizations. A JITT intervention requires a logically designed approach that ensures personnel are properly trained and assessed in processes and procedures just prior to needing to use specific skills. It is expected that the JITT approach will significantly change the expertise of employees and substantially affect the performance of the company (Jones, 2001).

Background of the Study

In order to compete for and prevent the loss of contracts, manufacturing organizations must continually improve performance through human capital. Ensuring recently acquired skills are used in the workplace or transferred to the job is critical for an organization's success. Organizations remain competitive by developing the knowledge, skills and capabilities of employees to ensure efficient operations. Formal employee training typically involves learning new knowledge, skills, attitudes, or other characteristics in one environment (the training situation) that can be applied or used in another environment (the performance situation) (Goldstein & Ford, 2002). Presumably, what is learned in training should be applied to performance on the job. However, a common experience is that employee learning from a formal training program is not applied on the job (Baldwin & Ford, 1988; Saks, 2002). Baldwin and Ford (1988) note estimates that suggest only 10% of training outcomes are transferred back to the job. Saks' (2002) survey data suggest about 40% of trainees fail to transfer skills to the job immediately after training, 70% falter in training transfer one year after training, and ultimately only 50% of training investments result in organizational or individual improvements.

Scrap learning, defined as training which is successfully delivered but not applied on the job, results in high costs (King, 2011). When employees cannot put what they

learn in training into practice, it is a wasted effort in both time and money. Skill Soft's Kieran King (2011) explains, "The failure of learning transfer costs companies millions of dollars a year in wasted expenditures and probably several times that in lost opportunities," (p. 1). Brinkerhoff (2011), an expert in training evaluation, estimates that scrap learning rates could be as high as 50%-80% of all training delivered.

With reported annual training investments exceeding \$55.8 billion in the United States (Industry Report, 2012), the amount of dollars wasted by non-transfer can be staggering. When addressing this issue, a general problem exists as training of adult learners continues to challenge training organizations. Researchers recognize adult learners have specific learning needs and expectations (Holton, 2005; Knowles, 1970, 1980; Swanson & Holton, 2009).

The issue of carry-over from training to the performance situation is referred to as the transfer of training problem. Baldwin and Ford (1988) define the positive transfer of training "as the degree to which trainees effectively apply the knowledge, skills and attitudes gained in a training context to the job" (p. 63). Understanding the dynamics of training transfer helps the practitioner look for ways to minimize transfer losses and improve the yield from a training program (Burke & Hutchins, 2008). Estimates vary widely regarding the exact extent of the training transfer problem. Since Baldwin and Ford's (1988) widely recognized review of the transfer problem in training literature, researchers have focused on how to close the gap between learning and sustained workplace performance. Experts estimate that between 70% and 90% of training dollars are wasted each year because no matter the quality of the instruction, it is rare to find employees consistently applying learning from training back on the job (Coates, 2007; Mattox, 2011). Given the estimates, it is clear that learning investments continue to yield

deficient results, making training transfer a core issue for designing interventions that support individual, team, and organizational performance (Yamhill & McLean, 2005).

One method researchers have used to close the gap between learning and sustained workplace performance is to study the relationship between HPWP and organizational performance. A review of theoretical literature indicates HPWP could provide a significant contribution to an organization's performance on multiple levels (Boxall & Purcell, 2008; Lepak, Liao, Chung, & Harden, 2006) and influence the skills and knowledge of individual employees, willingness and motivation to work, and opportunities to perform work (Boxall & Macky, 2009). The theoretical foundation in both strategy and organizational economics literature is consistent with the idea that an organization's HPWP system is a source of competitive advantage (Becker & Huselid, 1998; Combs et al., 2006; Datta et al., 2005). Human resource strategies can be an essential source of competitive advantage when they are deeply embedded within an organization (Boxall & Macky, 2009).

High Performance Work Practices are one of the most studied methods for solving organizational performance problems, such as increasing an employee's knowledge, skills, and abilities (KSA) by transferring learning (Combs et al., 2006). However, HPWP remains one of the greatest challenges in performance optimization in the workplace. Solving performance problems with HPWP remains a difficult task due to the widely varying characteristics of each organization (Combs et al., 2006; Huselid & Becker, 2011; Wright et al., 2003). Researchers' results have varied dramatically, making the size of the overall effect on organizational performance difficult to estimate (Combs et al., 2006).

High Performance Work Practices have been researched and discussed since Huselid's (1995) study linking HPWP to organizational performance (Boxall & Macky, 2009). Study findings report a statistically significant relationship exists between organizational competitiveness and HPWP, if effectively implemented (Combs et al., 2006). Conversely, criticisms of the research methodologies exist. Mixed evidence to support Huselid's (1995) findings (Combs et al., 2006) and uncertainty on how to effectively adopt HPWP are reported in the literature (Burke & Hutchins, 2007). Links between practices and outcomes currently remain in a *black box* (Becker & Huselid 2006; Boxall & Macky, 2009; Wright, Gardner, & Moynihan, 2003) with theoretical and empirical gaps (Luthans & Sommer, 2005). In this usage of the term, *black box* describes the relationship between HPWP and the outcomes as known, but the relationship between HPWP and internal working structure is not well understood.

According to Burke and Hutchins (2008), best practices' reports for training transfer are limited and often anecdotal. Performance improvement practices, such as the JITT intervention used in the current study, can be considered fad-driven, and can have inconsistent results (Bing, Kehrhahn, & Short, 2003). In order to result in a positive outcome, the HPWP system must be sufficiently aligned and embedded within the organization in order to be considered a unique source of competitive advantage. The more effective systems of HPWP utilize complementary and synergistic practices as sources of sustained competitive advantage. However, only limited empirical evidence exists supporting this notion (Burke & Hutchins, 2008). This study focuses on how JITT interventions affect employees' performance in a manufacturing organization.

Statement of the Problem

Just-in-Time Training focuses on solving transfer of training problems, which many organizations and industries face (Dreikorn, 2007; Holton, 2005; King, 2011). The JITT approach allows employees to regularly focus on a specific training requirement in order to learn a new skill or to increase competency in an infrequently used skill. Learners quickly acquire a working knowledge of the methods and processes required to perform job functions, which are performed immediately after receiving the training (Jones, 2001).

According to previous research, trainees who fail to transfer trained skills to the job immediately after training lose a high percentage of skills. According to Saks' (2002) survey data, 70% of employees falter in training transfer within one year after training, and only 50% of training expenditures result in organizational or individual improvements. As a result, in order for adult learners to become highly skilled in the workplace, they must put recently acquired training information into practice quickly (Beavers, 2009; Leal, 2009).

Further, a specific problem that exists at some manufacturing companies involves the design and delivery of JITT instructional material that provides employees with the learning experience needed to effectively perform tasks without remedial training. Previously, researchers focused on how to improve training transfer and how to decrease the gap between learning and sustainable workplace performance (Brinkerhoff, 2005, 2011; Burke & Hutchins, 2007, 2008; Mattox, 2011). Factors that influence training transfer include: 1) learner characteristics; 2) training design and delivery activities; 3) the work environment (Alvarez, Salas, & Garofano, 2004; Burke & Hutchins, 2008); 4) Motivation to learn (Holton, 2005); 5) motivation to transfer (Mathieu, Tannenbaum, &

Salas, 1992; Patrick, 1992; Tracey et al., 1995); individual characteristics (Mathieu et al., 1992; Mumford et al., 1988; Noe, 1986; Tracey et al., 2001; Warr & Bunce, 1995); 6) Organizational factors (Holton, Bates, & Ruona, 2000; Holton, 2005); 7) Stakeholders (i.e., trainers, trainees, supervisors); and 8) Periods before, during, and after interventions (Broad, 2005).

Unfortunately, best practices for the transfer of training are often limited, dated, or anecdotal in nature. The American Society for Training and Development (ASTD) compile best practice data. In ASTD's Best Practice Series, Carnevale et al. (1990), present checklists and examples of workplace training basics, including the purpose, use, and rationale for training evaluation. In her book, Chan (2010) also provides lists and guidelines of essential training basics and describes the foundational competencies in ASTD's Competency Model for Learning and Development. Although guidelines for measuring behavioral change exist, training transfer is given minimal attention. The concept of JITT has emerged as a way to meet rapidly changing training needs by having training provided just prior to use. Just-in-Time Training should result in improved job performance and other positive changes, including a decrease in manufacturing errors, yet JITT is often overlooked as a viable performance intervention to produce effective learning and reduce training and production costs.

Purpose of the Study

The purpose of this research is to explore the effect of JITT on job performance in a manufacturing organization. The importance of this research includes understanding the: 1) effectiveness of JITT; 2) ways it is used; and 3) role it plays in providing solutions to organizational performance problems. In the current study, the researcher examines the relationship between JITT and performance outcomes in order to determine the: 1)

effectiveness of JITT as a method for supporting training transfer in a manufacturing organization, 2) effect of JITT on employees' performance outcomes, and 3) JITT's usefulness in bolstering training transfer.

Significance of the Study

The study will help determine how JITT transfer strategies can be used in a manufacturing setting and if they have a significant impact on training outcomes. The results may help to determine if JITT is more effective in training transfer than traditional training. Measuring training transfer is a topic of interest to many contemporary training professionals (Bersin, 2006). According to Phillips (2012), an important trend in the Human Resource Development field exists: a move toward more relevant programs whose impact and results are monitored, evaluated, and reported. It is becoming increasingly necessary to hold trainees, supervisors, and trainers accountable for transfer (Kopp, 2006; Longnecker, 2004). Bersin (2006) reports training measurement best practices from a survey of 140 companies. Bersin found that organizations spend only about 2.6% of the total training budget on evaluation and that organizations continue to struggle with how to practically determine the value of training. Training costs and outcomes clearly have an impact on an organization's fiscal results (Bersin, 2006; Kopp, 2006; Longnecker, 2004; Phillips, 2012).

Leaders continue to search for processes to enhance abilities to manage the fiscal operations of a company (Lee & Ahn, 2008; Hiles, 2009). Identification of training costs and management's ability to reduce these costs by applying JITT methods can allow management to lower the total costs within the company. Just-in-Time Training is less expensive than other forms of training because it reduces the number of individuals trained by only targeting individuals who need training in a particular skill. Theoretically,

it is more efficient than other forms of training because it delivers the training just before it is needed; thereby, it reduces knowledge deterioration that results when skills are not immediately put to use after training. Thus, JITT is used to reduce costs in two ways: 1) by reducing training expenses; and 2) by reducing costs associated with production errors. With everything else being equal, reducing costs increases profit margin (Luthans & Sommer, 2005).

Limitations

As with any research, this study has limitations. It focuses on JITT conducted at a large manufacturing organization located in a single location in the Gulf Coast region of the United States. The study is limited to a large U.S. based global security company. Employees who work in one of the manufacturing departments in the company were selected and trained on manufacturing operations processes, which they are either unfamiliar with or have not used recently. A convenient sample consisting of individuals from the same department who have received JITT make up a JITT group. A previous cohort (i.e., a group of employees performing the same tasks but who did not have JITT) makes up a control group. Instructional design and delivery methods of face-to-face, instructor led training (ILT) is the independent variable (IV) examined in the study.

Due to a number of factors, which include the nature of the business and personnel requirements, there are three limitations in this study. The first limitation is a random assignment to both groups in the study will not be possible. However, the JITT and control groups are as nearly identical as possible. The second limitation involves the use of multiple instructors teaching the JITT courses. A third limitation of the study involves researcher inexperience with the focus group process. The study represents the first time the researcher utilizes focus groups. The focus group portion of the study may

have weaknesses that are attributed to the facilitator or the nature of the group discussions (NOAA, 2009). The nature of the group discussions may cause participant attitudes to become more extreme, which could either result in a greater unification of group opinions or could polarize participants' opinions. A skilled facilitator who uses adequate advance planning can lessen and eliminate some of these weaknesses (NOAA, 2009). The researcher made every effort to limit these issues.

Delimitations of Study

One delimitation of the study is that participants who work on day shift comprise most of the production personnel targeted in the study. Employees on different shifts are primarily support personnel (e.g., maintenance and security personnel) and will not be part of this study. The day shift employees will make up the study population. An endorsement and sponsorship by management will help to encourage completion of the research activities. Employees who know the process instructions for their next job assignment, but who have not performed this type of work recently, will require JITT prior to performing the process again.

Research Question and Hypothesis

The following research question guided the framework of the study: How does JITT affect transfer of training in a manufacturing setting? This question is evaluated using measurements of production-quality defect error rates in treatment and control groups. Quantitative analysis is followed up with a focus group comprised of the JITT group's management. The focus group's comments help provide insight and a deeper understanding of the quantitative results. The research question is assessed with the following hypothesis:

H₀₁: Groups of employees receiving JITT will have no statistically significant improvements in job performance, as measured by the proportion of manufacturing error rates compared to groups of employees receiving regularly scheduled training.

H₁₁: Groups of employees receiving JITT will have statistically significant improvements in job performance, as measured by the proportion of manufacturing error rates compared to groups of employees receiving regularly scheduled training.

Conceptual Framework

Based on an extensive literature review, a relationship may exist between Just-in-Time Training (Globerson & Korman, 2001; Jones, 2001), trainee's knowledge (Boxall & Macky, 2009; Burke & Hutchins, 2008; Luthans & Sommer, 2005); and JITT transfer to improvements in performance (Dreikorn, 2007; Holton, 2005). Existing conceptual frameworks describe factors that influence training transfer. They include: 1) motivation to learn (Holton, 2005); 2) motivation to transfer (Mathieu et al., 1992; Patrick, 1992; Tracey et al., 1995); 3) individual characteristics (Mathieu et al., 1992; Mumford et al., 1988; Noe, 1986; Tracey et al., 2001; Warr & Bunce, 1995); and 4) organizational factors (Holton, Bates, & Ruona, 2000; Holton, 2005).

The conceptual model of JITT presented in Figure 1, represents an effort to integrate potentially critical elements in JITT. Many of the factors shown in the model, as well as the indicated relationships, are derived from past research findings. For example, motivational influences on learning are studied extensively by Combs et al., (2006). A thorough validation and testing of applicability in the context of JITT is needed. For this reason, several factors affecting training are discussed.

The conceptual model of JITT incorporates six variables: 1) individual characteristics of the trainee; 2) organizational factors of the work environment; 3)

motivation to learn (i.e., pre-training motivation); 4) motivation to transfer (i.e., post-training motivation); 5) Just-in-Time Training, and 6) Just-in-Time Training transfers to improvements in error rates. Motivation to learn is a trainee's desire to learn the trained skills before and during the training. Motivation to transfer is the trainee's desire to transfer the learned skills back to the workplace after the training. Both variables are dependent on individual characteristics and organizational factors (Holton, 2005).

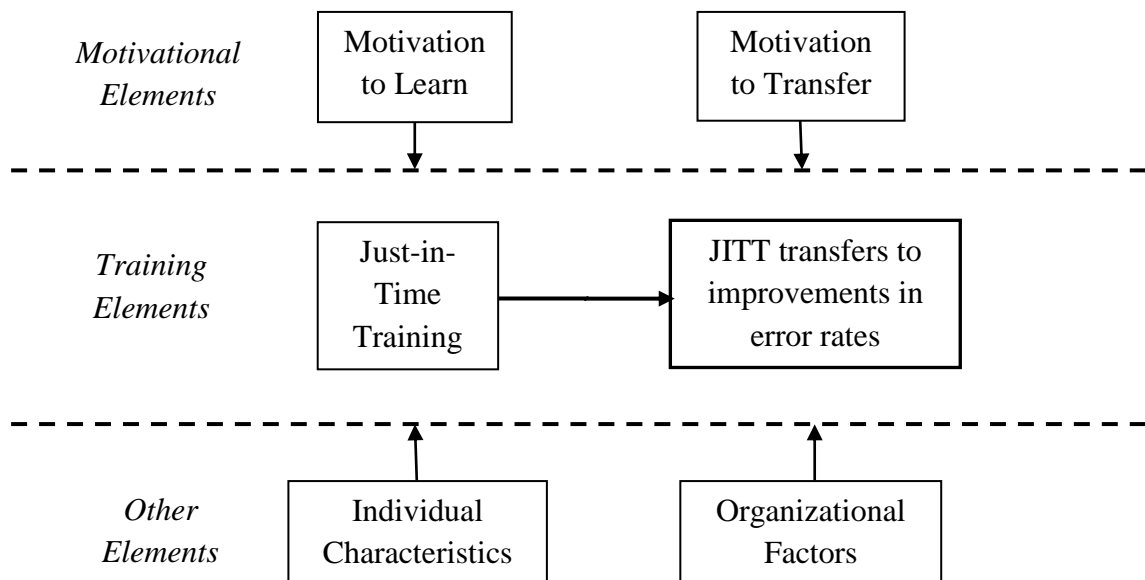


Figure 1. A Conceptual Model of Just-in-Time Training (JITT).

The conceptual model utilized is primarily concerned with performance. The more significant outcomes of Just-in-Time Training are JITT transfers to improvements in error rates. A JITT transfer to improvements in error rates indicates how the trainee has transferred the learned skills back to the workplace and whether or not job performance has improved. Improvements in error rates would indicate an improvement in individual job performance and organizational performance.

According to the literature review conducted by Burke and Hutchins (2007), certain intervention design and work environment topics largely hinge on anecdotal

support and warrant additional attention. Field studies are necessary because of the importance of the work environment and elements within it. In terms of the intervention design factor, certain instructional methods (e.g., the problem-based approach), which JITT is based on, require scrutiny for their effect on transfer (Kirschner, Sweller, & Clark, 2006). The dependent variable (DV) typically studied in training transfer is learning outcomes. The principle issue in transfer studies is to determine that learning interventions have improved organizational and employee performance (Baldwin & Ford, 1988; Burke & Hutchins, 2008; Cheng & Ho, 2001; Ford & Weissbein, 1997). Training transfer refers to the application of acquired knowledge and skills on the job, which is the variable of interest in the current research study. Therefore, whether or not JITT actually helps learners retain and apply knowledge and subsequently improve performance in the workplace remains largely unexplored. Even though learning has been shown to be moderately related to transfer (Colquitt, LePine, & Noe, 2000), providing additional empirical evidence (i.e., transfer outcomes) would prove useful (Burke & Hutchins, 2008).

Definition of Terms

The following terms and definitions are directly related to the scope of this research.

High-performance work organizations (HPWO) are organizations that adopt high-performance work practices (HPWP). In HPWO, the development of skills helps to achieve specific business outcomes and levels of performance. HPWO focus on linking training to performance requirements rather than quantity. In an HPWO, human capital development may be about creating a work environment, which encourages employees to

learn as part of their normal work and where they can take advantage of the system to effect performance and innovation (Sung & Ashton, 2005).

High-performance work practices (HPWP) focus on the synergistic application of new work practices that enhance employee skills and increase their involvement (Gephart & Van Buren, 1996; Wright, Dunford, & Snell, 2001). They are a set of complementary work practices that cover three broad areas referred to as bundles of practices (Boxall & Purcell, 2008). These three areas are: 1) high-employee-involvement practices, 2) HRP, and 3) reward and commitment practices (Ashton & Sung, 2002). High Performance Work Practices have also been referred to as high-commitment management (Walton, 1985), high-involvement management (Lawler, 1986), high-performance organizations (Ashton & Sung, 2002; Lawler, Mohman, & Ledford, 1998), high-involvement work practices (Wood, 2001), high-involvement work systems (Edwards & Wright, 2001), progressive work practices (Delaney & Huselid, 1996), high-commitment work systems (Osterman, 1995), and HPWS (Huselid & Becker, 1997).

Just-in-time training (JITT) is a specific type of high-employee-involvement training intervention program that Globerson and Korman (2001) provide to individuals or units. Just-in-Time Training includes only the information necessary to perform skills or functions at a point in time and at a specific location at the time of need, and not any sooner. Just-in-Time Training is used when job performance suffers because of a lack of competence. It is a comprehensive training approach that links training and work performance requirements. Advantages of the JITT process are that it: 1) eliminates the need for refresher training due to subject knowledge loss; 2) prevents decay if the learner cannot use the material upon returning to the job; 3) prevents training being wasted on people who leave the job before the training they received is used on the job; and 4)

allows learners to receive training when they need it...not weeks or months later (Jones, 2001).

Training-intervention programs is a type of high-performance human resource work practice that may contribute to organizational performance. The optimization of employee skill sets can be achieved by using a training-intervention program in order to achieve a desired change in the employees output (Burke & Hutchins, 2007).

Summary

Globalization of world economies and increased competition, coupled with limited resources, require companies to increase efficiencies in order to survive in today's marketplace. In today's globalized economy, ever increasing costs for HRD programs and initiatives place an increased emphasis on effectiveness (Wright et al., 2003). Initiatives must be deemed effective in order for programs to remain funded and sustainable. The demand for results continues to increase in importance in both the public and private sectors (Burke & Hutchins, 2008; Phillips, 2012). The aforementioned trends have increased the awareness of HRD programs and initiatives and helped to show the importance of HPWP. The increased use of HPWP, such as JITT intervention measures improve organizational effectiveness and will become a vital part of an organization's HRD (Wright et al., 2003).

Effective training intervention indicates the HPWP process extends further than the implementation of the process within a company. Effective training means JITT intervention measures help achieve the desired results and that HPWP are endorsed by management and workers at all levels. The HPWP process needs to be responsive to change and flexible enough to evolve and adapt to constantly changing job requirements in order to remain sustainable (Boxall & Macky, 2009).

Chapter II introduces an outline of the basic HPWP. A review of related literature includes a discussion of HPWP and its applications. Chapter III contains the methodology of exploring the effects of JITT for a manufacturing company and how the training can influence the outcome by having an effect on performance.

CHAPTER II

LITERATURE REVIEW

Introduction

This literature review details recent studies relevant to HPWP and training intervention measures in order to identify how conceptual theory, frameworks, and processes apply in HRD practice. The review identifies how the JITT-intervention variables affect transfer to job performance. Ways in which JITT-intervention variables should be measured and tested for the effect of transfer on specific job performance outcomes is also discussed.

Literature was reviewed in order to identify how HRD-intervention measures, such as skill upgrading and training apply in HRD practice. The Kirkpatrick four-level taxonomy was one of the most frequently cited frameworks identified in the academic literature (Bates, 2004; Kirkpatrick, 1959; 1975; 1976). More recently, a number of refined models have emerged, based mostly upon previous models (Alvarez et al., 2004; Holton, 2005; Kraiger, 2002; Noe & Colquitt, 2002; Phillips & Phillips, 2007). Most HPWP include programs or initiatives that address issues such as skill-upgrading, training, and organization-level human resources enhancement. These are component parts of the overall solution in increasing productivity for organizations (Datta et al., 2005). The HPWP may include employee engagement and decision-making, teaming or other collaborative work design processes, management/leadership practices, or scheduling or organization of work (Combs et al., 2006; Sung & Ashton, 2005).

High Performance Work Practices (HPWP)

High Performance Work Practices are not radical new practices; instead, they are work practices providing an organization with additional tools used to improve

performance. Organizations that adopt them are known as High Performance Work Organizations (HPWO). Although many businesses may be unfamiliar with the conceptual theory concerning HPWP and HPWO, most of the practices associated with them are not new. Often, the implementation has been viewed as ordinary, common sense business practices that deliver results. According to Sung and Ashton (2005), the practices in three categories (i.e., high involvement, human resources, and reward practices) are either understood or implemented by organizations.

There are also issues in the way the practices have been used which may lead to confusion. First, instead of an agreed-upon list of practices, research on HPWP has been characterized by the use of various lists, in some cases containing different practices. For example, Becker and Huselid (1998) used more than thirty practices in a U.S. study while Guest (2000) used 18 practices in a United Kingdom (U.K.) study. The lists overlap, and while essentially studying the same organizational phenomenon, the use of different lists by researchers can create confusion. It is not necessarily the number or type of practices that matters as much as the way they link to performance (Sung & Ashton, 2005).

One widely accepted view of HPWP is the set of 35 complementary work practices which cover three broad areas known as bundles of practices (Ashton & Sung, 2002). The three broad areas include:

- 1) High-employee-involvement practices such as self-directed teams, quality circles, and other means where company information can be shared or accessed;
- 2) HRP such as hiring/recruiting processes, redesigning work, and mentoring. Just-in-Time Training is a type of human resource practice because it involves a review of the employee's training needs, training to perform multiple jobs and skills development;

- 3) Reward and commitment practices such as financial rewards, flexible working hours, job rotation, and family-friendly policies (e.g., working from home). Some HPWP can affect multiple areas. For example, flexible working arrangements may impact both employee commitments to the company as well as the level of employee involvement. Job rotation can: 1) help increase employee knowledge; 2) improve long-term commitment to an organization; and 3) help increase both work involvement and skill levels.

Researchers theorize that HPWP improve organizational performance and workplace effectiveness. Recent research focuses on motivational influences on learning. HPWP provide learners with the knowledge, skills, and abilities (KSAs) needed to perform jobs and the motivation and opportunity to use the skills (Combs et al., 2006). Individual learner characteristics or traits, such as personality, may predispose an employee to certain behavioral patterns (Holton, 2005). Research studies have shown that individuals with a learning orientation tend to pursue difficult learning challenges and persist even when they face failure. However, individuals with a performance orientation tend to see the same situations as threatening and withdraw. Thus, a learning orientation is associated with more positive learning outcomes; whereas, a performance orientation is associated with negative or neutral learning outcomes (Bell & Kozlowski, 2002; Chen, Gully, Whiteman, & Kilcullen, 2000; Colquitt & Simmering, 1998; Ford, Smith, Weisbein, & Gully, 1998).

In a meta-analysis of studies focusing on the link between HPWP and organizational performance, Combs et al. (2006) found 92 studies with relevant statistics. Combs et al. (2006) report that the overall size of the effects of HPWP on organizational performance was difficult to estimate due to different sample characteristics, research

designs, types of practices used, etc. However, a statistical aggregation of the studies reveals an overall main effect of HPWP on organizational performance. The correlation of this effect on performance conservatively estimates a 0.20 effect, meaning that 20% of the performance differences among the 92 organizations included in the meta-analysis can be attributed to HPWP Combs et al. (2006).

Datta et al. (2005) state only limited research exists on the contextual conditions affecting the effectiveness of HPWP. Findings from the study indicate the impact of HPWP on organizational productivity was influenced by the type of industry, the amount of capital investment in the industry, the industry growth rate, and the level of product differentiation. Huselid (1995) reports the returns on investments in HPWP are substantial. The results of the study are based on a national sample of nearly one thousand companies. Huselid (1995) states an increase in the use of HPWP by the equivalent of one standard deviation will lead to an average decrease of 7.1 percent in turnover and an increase of \$27,044 in sales per employee. This is associated with \$18,641 more in market value and \$3,814 more in profits. Therefore, the impact of HPWP on organizational performance is both significant and relevant (Huselid & Becker, 2011). The value of HPWP to an organization is best demonstrated by studies that observe the operational outcomes of an actual production process (Boxall & Macky, 2009). A sustainable HPWP system must benefit organizations in order to mitigate the possibility of managers having to shut down operations or relocate production. Holton (2005) proposes the *HRD Evaluation and Research Model* as a comprehensive framework for diagnosing and understanding the causal influences of HRD intervention outcomes.

A discussion of the history of high performance work practices (HPWP), including Taylor's principles of scientific management, follows next. The three main sources of HPWP: Walton's (1985) high-commitment work practices, Lawler's (1986) high-involvement practices, and the U.S. Department of Labor's (DOL, 1993) HPWP, are included in the discussion. This will be followed by a discussion of the origin of Just-in-Time Training.

History of High Performance Work Practices (HPWP)

Taylor's (1911) earlier views were illustrated during the historical period when Taylor transformed the Bethlehem Steel yards at the turn of the 20th-century. According to Taylor's description, when he was hired in 1898, over 500 laborers worked at different tasks in the yard in gangs of up to 75 men, with each group under a supervisor. Management instructed supervisors as to what needed to be accomplished and trusted the experience of both supervisors and workers, who often used their own tools, to do the job in their own way. Three years later, in 1901, there were only 140 laborers in the yard, each accomplishing the work previously performed by three or four men. This occurred because the men used standardized, carefully designed company tools and followed strict standardized procedures determined by time-and-motion studies. A planning room was equipped with a telephone and messenger system. The planning room staff, consisting of engineers, time-and-motion personnel, drafters, and clerical staff carefully prepared the next day's work for each individual worker and coordinated all movements in the yard. A set of functional overseers coordinated, trained, timed and measured work, and acted as agents of the planning department, which replaced the single group of supervisors.

The innovative organization, despite the new planning and tool room expenses and the much higher salaries of the white-collar staff, substantially reduced expenses.

Even though the wages of the remaining laborers increased by 60%, the cost of handling a ton of metal decreased from 7.2 cents per ton to 3.3 cents per ton because the output increased significantly. The new scientific-management techniques yielded similar cost-cutting results when applied to everything from bricklaying to ball-bearing quality inspection to machine-shop work (Taylor, 1911).

Taylor's early 20th-century views were at the forefront of continuous mass production and evolved into a technological style. Even in its earliest form, Taylor's scientific management techniques serve the purpose of the current analysis of management practices prior to the introduction of HPWP at the latter part of the 20th-century (Antonioli, Massimiliano, Pini, & Tortia, 2004). The profit motive helped propel the application of scientific management techniques. As one organization after another reduced the usual size of its workforce in relation to output and transformed its composition and compensation, new trends become gradually visible in the total occupational structure. Historically, Henry Ford implemented Taylor's principles on a large scale with his mass-production assembly line (Watts, 2005). Ford called in Frederick Taylor, the creator of "scientific management," to do time and motion studies to determine the exact speed at which the work should proceed and the exact motions workers should use to accomplish their tasks. Taylor was one of the first management consultants who sought to improve the manufacturing industry through improved industrial efficiency (Taylor, 1911).

The spread of scientific management caused growth of a new layer of white-collar workers between managers and supervisors. The reduction in the number of manual laborers required for a given output hastened the evolution in the occupational structure. Initially, the old Taylor scientific management styles remained, for much of the growth

took place along traditional lines. New trends in management practices (HPWP) appeared as counter trends of earlier practices. Each business cycle helped to filter out the old practices and strengthen and accelerate the application of new ones (Antonioli et al., 2004). In a sense, Taylor may be credited as being the first to recognize that there was a distinct role for the independent expert separate from the front line business manager (Stewart, Taylor, Petre, & Schender, 1999).

All of the High Performance Work Practices attempt to modify Frederick Winslow Taylor's view of highly specialized jobs, which are typical of mass production. Taylor (1911) describes four principles of scientific management in his book, *The principles of scientific management*. Specific examples of HPWP, which modify or replace Taylor's four principles of scientific management, include: 1) employment security; 2) selective hiring; 3) self-managed teams and decentralization; 4) high-contingent compensation; 5) extensive training; 6) reduction in status differences; and 7) sharing information (Pfeffer & Veiga, 1999).

Boxall and Purcell (as cited in Gill, 2008) identify three main sources of HPWP: 1) Walton's (1985) concept of high-commitment work practices focus on building employee commitment to organizational goals through incentives and identification with the company culture instead of using direct supervision of routine jobs; 2) Lawler's (1986) study focuses on high-involvement practices which place an emphasis on redesigning jobs to increase employee involvement in decision making and on the skill and motivational practices that help to support this; and 3) a U.S. DOL report cited in Subramony (2009) that focused on HPWP. High Performance Work Practices involve revising work practices in order to increase employee involvement in the decision-making process. They also involve the related investments in employee skills

development and the use of performance incentives to help ensure employees are motivated to take on greater responsibilities (Holton et al., 2000; Sung & Ashton, 2005).

Just-in-Time Training, which is a specific type of high-performance-work practice, has evolved from the need to make learning and workforce development more efficient. Frequently, companies utilize on-the-job training (OJT) to address this need. However, OJT alone, may not always be sufficient due to the ever-changing future needs and requirements of companies. A discussion of the origin of Just-in-Time Training follows next, followed by a discussion of JITT intervention design and delivery and the JITT model.

The Origin of Just-in-Time Training (JITT)

Just-in-Time Training describes a collection of training approaches and media that present a defined set of information, most of the time on the job, used by employees immediately following training (Jones, 2001). This definition suggests three key points about JITT. First, similar to other planned training programs, JITT requires the same attention to the design process (Jacobs & Jones, 1995). This is necessary because JITT has an expedited delivery basis, but this does not imply the circumventing of the design process in any way. It may be true that JITT requires even more careful design than other types of training because it needs to be embedded into the work setting (Jacobs & Jones, 1995). Jacobs and Jones (1995) presented a six-step process for designing and delivering structured OJT programs: 1) determining the appropriateness of the training; 2) analyzing the task; 3) training the trainers; 4) preparing the materials; 5) delivering the training; and 6) evaluating and improving the training.

Second, the definition suggests that training will include only the information necessary to perform at a specific point in time and at a specific location. Providing

information to the worker must occur at the time of need and not any sooner. Just-in-Time Training is a relatively short unit of instruction with defined boundaries. Just-in-Time Training assumes that in the course of doing work, the employee realizes that he or she cannot complete the work because of a lack of competence. Providing JITT at that exact point in time addresses the need. It is conceivable that other training approaches or even a job performance guide (Gery, 1991) might also be used to address the issues of timing and location. However, JITT is ideally suited for use when job performance suffers because of a lack of competence. This emphasis is a major part of the uniqueness of JITT. Just-in-Time Training addresses specific performance issues strategically, without unnecessary additional information (Jones, 2001).

Finally, the definition suggests that JITT can combine differing training approaches and media. For instance, in terms of training approaches, JITT might use a self-paced or a trainer-driven approach, similar to that of structured OJT. In terms of training media, JITT may use printed text materials, visual media, or electronic devices to deliver the training. It is the promise of using electronic devices (e.g., wireless communication products) or the Internet that has given JITT its most interesting possibilities (Clark, 1998). These options allow the potential to deliver JITT with access to large sets of information in situations that would have been otherwise impossible.

The manufacturing concept of JITT is rooted in Japanese management theory. Ohno Taiichi (1988) popularized JITT in the 1970s in order to establish the Toyota production system. JITT became a way of using limited production resources more efficiently. Billesbach (1991) defines JITT as an organizational philosophy that uses employees to identify and resolve problems in the workplace and seeks to eliminate all non-value-added activities. Many organizations adopted JITT because of its perceived

ability to address 21st-century business demands for shorter cycle times, quicker decision points, and more rapid deployment of services and solutions (Jones, 2001).

During the 1980s, JITT was introduced to many U.S. manufacturing companies, and it often produced significant gains in productivity and quality. According to Jones, (2001), JITT is one of the first major quality approaches introduced in the post-World War II era. Jones (2001) states that the major principles from JITT include: 1) Each process is a supplier to another process, and each process is a customer to another process; 2) Use a pull production approach, not a push approach; 3) Visibly display performance, production, and inventory state; 4) Deliver to factories only what is needed, when needed, and exactly where needed; 5) Shipments of raw materials are unloaded directly onto the production lines; 6) Multi-skilled workers staff a U-shaped production design; 7) Ship orders immediately without warehousing; 8) The kanban card is the sole inventory tracker, invoice, and reorder form between companies; and 9) Creative use of tools and technology help eliminate worker motion, strain, and error.

Many managers in the U.S. have had difficulty understanding the dramatic changes that JITT brings to organizations. The JITT involves more than implementing quality circles to discuss issues or using statistical process control to understand defect rates (Jones, 2001). The JITT also includes an introduction of a complete production system, along with accompanying HRD implications, such as employee development and involvement. Very few quality approaches are as effective as JITT in producing improvement and innovations in organizational design. The JITT is a system that has the capability to respond quickly. Shortly after a customer thinks up a new product, just enough raw materials go to the factory to make the product, and just enough of the new products are produced to meet customer demand. Even though this ideal state is

unrealistic from a market perspective, the general principles involved in JITT have had a powerful influence on organizational functioning (Jones, 2001).

Use of Just-In-Time (JIT) in Human Resource Development (HRD)

One of the major characteristics of JITT is the emphasis on work processes. The implementation of JITT encompasses the total work process as it flows from every customer to every employee to every supplier. Managers view work processes across functions and organizations. Emphasis on work processes and a systems view of organizations have become common among many HRD personnel (Jacobs, 1989). One of the primary implications of JITT is the role that management plays in the production process. One component of JITT is that the current state of each work area is communicated, often through posted metrics. For this reason, JITT is a visible management approach (Jones, 2001).

Before the introduction of JITT, only middle and senior managers received performance data (Jones, 2001). Performance information stays within the work area in JITT because workers have the most impact on influencing changes in the organization and need to receive the information. Sometimes, JITT involves the use of work teams because work teams are one of the methods of acting upon production information (Jones, 2001).

The concept that human activities could be coordinated relatively simply was pioneered with the introduction of JITT (Jones, 2001). Kanban cards, also known as order and production cards, came into use through JITT systems. A single card or in some cases, the use of signal lights mounted in production areas, replaced much of the paper flow found in many organizations. It has been said that one piece of paper could conceivably control the production flow of entire factories. The kanban concept is at the

center of JITT systems because it governs the movement of raw materials to the factory, the volume of products made from the raw materials, and the volume of finished products shipped to the customer (Jones, 2001).

Human Resource (HR) professionals use JITT in order to deliver HRD programs and services more strategically to their clients, based on the need to increase the speed, flexibility, and innovation of organizational activities. Similar to using JITT principles to conduct the business of the organization, the HRD profession concentrates on: 1) eliminating wasted organizational resources; 2) reducing training inventory; 3) focusing more on internal and external customers; 4) designing learning environments that directly support work performance; 5) reducing the cost of designing and delivering the training; and 6) reducing the overall time required to meet customer needs (Jones, 2001).

In response to the demands of industry in the 21st century, the HRD profession places a growing emphasis on new ways to manage the delivery of training (Caudron, 1996; Van Buren & Woodwell, 2000). This awareness has shifted emphasis to the concept of JITT (Jones, 2001; Kanagasabai, Najimudeen, & De, 2013; Sampson & Karagiannidis, 2002). This emphasis has increased due to the availability of advanced training technologies, such as wireless communications and the World Wide Web (Jones, 2001; Sampson & Karagiannidis, 2002). The new corporate reality is that managers and employees demand that critical information is available immediately when they need it, at or near their job site (Jones, 2001; Kanagasabai et al., 2013; Sampson & Karagiannidis, 2002). However, until about 2001, the HRD profession focused on developing learning environments in which the trainee was away from the job and the information was delivered at the convenience of the HRD function (Jones, 2001). The impetus was that for adult learners to learn, they must be free from the distractions that occur in the work

environment (Jones, 2001; Kanagasabai, Najimudeen, & De, 2013; Sampson & Karagiannidis, 2002).

Although the traditional learning approach may work well in certain learning situations, it is not economical or effective for a vast majority of the learning situations that are now emerging in high-performing organizations in the 21st century (Jones, 2001; Kanagasabai et al., 2013; Sampson & Karagiannidis, 2002). Other forms of planned training on the job, such as structured OJT (Jacobs & Jones, 1995), have demonstrated the ability to provide training from a JITT perspective. The challenge of defining a distinct training approach from structured OJT that would address organizational issues has emerged. In addition, JITT has evolved from only being training that should be available on demand to becoming a more comprehensive training approach that links training and work performance requirements (Jones, 2001).

Research Opportunities for Just-In-Time Training (JITT)

Given the current trends in training, the future use of JITT appears promising. However, the topic has attracted a minimal amount of research interest. Only through research will the potential contributions of JITT be fully understood (Collins & Halverson, 2010; Jones, 2001). JITT combines the most critical aspects of structured OJT and places greater emphasis on having relevant training made available to employees at the immediate point of performance need. Since the purpose of the current research is to study the effect of JITT on job performance, a discussion of the learning transfer system included in Holton's *HRD Evaluation and Research Model* follows next. The learning transfer system includes personnel, training, and organizational factors influencing the transfer of learning to job performance.

Holton's HRD Evaluation and Research Model

Holton's (2005) theoretically derived original model had three outcome levels: 1) learning, 2) individual performance, and 3) organizational performance. Holton's model forms the basis for the concepts from which the JITT model was derived. Holton's (2005) model addresses one of the biggest risks of Kirkpatrick's (1959) four-level model; specifically, that any failure to achieve outcomes from an intervention is due to the intervention when it could be due to other variables. One example of this is when learning outcomes from a training intervention have a positive result but no on-the-job behavior change occurs because of a poor transfer in learning climate. Therefore, the transfer climate requires evaluation in order to avoid an erroneous decision such as blaming the failure of achieving a favorable training transfer when it may be due to other variables such as motivation to transfer. The decision derived from Kirkpatrick's model would be the training intervention failed and needs changing. In this instance, the correct decision from Holton's model might be that the training intervention did not need to be changed. Instead, the organization lacked the transfer climate to support the training intervention, so an organizational training intervention would be required (Holton, 2005).

Holton's (1995) work on a conceptual framework led to efforts to test the model. He discovered that existing measurement tools were inadequate for testing his model. He needed to address deficiencies in both theory and measurement tools before a full test of the model would be possible. A full test of Holton's (1996) model was not possible because many of the tools needed to measure the constructs in the model did not exist at that time. This led Holton and his associates to begin work on a conceptual framework and measurement instrument. They addressed the gaps in the area of transfer climate. The

result of their efforts was an updated version of the model that was more appropriate for empirical testing.

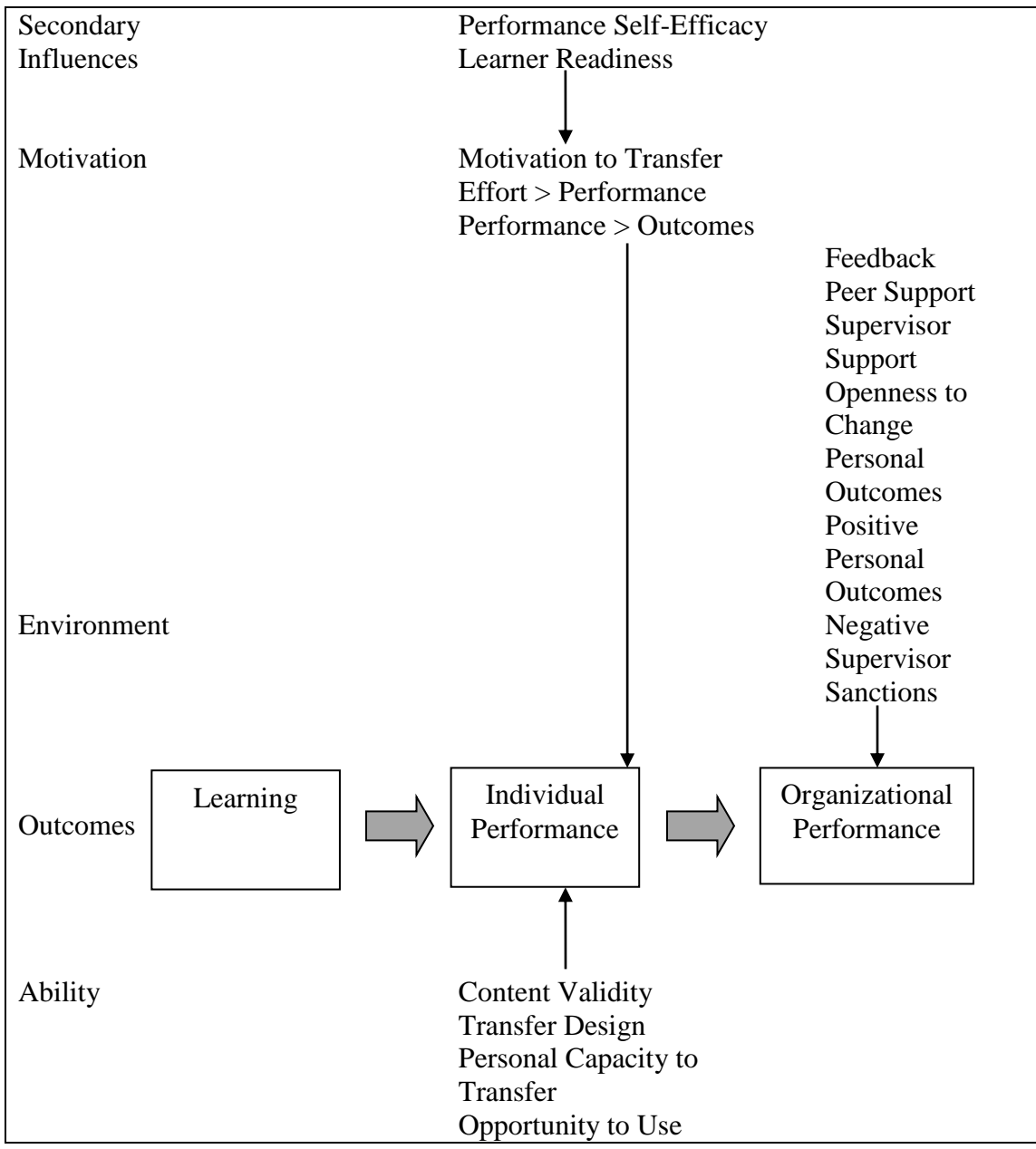


Figure 2. Learning Transfer System Inventory (LTSI) Conceptual Map of Constructs (Holton, 2005, p. 48).

Holton, Bates, and Ruona's (2000) learning transfer research focuses on the learning transfer system as a whole in contrast to looking at only the transfer climate. The

learning transfer system includes personnel, training, and organizational factors influencing the transfer of learning to job performance. Holton et al.'s (2000) efforts resulted in a measurement instrument called the *Learning Transfer System Inventory*. The validated LTSI framework (see Figure 2) defines transfer climate and measures as transfer design, transfer climate, and motivation to transfer elements. Transfer climate is one subset of factors influencing transfer, although the term is incorrectly used at times to refer to the full set of influences (Holton, Bates, & Ruona, 2000). Other influences on transfer include: 1) training design; 2) personal characteristics; 3) opportunity to use training; and 4) motivational influences. Thus, the transfer system is a broader construct than transfer climate and includes all of the factors traditionally referred to as transfer climate. In order to completely understand and influence transfer, the entire system of influence requires examination (Holton, 2005).

The LTSI program underwent extensive testing and shows strong evidence of construct validity (Bookter, 1999; Holton et al., 2000; Seyler, Holton, Bates, Burnett, & Carvalho, 1998), initial evidence of criterion validity, (Bates, Holton, Seyler, & Carvalho, 2000; Ruona et al., 2002), and good cross-cultural validity (Chen, 2003; Holton, 2005; Khasawneh, 2004; Yamnill, 2001). The LTSI defines 16 factors that make up the learning transfer system. The factors in the LTSI are: 1) supervisor support; 2) supervisor sanctions; 3) perceived content validity; 4) transfer design; 5) opportunity to use; 6) general scales: transfer effort-performance expectations; 7) training-specific scales or learner readiness; 8) motivation to transfer; 9) positive personal outcomes; 10) negative personal outcomes; 11) personal capacity for transfer; 12) peer support; 13) performance-outcomes expectations; 14) resistance/open-ness to change; 15) performance self-efficacy; and 16) performance coaching. Holton asserts the 16 constructs will measure all

factors influencing learning transfer (Holton, 2005). The LTSI defines and measures transfer design, transfer climate, and motivation to transfer from the Holton (1995) model. One of the most noteworthy contributions of the Holton model was the conceptualization and creation of the construct or the Motivation to Improve Work through Learning (MTIWL). Naquin and Holton (2002) propose the work construct improvement process and HRD required learners to acquire knowledge and then transfer knowledge, resulting in improved work or increased productivity. The researchers indicate the traditional model which treated Motivation to Learn (MTL) and Motivation to Transfer (MTT) as two separate construct domains and as too limiting for organizational learning environments. MTIWL was defined as:

$$\text{Motivation to Improve Work through Learning (MTIWL)} = f(\text{Motivation to Learn [MTL]}, \text{Motivation to Transfer [MTT]})$$

Naquin and Holton (2002) demonstrate the construct validity of the new MTIWL construct using confirmatory factor analysis. Persons entering training with high levels of MTIWL are more likely to have higher motivation than persons with high levels of MTL (Holton, 2005). Holton (2005) purports the effects will likely be more significant on outcomes. This is because an individual entering a learning situation with high levels of MTIWL is likely to have greater motivation to engage in work-relevant learning experiences when offered with strong transfer designs that stress practice and job application than a person with high levels of MTL. People with high levels of MTIWL are more likely to engage in work-related learning that transfers directly to their work practices and specific job application. Therefore, it is expected that MTIWL motivation in the learning environment will differ substantially from MTL and will require different types of learning experiences. Furthermore, it is expected that individuals possessing high

levels of MTIWL will exhibit higher rates of transfer to individual performance (Holton, 2005).

According to Holton (2005), his model needs testing because many of the tools needed to measure the constructs in the model did not exist when the model was developed, and the LTSI has unknown criterion validity. Holton revised his model to incorporate the LTSI in order to spur research about its validity. Constructs that were previously included in the MTL and MTT in the original model are now combined in MTIWL. In Holton's (2005) model, he describes the linkages between the outcomes of learning, individual performance, and organizational performance. A HPWP possesses attributes which correlate with Holton's (2005) model. These attributes include: employee skills development (i.e., learning), employee commitment (i.e., individual performance), and commitment to organizational goals (i.e., organizational performance). The literature review that follows in the next section on the Just-In-Time Training (JITT) Intervention Design and Delivery provides an in-depth discussion of the primary factors influencing learning transfer.

Just-In-Time Training (JITT) Intervention Design and Delivery

The literature review of training transfer studies reveal primary factors influencing learning transfer are learner characteristics (Sackett, Gruys, & Ellingson, 1998), intervention design and delivery (Holton et al., 2000), and work environment influences (Burke & Hutchins, 2007; Ford, 1997). The second group of constructs (i.e., training intervention design and delivery) influence transfer directly or indirectly through their impact on learning. Forrest and Peterson (2006) discovered the adult learner needs to absorb the JITT material quickly and return to work as a productive employee. The adult learner's ability to retain and quickly put to use unfamiliar learning material is a

challenge faced by the training division of the participating company. Stakeholders will impress upon the training personnel the importance of this JITT intervention task. The JITT will replace the current training programs used by the manufacturing departments. It is unknown if the incorporation of the JITT will cause anxiety from the incorporation of the change (Lüscher & Lewis, 2008). A discussion of prior research on the identification of learning needs, the identification of learning goals, and content relevance, as relevant to JITT transfer follows.

Needs Analysis

In the field of Instructional System Design (ISD), a long-standing principle is that trainers must first assess the cause of a performance situation to ensure an appropriate intervention is employed (McGehee & Thayer, 1961). It has been reported that the bulk of performance problems stem from work environment causes such as: 1) unclear performance specifications; 2) inadequate resources and support; 3) inappropriate consequences; or 4) untimely feedback (Rummler & Brache, 1995). Just-in-Time Training works best when employed to address KSA deficits; therefore, appropriate needs analysis can be useful for determining when a JITT intervention is relevant. Researchers further suggest stakeholders are included in the training curriculum design (Brinkerhoff & Montesino, 1995; Broad, 2005; Broad & Newstrom, 1992; Clark, Dobbins, & Ladd, 1993) and to use a needs analysis approach that specifically identifies obstacles to positive transfer (Gaudine & Saks, 2004). For example, Holton et al. (2000) developed the Learning Transfer System Inventory (LTSI) as a diagnostic tool to assess the degree of support in the transfer system. Transfer system was defined as all factors in the person, training, and organization that influence transfer of learning to job performance. The LTSI discussed previously includes 16 factors that tap trainee

perceptions of how their transfer of learning to performance would be impacted by aspects of the specific training program and general training issues. Trainers can use the results of learner responses to the LTSI to identify areas that may impair positive training transfer at the learner, design, and work climate levels. While the bulk of empirical work using the LTSI has been to validate the instrument with domestic and international samples (Khasawneh, Bates, & Holton III, 2004; Yamnill & McLean, 2005) and to conduct correlational studies involving learner and organizational variables (Bates & Khasawneh, 2005; Seyler, Holton, Bates, Burnett, & Carvalho, 1998), no published work was identified linking the use of the LTSI to actual improvement in transfer outcomes.

Learning Goals

Presuming a learning intervention is needed, explicitly communicated objectives can inform learners of the desired performance, the conditions under which the performance will be expected to occur on the job, and the criterion of acceptable performance to maximize transfer (Mager, 1962; 1996). Including specific behavioral objectives is a basic strategy used by trainers to elicit a desired behavior in the transfer environment (Gagne, 1965). Indeed, using goals, both assigned and participative, to increase training transfer has received much support in the existing literature (Locke, Shaw, Saari, & Latham, 1981; Richman-Hirsch, 2001; Taylor Russ-Eft, & Chan, 2005; Wexley & Baldwin, 1986; Wexley & Nemeroff, 1975). Goal setting has been found to help individuals regulate their behavior by directing attention and action, mobilizing energy expenditure or effort, prolonging effort over time (i.e., persistence), and motivating the individual to develop relevant strategies for goal attainment (Brown, 2005; Locke et al., 1981; Locke & Latham, 2002).

In a study comparing trainee and manager perceptions of the importance of training objectives, Lee and Pucil (1998) found a significant relationship between the importance of training goals and perceived transfer of training. The authors reasoned that trainees might focus more on maintaining the knowledge or skills in the work context when they and their manager perceived the specific training outcome as necessary. Kraiger, Salas, and Cannon-Bowers (1995) also found that transfer outcomes were higher for participants who were provided learning objectives as advance organizers (i.e., background information) to the training program. In addition, in a study of the relationship between the use of ISD components and transfer, Kontoghiorghes (2001) found that the development of learning goals and objectives was significantly correlated with transfer, indicating that participants were likely to transfer when they had a clear understanding of what knowledge and behaviors were required after training. From a practical perspective, Brown (2005) found that participants who set proximal (i.e., short-term) goals plus distal (i.e., long-term) outcome goals reported increased transfer compared to those who set only distal outcome goals.

Content Relevance

According to Bates (2003), training goals and materials should also be content valid or closely relevant to the transfer task. According to identical elements theory (Thorndike & Woodworth, 1901), trainers should keep the responses trainees make consistent from the training environment to the job to ensure transfer. Although content relevance has consistently been a critical cognitive component of instructional design approaches (Clark & Voogel, 1985), only in the last decade has it been examined empirically as a correlate with transfer outcomes (Lim & Morris, 2006; Rodriguez & Gregory, 2005). In their empirical work, Axtell, Maitlis, and Yeararta (1997) found that the

content validity of training information was highly correlated to transfer immediately after and one month after training ($r = .61, .45$, respectively $p < .01$). Content relevance emerged as the primary factor in predicting trainee perceptions of successful transfer in a cross-sectional transfer study of Thai managers (Yamnill & McLean, 2005). Taken together, it appears that trainees must see a close relationship between training content and work tasks to transfer skills to the work setting, thus, underscoring the utility of needs assessment in identifying appropriate training content.

Therefore, based on findings from previous research, content relevance correlates to training outcomes. In order to be effective, the employee needs to use the knowledge from the recent training as soon as possible. Just-in-Time Training (JITT) addresses these points by having the employees use the newly acquired relevant information as soon as possible after the training (Jones, 2001).

It is essential to develop a comprehensive model of intervention training. A discussion of the Just-in-Time Training (JITT) Model will follow next, followed by a discussion of the need for Just-in-Time Training, followed by a discussion of training outcomes. Just-in-Time Training implications will be discussed, followed by a summary.

Just-in-Time Training (JITT) Model

Based on the discussion of past research on training and evaluation models, a conceptual model of JITT (see Figure 1) was constructed which incorporates seven variables. These include individual characteristics of the trainee and organizational factors of the work environment, which have been discussed earlier in this paper. These characteristics can exert various influences on training effectiveness at either the individual or organizational level.

Training motivations are intermediate influential factors to training outcomes that are borrowed from the management research literature (Mathieu & Farr, 1991; Naquin & Holton III, 2002; Noe, 1986; Warr & Bunce, 1995). In the model presented in Chapter I (see Figure 1), they are divided into pre-training motivation (i.e., motivation to learn) and post-training motivation (i.e., motivation to transfer). Motivation to learn is a trainee's desire to learn the trained skills before and during the training. On the other hand, motivation to transfer, which has attracted comparatively more research attention because of its importance from a management perspective, is the trainee's desire to eventually transfer the learned skills back to the workplace after the training. Both variables are dependent on individual characteristics and organizational factors (Holton, 2005).

The conceptual model utilized by the researcher in this paper will be primarily concerned with learning performance. Just-in-Time Training influences what the trainee has learned throughout the training, which can be measured by a quiz, exam, or practical test. The more significant outcomes are JIT Training transfer/individual job performance and organizational performance. Training transfer/individual job performance indicates how the trainee has transferred the learned skills back to the workplace, and whether or not job performance has improved. It can be measured by directly observing the trainee and talking to her/his superiors. Ultimately, the most desired training outcome would be improvement of organizational performance in terms of productivity and bottom line profit performance. The last two outcomes, which are the most critical, are usually not checked in actual training practices because they are difficult to measure (Brinkerhoff, 2005; Nickols, 2005).

The relationships among the training elements, as shown in the conceptual model in Figure 1, imply that Just-in-Time Training is an essential training element which can

positively affect trainee's knowledge. It can lead to the better learning performance of individual trainees, which will contribute to better training transfer/individual job performance and eventually lead to better organizational performance. These outcomes are also subject to the influences of other intervening factors such as individual characteristics, organizational factors, and motivational factors. Details of the measurement instruments of these variables are presented in the next section.

The model is unique in three main areas. First, based on the literature review, the model establishes the trainee's knowledge as a primary training outcome. Second, constructed in an organizational context, the model reflects organizational influences on JITT. Third, the model incorporates factors in all aspects: individual characteristics, organizational factors, motivational elements, and training outcomes.

Since most of the variables in the conceptual model were studied either in training or in other related research, their measurement constructs and the associated measures were already available. However, the applicability of these constructs and the associated measures to JITT may need further validation, reliability testing, and refinement in in-depth empirical research.

The Need for Just-in-Time Training (JITT)

Just-in-Time Training, which is a type of planned OJT, places a greater emphasis on having the training administered as closely as possible to the time the training is needed. The concept for JITT derives from using training in order to meet the production and scheduling requirements typically found in manufacturing environments. The 21st-century globalized economy caused an accelerated rate of change in many companies. Consequently, organizations need to work faster and more efficiently than ever before in order to compete and remain in business. Just-in-Time Training emerged as a way to

meet the rapidly changing training needs by providing training immediately prior to when it will be used by the worker. The JITT concept was initially used in manufacturing production environments. Since then, it has evolved as a unique type of planned training, which is usually delivered on the job (Jones, 2001).

Instructional material designers on a training team are required to design and deliver the necessary JITT material to support employees' intervention training needs. Ineffective instructional delivery methods, or material design, or a combination of both limit the effectiveness of JITT. Fisher and Baird (2005), in a study related to online learning, report that a better understanding of material content is gained when students link what they are learning with what they are doing. Researchers indicated a statistically significant difference existed between material design and delivery methods and the learners' ability to retain knowledge that would result in improved performance (Fisher & Baird, 2005).

Just-in-Time Training can combine different training approaches and training media. For example, in terms of training approaches, JITT may utilize a self-paced or a trainer-driven approach in a classroom setting, similar to that of structured OJT. In terms of training media, JITT may use printed text materials, visual media, or electronic devices to deliver the training. The capability to use different training approaches and training media has given JITT much flexibility to respond to specific needs of an organization (Clark, 1998). These different approaches give JITT the potential to deliver training with access to large sets of information in various situations or work settings that would have been difficult otherwise (Clark, 1998; Jones, 2001).

Although JITT can be delivered in an efficient and relatively cost-effective way, such as through printed text manuals, JITT also has the potential to allow access to stored

information, often through electronic means. However, just because the JITT could provide such access does not necessarily mean that it makes sense to do so from a financial perspective (Burkett & Phillips, 2000). Jacobs, Jones, and Neil (1992) compared the financial benefits of structured OJT and unstructured OJT and illustrate that structured OJT yields higher benefits across three different task situations. However, the cost of structured OJT in these instances was relatively low because the delivery relied on the use of on-site trainers to deliver the training. For whatever appeal that technology may bring to a training situation, there is the unavoidable cost involved as well. How to resolve the potential cost issues related to JITT relative to the performance value of the task and the resulting benefits may need to be examined in the future (Burkett & Phillips, 2000; Jacobs, Jones, & Neil, 1992).

The timing of the training is very critical, and the amount of knowledge lost depends on the length of time that elapses before the skills are put to use. If training occurs 3-4 weeks prior to starting upcoming work, the time gap will negatively impact performance (Brinkerhoff, 2011; Ebbinghaus, 1885; Saks & Belcourt, 2006). Research shows scrap learning rates, defined as training which is successfully delivered but not applied on the job, result in high costs (King, 2011). When employees cannot put what they learn from training into practice quickly, it is a wasted effort in both time and money. Scrap learning rates are as high as 50%-80% of all training delivered (Brinkerhoff, 2011). Ebbinghaus (1885) demonstrates that the longer the delay between practice and recall, the more memory loss increases.

Saks and Belcourt (2006) conducted a study of 150 members of a large training and development society in Canada. The 150 participants represented organizations averaging between 500 and 1,000 employees and comprised over a dozen sectors,

including manufacturing, service, and government. Saks and Belcourt (2006) found that 62 percent of employees transfer training immediately afterward, and 44 percent of employees transfer training after six months. The scrap learning rates were 38 percent and 56 percent, respectively. Brinkerhoff (2005; 2011) determined the scrap learning rate can be as high as 80 percent. Even among the best learning organizations, participant memory deteriorates, and the knowledge and skills acquired decay with time. Consequently, optimal performance is not achieved. A discussion of the reasons that the business and economic market demand more efficient use of human capital resources and how JITT can help provide a response to market demands follows next.

JITT Responds to Market Demands

The HRM system can be a strategic asset, capable of affecting performance on multiple levels (Boxall & Macky, 2009; Lepak et al., 2006) and may generate above-average economic returns in certain contexts (Combs et al., 2006). Driven by market demands to develop more efficient organizational structures and practices, there is an increasing emphasis between academics and practitioners in behavioral competitive strategies, such as HPWP, that rely on core competencies and capabilities among employees. This is because these strategies provide an effective response to market demands, especially when the workplace is highly differentiated from competitors who cannot easily duplicate strategies (Becker & Huselid, 2006; Huselid & Becker, 2011). Within this context, a HPWP strategy plays a strategic role as a resource to support the development of core competencies and as an essential ingredient for effective strategy implementation (Becker & Huselid, 1998, 2006; Huselid & Becker, 2011).

An organization's current and future human resources are essential considerations in the development and execution of its business plan and can help create a source of

competitive advantage when aligned with an organization's competitive strategy (Huselid, 1995). Organizations that rely on human capital for competitive advantage require productive behaviors in order to implement strategies. JITT, a form of HPWP, helps to improve an organization's performance.

Business strategy literature draws from practices derived from Barney's (1991) resource-based theory of the organization, which contends that human resources can provide a source of competitive advantage when four basic conditions are satisfied. First, HR practices must add value to the organization's production processes, and levels of individual performance must matter. Second, the skills the organization seeks must be rare. In a manufacturing organization, this implies the KSA needed are often organization-specific (Combs, et al., 2006). Most generally, workers must receive formal training on the scarcer higher-level technical skills such as computer-controlled machine use and complex production procedures. The third condition is that competitors cannot easily imitate the human capital investments that an organization's employees represent. Investments in organization-specific human capital can help to decrease the possibility of imitation by differentiating an organization's employees from those of a competitor. Finally, an organization's human resources must not be subject to replacement by technological advances or other substitutes if they are going to remain a source of sustainable competitive advantage. In this sense, Barney's (1991) resource-based view of the organization suggested that an organization's human resources are a source of competitive advantage if they add value to its production processes and are a unique resource that are difficult to replace. Training intervention practices are an example of one of the many ways that an organization can create a unique workforce that meets these conditions (Burke & Hutchins, 2008; Jones, 2001). Just-in-Time Training can help boost

training transfer because: a) it is conducted at work; b) the newly learned skills are used immediately after training; and c) the intervention involves trainers and supervisors. A discussion of why JITT is appropriate in a manufacturing setting follows next.

JITT Intervention in Manufacturing

Liu et al. (2007) identified business goals of training to include training approaches that are alleged to be better, faster, and cheaper than training in the traditional training environment. Just-in-Time Training aims to be better, faster, and cheaper than the traditional-training approach by offering training only when it is needed and only to those personnel that will be using the skills. By inherent design, HPWP (e.g., JITT) possess characteristics that include team-based design, empowerment, and long-term development of talent, which are hard to copy by competitors and which make the personnel trained using High Performance Work Practices unique. The resource-based view of the organization suggests that increasing knowledge and skills and creating a culture that people want to work in will help sustain a competitive advantage (Afiouni, 2007; Barney, Wright, & Ketchen, 2001).

Due to the unique job requirements of positions within complex manufacturing organizations, all hired production personnel require substantial amounts of training before working in production. Placing an emphasis on JITT can significantly change the trajectory of the company by ensuring the training program provides high-quality personnel in the workforce. The JITT-intervention strategy requires all production personnel attend the training, receive a consistent evaluation of their skill sets, and receive the right training and set of expectations that allow for increased productivity in the workforce (Burke & Hutchins, 2008). Jones (2001) discusses JITT as a variation of planned on-the-job training, but with a greater emphasis placed on the need and the

delivery of the training. Jones (2001) asserts JITT is appropriate for use in manufacturing settings due to scheduling and production requirements.

Training Outcomes

Pre-training briefings, accountability for learning by supervisor, and perception of a training program as mandatory all have a positive impact on intention to transfer learning to the workplace (Baldwin & Magjuka, 1991). Transfer design, which implies that trainees have the opportunity to practice learned skills in a job context, was also found influential on training transfer in some studies (e.g., Werner, O'Leary-Kelly, Baldwin, & Wexley, 1994; Wexley & Baldwin, 1986; Xiao, 1996). This section focuses on trainee's reaction, learning performance and training transfer, and organizational performance.

Trainee's Reaction

Since the ultimate goal of JITT is to improve organizational performance, it is crucial to measure the success of a training program in terms of training outcomes. A trainee's reaction was one of the possible outcomes in level one of Kirkpatrick's model (1976). In this model, a trainee's satisfaction with the program was represented by three main components: expectation, desire, and perception (Tannenbaum, Mathieu, Salas, & Cannon-Bowers, 1991). The trainee's reaction plays a vital role in building interest and attention and enhancing motivation to transfer (Patrick, 1992). For instance, unmet expectations about one's training may lead to low training transfer (Hicks & Klimoski, 1987; Tannenbaum et al., 1991). Fulfillment of the trainee's expectations is one of the main reactions often subject to investigation in training research. This is because satisfaction with the learning experience is a measure of performance, and this factor received more attention from training practitioners.

Mathieu, Tannenbaum, and Salas (1992) found that the trainee's reaction functioned mainly as a moderator of the relationship between training motivation and learning. Mathieu et al. (1992) determined that trainee reaction did not directly relate to learning and transfer to job performance. Eventually, Holton (2005) dropped the trainee's reaction from the list of training outcomes in his training model and treated trainee reaction as an intervening factor affecting learning and training transfer. Prior researchers suggested that while trainee reaction is important, it does not directly relate to transfer to job performance. Since the focus of the current study is on organizational performance, management research on trainee's reaction to training mainly concerns satisfaction with the training material, instruction, instructors, and environment.

Learning Performance and Training Transfer

Level two (i.e., learning performance) and level three (i.e., training transfer) are two of the potential training outcomes in intervention training research, according to Kirkpatrick's Model (1976). Learning performance is the trainee's performance in a training program, which can be measured by asking trainees to recall trained materials immediately or shortly after completion of a training program (e.g., Wexley & Baldwin, 1986). Learning performance has been one of the major focuses of many management training programs because successful trainees would likely feel better able to perform and more motivated to transfer (Holton, 1996). However, training would be useless if it could not be translated into both individual and organizational performance.

Several theories such as expectancy theory, equity theory, and goal setting theory help researchers interpret behaviors that contribute to performance at work and explain motivation to transfer. Expectancy theory iterates the trainee's perceived connection between effort and job performance, their perceived relationship between performance

and outcome, and their perceived value or utility of training (Leung & Mun, 2006).

Equity theory explains that employee desire is that they are fairly treated and that they choose a method of inequity reduction that is least costly to them personally (Adams, 1963). Equity theory relates very well to JITT, as one of the benefits of JITT is to treat everyone fairly and give him or her equal opportunity to bring his or her skills to the highest level of competency and train him or her as well as coworkers. On the other hand, goal-setting theory explains the intention to achieve certain goals, the choice or acceptance of the intentions, and subsequent commitment to those goals (Locke, 1968).

Based on these theories, many researchers have investigated the influence of various factors on training transfer and on developing their measurement constructs. For example, Noe and Schmitt (1986) found that job involvement and career planning are influential on training transfer. Similarly, Tannenbaum et al. (1991) reported that a trainee's positive job attitude could lead to better transfer of learning to job performance. In addition, organizational climate can significantly affect a trainee's ability and motivation to transfer learning to job performance (e.g., Mathieu et al., 1992; Tracey et al., 1995).

Influential Factors on Intervention Training Outcomes

Influential factors on intervention training in general can be grouped into two main categories, individual characteristics and organizational factors. Some of these factors have been previously studied in management training research. However, other factors that could be relevant to intervention training have rarely been targeted in studies (Leung & Mun, 2006).

Individual characteristics have been found to be influential on training effectiveness. Some of these characteristics (i.e., age, educational background, work

experience, ability, self-efficacy, job tenure, organizational commitment, job involvement, and career planning) have been investigated in previous management training research (Mathieu et al., 1992; Mumford et al., 1988; Noe, 1986; Tracey et al., 2001; Warr & Bunce, 1995). Individual characteristics have also been extensively studied in organizational and training research and found to influence motivation to learn and skill transfer to the workplace (Birdi et al., 1997; Mathieu & Farr, 1991; Naquin & Holton III, 2002; Noe & Schmitt, 1986).

Organizational factors have also been extensively studied in management training research and were found to be influential on management training, namely: supervisory/peer support (Tannenbaum & Woods, 1992; Tracey et al., 1995; Tracey et al., 2001; Xiao, 1996), accountability, organizational culture/climate (Tracey et al., 1995), reward/appraisal (Tracey et al., 2001), choice of training/training assignment (Brown, 2001), pre-training briefing (Werner et al., 1994), opportunity of applying learned skills to task on job (Ford & Weissbein, 1997), and post-training intervention (Richman-Hirsch, 2001; Werner et al., 1994). However, it has only been in recent years that the importance of organizational factors has been recognized in both research and practice (Gallivan et al., 2005; Salas & Cannon-Bowers, 2001; Smith & Dowling, 2001; Spitler, 2005). Their applicability to JITT-intervention programs needs further investigation.

Organizational Performance

In terms of productivity, efficiency, effectiveness, and customer satisfaction, improved organizational performance-level four of Kirkpatrick's Model (1976)-could be the ultimate objective and the most desired training outcome in an organization. However, besides individual improvement through training, many other factors that are

completely outside the realm of training may influence organizational performance such as equipment, material supplies, and economic environment. It could be difficult to isolate the effect of training from other influences. Measures should be taken to discount those influences when measuring the effect of training on improvement in organizational performance. Furthermore, in order to obtain an objective assessment, efforts to measure improvements in organizational performance may require participation of trainees, their supervisors/peers, and top management (Leung & Mun, 2006).

Some researchers focused on modeling organizational performance in management training. Holton (2005), in particular, proposed three influential factors independent of the learning outcome and individual performance improvement: 1) link to organizational goals (i.e., ability); 2) expected utility or payoff (i.e., motivation); and 3) external factors (i.e., environment). Training programs not linked to the organizational mission, goals, and strategy are unlikely to produce performance that is valued by the organization, even with positive learning and individual performance improvement (Swanson, 2003). Therefore, greater linkage to organizational goals would tend to produce training programs that promote training transfer (Holton, 2005).

All of these requirements have made the evaluation and assessment of the impact of training programs on organizational performance very difficult (Brinkerhoff, 2005; Nickols, 2005). It is probably because of these difficulties that little research has been conducted at this level (Leung & Mun, 2006). However, research findings in this aspect would make major contributions to training research in general (Kraiger, McLinden, & Casper, 2004; Rowden, 2005).

Just-In-Time Training (JITT) Implications

The evolving workplace in the 21st-century has influenced changes to the way we work and learn. The global economy is experiencing a significant downturn and headed toward an extended period of growth that will bring about tumultuous change (Jones, 2001; Lang, 2012). Many learning organizations are reducing budgets and staff, which affect the way that training is delivered within the company. HRD professionals have always focused on these issues, but the rapidly changing workplace has placed even greater demands on the way we work and learn. Learning managers have to think differently and find creative and innovative ways to bridge the skill gaps that may result from rapid changes in the marketplace. Company leadership needs to adapt their learning delivery methods in order to affect results. The global economy requires that 21st-century HRD models also change. There are at least five essential implications related to JITT that will be discussed.

Key Business Drivers

HRD professionals are usually familiar with the many factors that contribute to the success of their respective organizations. However, one of the implications of JITT is an increased need to have the capability and tools available to respond to key business drivers. JITT is based on the company needs of increased competition, lower costs, and higher customer satisfaction (Jones, 2001). JITT can be viewed as a way to support the key business drivers in an organization (Jones, 2001).

Work Conditions

A second implication of JITT is to understand work conditions. Traditional methods used to analyze work may not provide adequate information for the design of a JITT program. Work-analysis models focus mostly on worker behavior and not

necessarily the interaction of the worker with objects in the environment. A more thorough analysis requires additional information such as: 1) knowledge of the probable points of error in performing new tasks based on differences with known tasks; 2) knowledge of the potential capabilities of the work environment to receive and deliver information electronically; and 3) knowledge of the constraints (e.g., noise, presence of others, or other hindrances) under which the work is performed (Jones, 2001).

Financial Impact

Although JITT can be delivered in a relatively cost-effective way, both in an instructor-led classroom setting and through printed technical manuals, additional benefits from JITT also come from its potential to allow access to stored information, often through electronic means. Even though designers of JITT can provide online access, it does not necessarily mean that it makes sense to do this from a financial perspective (Burkett & Phillips, 2000). Jacobs, Jones, and Neil (1992) compared the financial benefits of structured OJT and unstructured OJT and showed that structured OJT yielded higher benefits across three different task situations. However, the cost of structured OJT in these cases was relatively inexpensive because of the use of on-site trainers to deliver the training. Even though the use of technology may seem appealing in a training situation, there is cost involved. Finding out how to resolve the potential cost issues related to JITT relative to the performance value of the task and the resulting benefits need close scrutiny (Jones, 2001).

Potential of Electronic Delivery Systems

As discussed earlier, the potential benefits of JITT may include the use of electronic technology to deliver training. Therefore, it is essential for HRD managers to familiarize themselves with this technology (Marquardt & Kearsley, 1999). Electronic

delivery systems will not be appropriate for all JITT situations. Instead, HRD managers should use available technology when appropriate within the constraints of their respective organizations (Jones, 2001).

The Goal of Just-In-Time Training (JITT)

Whenever new or somewhat different training approaches are introduced, the tendency is often to focus more on the approach instead of concentrating on the specific issues that the approach is supposed to address. JITT may be subject to these same concerns. JITT should be viewed as part of the solution to a documented performance problem, and training should make sense for the organization. Whenever JITT is used, it should be in order to achieve the goal of improving organizational performance (Jones, 2001).

Summary

The conceptual model of JITT (refer to Figure 1) shows the relationships between the influential factors, individual characteristics and organizational factors, and the outcomes of JITT: 1) trainee's knowledge, and 2) training transfer/job performance. The model is an integrated effort to make JITT measurable and understandable, and ultimately more effective and beneficial to organizations. Overall, the model makes three major contributions to JITT research and practice.

First, the conceptual model of JITT adopts some of the elements from both the conceptual and strategic HRM literature and adapts and incorporates some of the elements found in Holton's *HRD Evaluation and Research Model* learning transfer system inventory (LTSI) conceptual map of constructs (see Figure 2). The conceptual model of JITT considers the role of the trainee's motivations to learn and transfer in JITT. By introducing the JITT Training transfers to improvements in quality defect error

rates into the context of JITT, the conceptual model of JITT is further defined and emerges as one of the primary training outcomes instead of an intervening factor affecting JITT. Such a change can bring practical insight into JITT program design, motivation, and evaluation in terms of perceived ease of use and perceived usefulness of JITT intervention, leading to eventual training transfer.

Second, the model considers JITT in an organizational context in view of the fact that organizational factors are also major contributors to training success. Most of the previous JITT research focused on the influences of individual characteristics on training transfer. However, organizational factors do exert significant influences on JITT outcomes as they do in management training programs. Therefore, they deserve much more attention in both research and practice in JITT.

Third, the conceptual model incorporates all the essential influential elements relevant to JITT (e.g., individual characteristics and organizational factors) and provides a comprehensive platform for further research study of JITT in an integrated context. The research question introduced in Chapter I is proposed for this purpose. Existing research on the conceptual model was largely based on a thorough analysis of past research results in both management and JITT. The model needs to be rigorously tested in empirical studies in the future, in order for it to be further validated and refined. Particularly, it is essential to further validate the various attributes of the job performance of the trainee because of the critical role projected in this research and because of contradictory results in past research.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

Introduction

As described in the literature review, researchers recognize that the design of a training intervention can have a significant impact on effectiveness and performance. A review of studies suggests a quasi-experimental approach is appropriate for studying JITT interventions (Burkett, 2010; Robbins, 2012). The present study utilized this approach.

As companies in the 21st-century look for ways to increase profitability and competitive advantage, developing more effective training methods continues to challenge training departments (Burke & Hutchins, 2008). The current research studies the differences in defect error rates between the control group and JITT group and tested for differences in proportions and evaluated with a chi-square test in order to determine whether the results attained by the JITT group differed significantly from the results attained by the control group. A control group consists of employees who received regularly scheduled training, and a JITT group consists of employees who received JITT. The research question is addressed by comparing each of the different defect error rates collected for the JITT group with the set of values collected for the control group.

Research Question

The following research question guided the framework of the study: How does JITT affect transfer of training in a manufacturing setting? This question is evaluated using measurements of production-quality-defect/error rates. The following hypothesis assessed the research question:

H₀₁: Groups of employees receiving JITT will have no statistically significant improvements in job performance, as measured by the proportion of manufacturing error rates compared to groups of employees receiving regularly scheduled training.

H₁₁: Groups of employees receiving JITT will have statistically significant improvements in job performance, as measured by the proportion of manufacturing error rates compared to groups of employees receiving regularly scheduled training.

Research Design

The purpose of this research was to explore the effect of JITT on job performance in a manufacturing organization. The importance of this research includes understanding: 1) the effectiveness of JITT; 2) ways it is used; and 3) the role it plays in providing solutions to organizational performance problems. In the current study, the researcher examined the relationship between JITT and performance outcomes in order to determine the: 1) effectiveness of JITT as a method for supporting training transfer in a manufacturing organization; 2) effect of JITT on employees' performance outcomes; and 3) JITT's usefulness in bolstering training transfer. Identifying the effect of the JITT and instructional material design on adult learners' ability to transfer instructional material provides valuable information about employee transfer of training in manufacturing organizations, which could have future financial and training implications. The current study confined the investigation to JITT used with adult learners in a specific workplace setting and established empirical data for the JITT model.

According to Creswell (2005), a quantitative approach is appropriate for: (a) statistically analyzing participants' data in an unbiased manner; (b) testing hypotheses; and (c) advancing an expectation about the outcome. Sproull (2003) reports when educated deduction can be made regarding variable interaction and hypotheses can be

tested, quantitative research is appropriate. A mixed-method design where both qualitative and quantitative methods can be used to explore the differences investigated was chosen for this study because mixed methods provide a better understanding than either quantitative or qualitative methodology alone (Creswell & Clark, 2007).

A quasi-experimental design permits researchers to explore how the IVs may influence DVs (Neuman, 2006). Coverdale, Roberts, Louie, and Beresin (2006) identify the quasi-experimental design as the method commonly used in quantitative research. In the current study, a quantitative, quasi-experimental, cohort-controls design (Shadish, Cook, & Campbell, 2002) was applied to explore the effectiveness of JITT at the subject company.

Shadish et al. (2002) offer compelling reasons why cohorts are useful as control groups in certain situations. They are useful if:

- 1) One cohort experiences a given treatment and earlier or later cohorts do not;
- 2) Cohorts differ in only minor ways from their contiguous cohorts; and
- 3) Organizations insist that a treatment be given to everybody, thus precluding simultaneous controls and making possible only historical controls; and
- 4) An organization's archival records can be used for constructing and then comparing cohorts (pp. 148-149).

The company where the JITT study occurred meets all of the above criteria:

- 1) The JITT group (E1) received the JITT intervention and the control group (C1) from an earlier cohort did not.
- 2) The cohorts for the JITT group (E1) were not significantly different from the cohorts in the control group (C1). Descriptive statistics, including demographics such as age, gender, education, etc., show the two groups are similar.

3) The organization's management required that the JITT be given to everyone in the department studied; thus, precluding the possibility of having simultaneous controls and making the use of a historical control group the only possibility.

4) Archival records were used for constructing and comparing the cohorts. The assumption is that the selection differences between cohorts are smaller than would be the case between non-cohort comparison groups (Shadish et al., 2002). It is for this reason the researcher needed to examine participant characteristics between the cohorts (Shadish et al., 2002). The researcher of the current study assumed the cohorts in the JITT group were nearly identical to the cohorts in the control group. Even though participant characteristics are nearly identical, comparability between cohorts is never as high as with random assignment (Shadish et al., 2002).

Due to the nature of treatment and outcome measures, it was not possible to conduct a pre-test of the participant's knowledge. (Shadish et al., 2002) states a cohort control group is useful in certain situations such as this. The organization where the JITT occurred met all of the criteria that (Shadish et al., 2002) described as reasons why cohorts are useful as control groups in certain situations. Therefore, this researcher employed quasi-experimental, two-groups and a post-test-only; cohort-controls design process (Shadish et al., 2002). All participants in the JITT group attended the same class (i.e., JITT) taught by the same instructor(s) in the organization's training department. The company's training department worked jointly with the manufacturing department to coordinate existing curriculums to meet the JITT needs of the employees.

The study utilized a sequential, mixed-method, quasi-experimental approach. Quantitative data was collected and analyzed first, followed by a collection and analysis of qualitative data (Hanson et al., 2005). Findings from the qualitative data were used to

expand and understand the quantitative data. Quantitative and qualitative results were integrated, interpreted, and discussed.

The researcher employed a cohort-control-group design to assist in analyzing the quantitative data. Cohort designates successive groups that go through processes. For example, this exists in business settings where one group of trainees follows another (Shadish, Cook, & Campbell, 2002). Figure 3 outlines the quasi-experimental, cohort-control-group design used in this study.

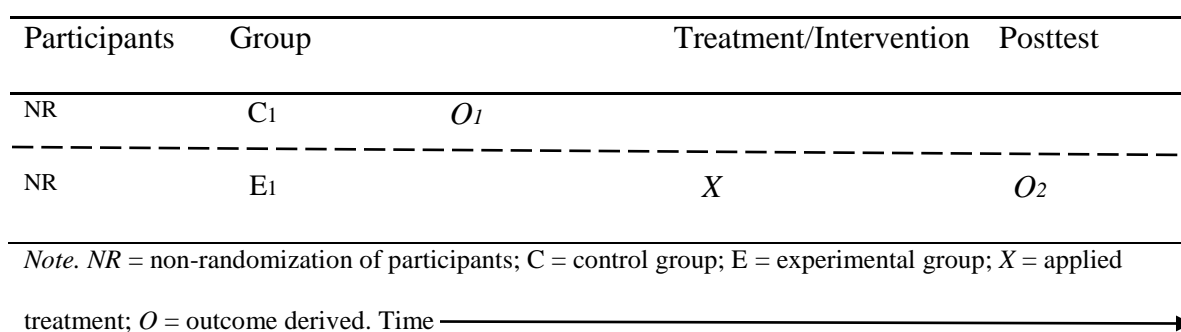


Figure 3. Quasi-Experimental Cohort Control Group Design Model with Nonequivalent Groups.

The dashed line and non-randomization (NR) participant designator indicates that subject groups are preceded by non-random assignment (NR) of participants (Shadish et al., 2002). In the diagram shown in Figure 3, the dashed line between nonequivalent groups indicates a cohort control. The numerical subscripts refer to time of measurement, with the effect of the treatment/intervention assessed by contrasting O₁ to O₂.

The process flow for the quasi-experimental cohort control group design is depicted in Figure 4. First, the pre-existing performance is analyzed for manufacturing errors. The earlier cohorts who performed similar work and are equivalent in terms of training received, knowledge, skills and abilities comprise the control group. The JITT group consisted of a cohort who received the JITT just prior to using the skills. The

curriculum for the JITT was identical to the training the cohorts in the control group received. The only difference was the timing of the training, which was administered just prior to use of the skills back on the job. The error rates were determined after the employees utilized the skill sets.

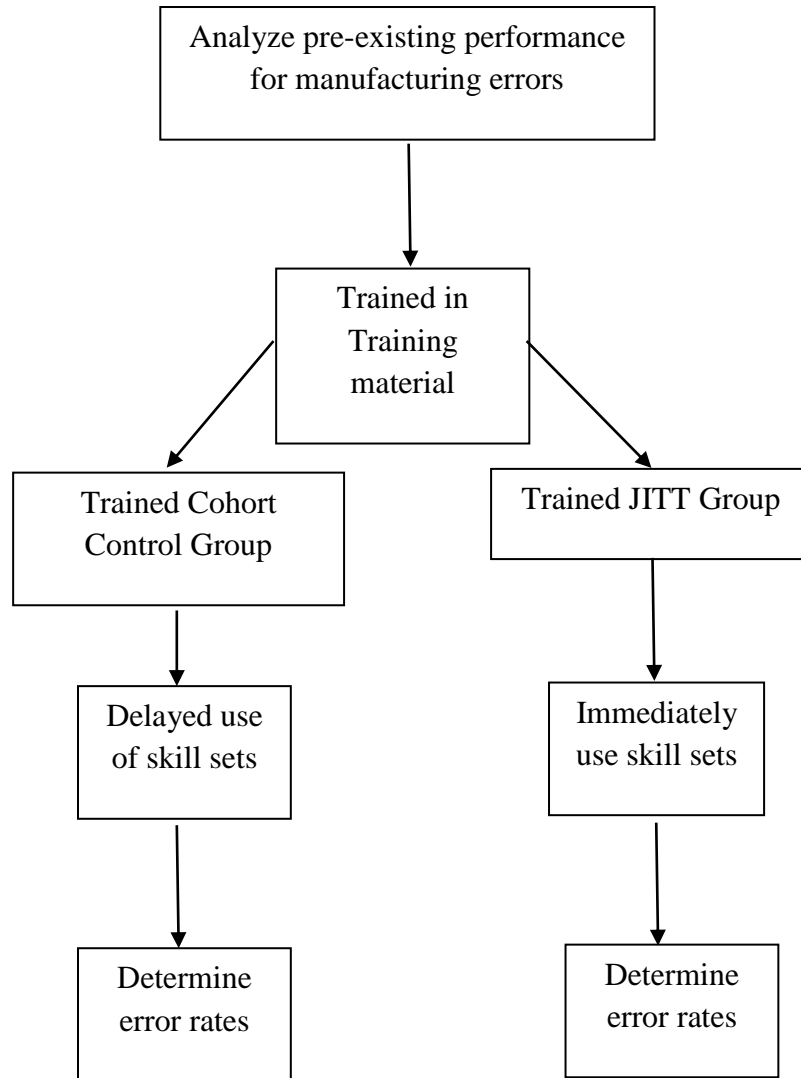


Figure 4. Process Flow for Quasi-Experimental Cohort Control Group Design Model with Nonequivalent Groups.

Population and Sample

Population

Employees in a large manufacturing organization located along the U.S. Central Gulf Coast form the study's population target. The selection of employees from a total employee population of over 10,000 involved identifying individuals in a single manufacturing production department with 943 employees. Administrative employees and engineers were not included in the target population because they perform a fundamentally different type of job in a substantially different work environment. All production employees from this department formed the study group. JITT and control groups included fitters and welders, and the production schedule dictated the number of employees attending JITT and the training topic. The JITT reflected the needs of the production schedule and involved all 943 employees in the department. Results from the JITT group's quality defect error rates were compared with the control group defect error rates. Although employees performed work at different work stations, individual locations were similar and representative of the participant sample for this research.

Sample

The sample consisted of groups of employees working in the subject company's pipe department. A convenient sample consisting of groups of individuals from the same department who had received JITT made up the JITT group. A previous cohort (i.e., a group of employees performing the same tasks but that did not receive JITT) made up the control group. The control group sample consisted of groups of cohorts working in seven work stations, and the JITT group sample was drawn from successive groups of cohorts working in the same work stations. The control group of cohorts performed work 3-6

months before the succeeding group of cohorts in the JITT group. The amount of work performed by the control group was identical to that performed by the JITT group.

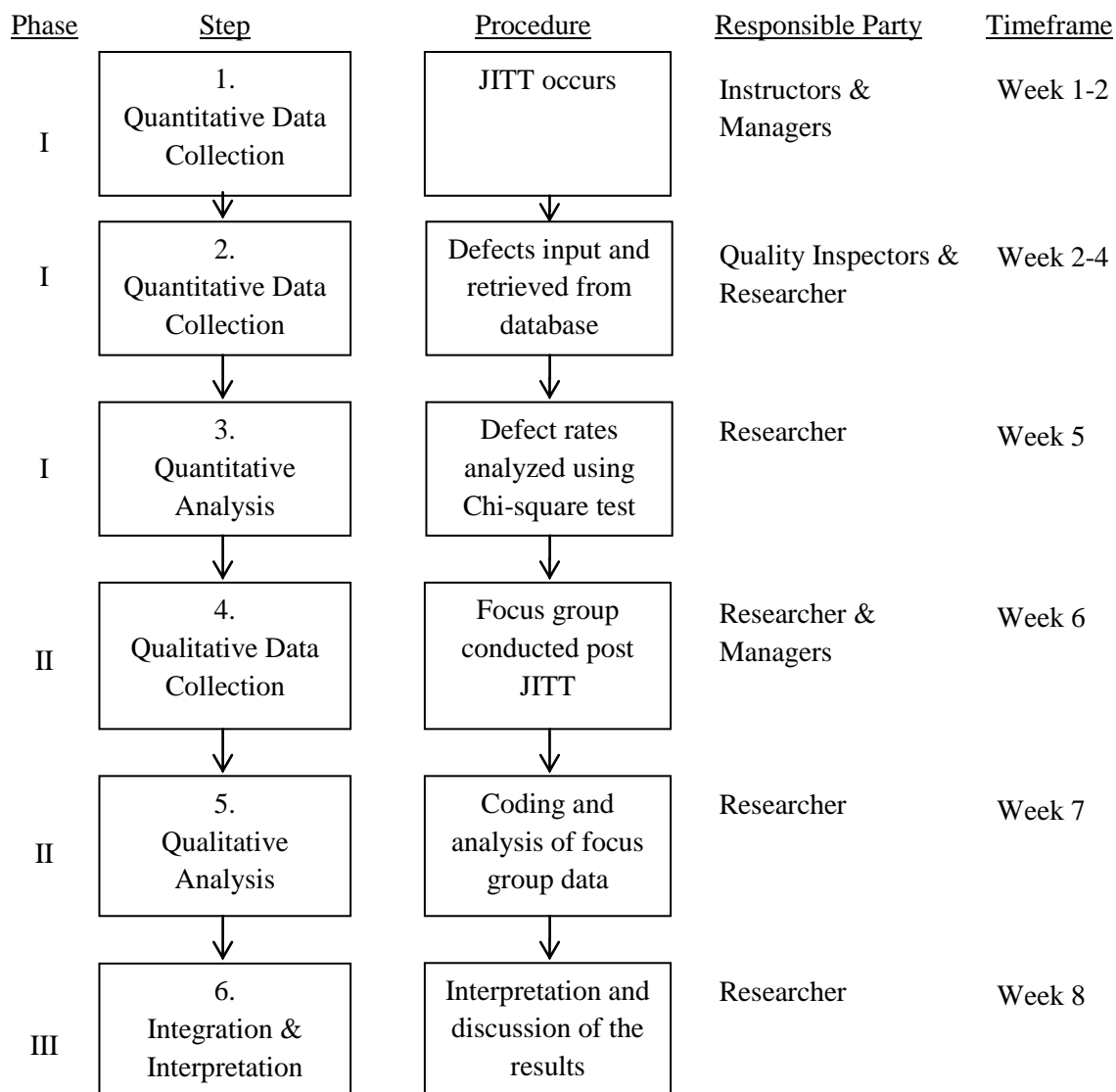


Figure 5. Sequential Explanatory Method Used in Current Study

Research Procedures

Overview

Six steps were established to guide the research procedures of the current study.

Three phases were also incorporated in the procedures: a quantitative phase (steps 1-3), a

qualitative phase (steps 4-5), and an integration phase (step 6). Figure 5 displays an overview of the steps and phases involved in the sequential explanatory method utilized in the current study. The first step of the research procedures conducting JITT occurred over a two week period just prior to when the employees needed to use the skills. The employees' management identified the personnel who needed JITT, based on the type of work and when it would be performed. The manager notified the company training department and requested a specific JITT, based on the training needed for the upcoming work and the number of personnel needing the training.

Step two, collecting quality defect/error rates, occurred when the defect/error rates for the recently performed work were measured and recorded by the Quality Assurance (QA) inspectors. Defect error rates are numeric measurements that indicate the level of proficiency learners transferred on the job from the JITT. The researcher accessed the company database and retrieved and recorded the results.

Step three involved a chi-square analysis of the defect/error rate data by the researcher. A chi-square-test was appropriate for this study because the researcher compared the proportions of the two groups and also because the sample size was reasonably large ($n \geq 25$). A chi-square test allowed the researcher to state with some degree of confidence whether the obtained difference between the proportions of errors of the sample groups was too great to be a chance event (Kish, 1987; Singleton & Straits, 1999; Wooldridge, 2003). The chi-square was used to determine whether a significant difference between the proportions of error rates of the JITT and control groups existed. The independent variable (IV) for the chi-square test, the JITT intervention, was applied. The dependent variable (DV) assessed was the quality-error rates for the product being

produced. A t-test of the demographics allowed the researcher to state with some degree of confidence that the two groups were not significantly different.

In step four, the researcher conducted a focus group with managers of employees in the JITT and control groups. Step five included the coding and analysis of the focus group data. The integration and interpretation of the results was the last step in the research procedures.

Quantitative Phase

For the control group, the researcher used the error rates of previous cohorts who performed similar work before JITT began. The error rates assessed for the control group were for the same stage of production as the JITT group. Defect/error rate data from the control group was used as a baseline from which to compare data from the JITT group. The most frequently occurring, quality-defects from previous work were used to identify work phases to include in the baseline study for the control group. Different phases of the production schedule determined what processes were performed. Criteria used to determine the appropriate JITT were based on the type of processes performed in the upcoming work phase, usually 12-18 weeks of planned, scheduled, pre-determined work. Specific training needs were identified by the department responsible for the work phase and geared toward the type of work in the phase. For example, if the most recent data for the upcoming work phase showed the two most frequently occurring manufacturing errors were due to improper installation of hangers and weld not meeting requirements, the JITT focused on hanger training and welding workmanship. However, if the two most common errors were due to documentation and markings not in accordance with procedures; and joint fit up or preparation for welding not in accordance with procedures, the JITT focused on joint record card training and fitting workmanship. The timing of

this training occurred just prior to starting the production phase, and a post-test measured the results of the training intervention applied to the JITT group by examining the data on error rates. In contrast, the control cohort received training 10-13 weeks or longer before starting the work phase.

Quantitative Data Collection

Collecting and evaluating differences between the quality defect error rates of the control and JITT group provided the data for analysis. Defect error rate data consisted of the number of occurrences (i.e., defective or not defective) and is comprised of nine different defect categories: 1) material was improperly located or oriented; 2) components did not meet drawing requirements; 3) hangers or hanger material were improperly installed, located, spaced, or fastened; 4) documentation and markings were not in accordance with procedures; 5) joint fit up or preparation for welding was not in accordance with procedures; 6) welding process was not in accordance with procedures; 7) weld completion was not in accordance with procedures; 8) mechanical fittings were not installed in accordance with procedures; and 9) O-ring was not installed properly.

Quantitative Data Analysis

Since the defect error data for each quality defect type was dichotomous, (i.e. either defective or not defective), the differences in defect error rates between the control group and JITT group were tested for differences in proportions and evaluated with a chi-square test in order to determine whether the results attained by the JITT group differed significantly from the results attained by the control group. For this phase of the study, each of the different defect error rates collected for the JITT group was compared with the set of values for the control group. Because differences in proportions were analyzed, a chi-square test was used as the statistical tool to test whether the error rates for the two

groups were different. Since there are nine categories of defects and the number of defects in each category were separated by group (JITT versus control), the defects were compared by category and group to determine if they differed. In particular, if training for the JITT group focused on the defects most common in the control group, one would expect defects in those groups to be less common for the JITT group. At the same time, if the JITT did not cover training that the control group received, such as for less frequent errors, more defects may be seen in those categories with the JITT group. For this part of the quantitative data analysis, a chi-square test was useful and appropriate. Chi-square is a statistical test often used to compare observed data with data expected to be obtained according to a specific hypothesis (Kish, 1987; Singleton & Straits, 1999; Wooldridge, 2003). The chi-square test was used when the researcher wants to know about the goodness of fit between the observed data in the control group and the expected data in the JITT group (Kish, 1987; Singleton, et al., 1999; Wooldridge, 2003). The chi-square test determined if the deviations (differences between observed and expected) were the result of chance, or were due to other factors. The investigator determined how much deviation was due to chance in order to conclude that something other than chance was at work, causing the observed to differ from the expected. The chi-square was used to test the null hypothesis, which stated that there was no significant difference between the expected and observed result.

Qualitative Phase

In the focus group moderated by the researcher, JITT participants responded to a protocol of interview questions. The focus group consisted of eight managers of the JITT group participants so that data on topics of central importance to the researcher could be captured from the participants. Participants received an invitation to participate in the

focus group. Participants in the research study completed and returned a research participation interest form, creating the sample of participants for the focus group. The sample was a convenient sample of managers, from which participants willing to participate were selected (Cooper & Schindler, 2008; Creswell, 2005). The invitation included an introductory letter, which provided the details of the research: 1) researcher's name; 2) purpose of the study; 3) importance of participation; 4) sponsorship; 5) time requirements; and 6) an overview of how the focus group research would be conducted (Creswell, 2005). Nine open-ended questions were utilized for the focus group (Appendix A). As per Krueger, cited by NOAA (2009), only open-ended questions should be used in qualitative research. Questions permitted the participants to offer suggestions to enhance participants' learning experiences related to the JITT method. Questions used in the current study were adapted from suggestions given by Krueger (2009) and Robbins (2012). Table 1 provides the types of questions employed in the focus group.

The following suggestions for focus group questions were adopted from Krueger (2009) to develop questions for the focus group: 1) Use only open-ended questions; 2) Avoid dichotomous questions, since they yield minimal response; 3) Avoid asking "why." Instead, ask about specific project components; 4) Use "think back" questions that highlight a past event or experience common to all participants; 5) Use a variety of questions that will encourage participant involvement. Questions may include perceptions, preferences, rating scales, and case examples; 6) Order questions in a sequence that goes from general to highly specific; and 7) Budget time for unanticipated questions.

In the current study, the researcher followed six steps to develop effective questions for the focus group (Krueger, 2009). First, the researcher reviewed the research

project goals and objectives in order to determine information that would specifically benefit this project and determined high-priority items about information needed. Second, the researcher determined information currently available in order to minimize redundancy of topics and questions. Third, a draft of a comprehensive list of questions was developed. Fourth, a meeting to discuss focus group questions was held with departmental supervisors familiar with Just-in-Time Training. A preliminary list of questions was presented to supervisors, and the researcher obtained feedback on the draft questions. Fifth, the researcher revised the list of questions and sixth, presented them to supervisors for final approval. The analysis of the quantitative data helped the researcher produce questions to elicit comments from the focus group and to help provide insight and a deeper understanding of the quantitative results.

Table 1

Types of Questions Employed in Focus Group

Question type	Purpose
Opening	Participants get acquainted and feel concerned
Introductory	Starts discussion of topic and provides participants with opportunity to reflect on experiences and their connection with topic.
Transition	Moves smoothly and seamlessly to key questions and serves as link between introductory and key questions.
Key	Obtains insight on areas of primary concern in the study.
Ending	Brings closure to discussion and enables participants to reflect on previous comments.

Qualitative Data Collection

After the quantitative data analysis of the defect error rates, the next data collection phase of the investigation consisted of a qualitative focus group in order to expand understanding of the quantitative data. The focus group was used to generate ideas and provide stakeholders with an opportunity to express their feelings about JITT (NOAA, 2009). The focus group explored reasons why participants perceived the JITT as successful or unsuccessful. The researcher conducted a focus group with the managers of the participants in the JITT group in order to gain a better understanding of the effect that JITT had on transfer of training and quality defect error rates.

Qualitative Data Analysis

Analyzing qualitative data from focus groups involved organizing and interpreting the data in order to gain a deeper understanding of a particular situation or topic (Creswell, 2009). The focus group analysis consisted of data which was derived from open-ended questions. Interview questions were structured in such a way that the researcher could determine the managers' perceptions of the JITT intervention. The focus group interview questions (Appendix A) helped the researcher understand the results of the quantitative analysis. Focus group results indicated perceptions, opinions, attitudes, feelings, and comments related to the JITT method. The researcher transcribed and analyzed the qualitative data in order to identify recurring concepts within the data. After the focus group data was analyzed, it was compared with the quantitative data for similarities and validity (Myers, 2009).

Integration and Interpretation Phase

After the qualitative phase was completed, the researcher integrated the results of the quantitative and qualitative analysis and interpreted the results. The focus group

interview helped the researcher understand the results of the quantitative analysis. Integration of quantitative and qualitative results led the researcher to two overall findings. Recommendations and conclusions were also determined.

Validity Concerns

According to D'Agostino and Kwan as cited by Shadish et al. (2002), a classic method for seeking a high degree of external and internal validity for an experimental design that used a control group but no pre-test was to have a control group that received no treatment selected to be as nearly identical as possible to the treatment group. This helped to support a counterfactual inference (Shadish et al., 2002). In this research setting, the control and experimental groups were made as similar as possible by using personnel who performed identical processes and worked in the same department of the same company. In this research study, the experimental group was referred to as the JITT group.

While precautions were taken to design this study to maximize internal and external validity, potential limitations may exist. According to Shadish et al. (2002), limitations to external validity could include:

- 1) Interaction of the causal relationship with units-the results found in the JITT experimental group might not be significantly different if other departments had been studied.
- 2) Interaction of the causal relationship with outcomes-an effect found on one kind of outcome observation (e.g., the data which is collected), may not be significantly different if other outcome observations such as different defects were used.

According to Shadish et al. (2002), limitations to internal validity could include:

- 1) *Selection*. There may be systematic differences over conditions in characteristics between the treatment cohort and the earlier control cohort that could cause the observed effect, even though every effort was made to make the treatment and control cohort groups nearly identical.
- 2) *History*. Events that were occurring concurrently with the treatment could cause the observed effect (i.e., the quality might be improving in the plant because of reasons other than the type of training being used).
- 3) *Maturation*. Naturally occurring changes (i.e., quality improving because the employees were getting better at their jobs over time) could be confused with the JITT treatment effect.

Summary

Chapter III described the research design for the current study, which sought to determine the impact of JITT on job performance. The researcher employed a sequential mixed-methods approach, collecting quantitative data through a quasi-experimental, cohort control group design with nonequivalent groups. The researcher conducted a focus group with the managers of the JITT group participants and collected qualitative data through open-ended questions.

The population for the study included production employees from a manufacturing department of a large manufacturing organization located on the U.S. central Gulf Coast. The JITT group sample included production employees from a single craft who participated in a JITT class. The control group sample consisted of a previous cohort, a group of employees who performed the same tasks but who did not attend a JITT class. To measure the results of the JITT post-intervention, the researcher utilized quantitative data (error rates) generated on the job by the JITT group participants. The

error rates of the JITT group indicated the level of knowledge transfer utilized from the JITT intervention.

Threats to external validity included the interaction of the causal relationship with units, treatment variations, and outcomes. Threats to internal validity included selection bias, history and maturation. Selection bias may have resulted from systematic differences over conditions in characteristics between the treatment cohort and the earlier control cohort that would cause the observed effect.

CHAPTER IV

RESULTS OF DATA ANALYSIS

Introduction

The sequential mixed-methods approach utilized in this study investigated the effects of JITT on job performance at a manufacturing company on the central Gulf Coast. The study employed a quasi-experimental research design to compare the proportion of manufacturing error rates between groups of employees receiving JITT to groups of employees receiving regularly scheduled training. This chapter will provide detailed results of the study. The results of the quantitative data analysis will be discussed first, followed by a discussion of the qualitative data analysis.

Quantitative Data Analysis

The current study used a sequential mixed-methods research design, utilizing a cohort-control-group design to assist in analyzing the quantitative data. For the control group, the researcher used the error rates of previous cohorts who performed similar work before the Just-in-Time Training began. The purpose of the sequential mixed-methods research design was to ascertain the influence of the independent variable (IV), the training intervention or treatment, which was manipulated. The control group consisted of employees receiving the regularly scheduled training, and the JITT group consisted of employees receiving JITT. The dependent variable (DV) assessed was the manufacturing error rates for the product being produced. Due to the nature of treatment and outcome measures, it was not possible to conduct a pre-test. Therefore, this researcher employed a quasi-experimental, two-group, post-test-only, cohort-controls design process (Shadish et al., 2002). First, each of the defect error rates for the JITT group was compared with the

defect rates of the control group. Because differences in proportions were being analyzed, a chi-square test was used to test whether the two groups were different.

In order to decrease the threat of selection bias to internal validity, the researcher performed t-test analyses on group demographics to detect possible differences between the control and JITT groups. As shown in Table 2, the two-tailed t-test comparison of the control and JITT groups by age yielded a P value equal to 0.9392. The mean of the control group minus the mean of the JITT equaled -0.044. The 95% confidence interval of this difference was from -1.169 to 1.082. The t-value = 0.0763, degrees of freedom (df) = 1896, and the standard error of difference = 0.573. By conventional criteria, this difference was not statistically significant. Since the P value was greater than 0.05, the researcher accepted the null hypothesis that the population mean difference is equal to 0 at the 0.05 level.

Table 2

T-test Comparison of Control and JITT Groups by Demographics

Group	Mean	Std. Dev.	N	t-value	p value
Control	42.269	12.527	954	0.0763	0.9392
JITT (Age)	42.313	12.427	943		
Control	7.395	8.064	954	0.4518	0.6515
JITT (seniority)	7.564	8.168	943		
Control	6.796	7.599	753	0.4048	0.6857
JITT (male)	6.957	7.687	736		
Control	17.027	9.160	201	0.1434	0.8861
JITT (female)	16.896	9.322	207		

Since the confidence interval of the difference between the mean of the control group minus the mean of the JITT group contained the number zero, the implication was that there was not a statistically significant difference between the group demographics in the control and JITT groups. The confidence interval was used to indicate the reliability and validity of the estimate. Conversely, if the confidence interval had not contained the number zero, the implication would have been that the two groups were significantly different.

The two-tailed t-test comparison of the control and JITT groups by seniority (number of years with the company) yielded a P value equal to 0.6515. The mean of the control group minus the mean of the JITT group equals -0.168. The 95% confidence interval of this difference is from -0.900 to 0.564. The t-value = 0.4518, df = 1896, and the standard error of difference = 0.373. By conventional criteria, this difference is not considered to be statistically significant.

The two-tailed t-test comparison of the control and JITT groups by number of years with the company by male gender yielded a P value equal to 0.6857. The mean of the control group minus the mean of the JITT group equaled -0.160. The 95% confidence interval of this difference was from -0.939 to 0.618. The t-value = 0.4048, df = 1487, and the standard error of difference = 0.396. By conventional criteria, this difference was not considered to be statistically significant.

The two-tailed t-test comparison of the control and JITT groups by number of years with the company by female gender yielded a P value equal to 0.8861. The mean of the control group minus the mean of the JITT group equaled 0.131. The 95% confidence interval of this difference was from -1.668 to 1.930. The t-value = 0.1434, df = 406, and

the standard error of difference = 0.915. By conventional criteria, this difference was not considered to be statistically significant.

Figure 6 displays the age of employees in the control group and Figure 7 displays the age of employees in the JITT group. The mean age of employees in the control group was 42.27 years old, and the mean age of employees in the JITT group was 42.31 years old. Figure 8 displays the number of years a control group was employed with company, and Figure 9 displays the numbers of year's a JITT group was employed with company. The mean number of years the control group employees were employed with the company was 7.39 years, and the mean number of years a JITT group of employees were employed with the company was 7.56 years. The abbreviation Craft-WL shown in Figures 6-9 refers to the Craft Work Leader. The light shading indicates the number of craft employees, and the dark shading indicates the number of work leaders. Figures 10-11 display the gender of employees in each group. The light shading indicates the number of males, and the dark shading indicates the number of females. The mean number of years male control group participants were employed with the company was 6.79 years, and the mean number of years female control group participants were employed with the company was 17.03 years. The mean number of years male JITT group participants were employed with the company was 6.96 years, and the mean number of years female control group participants were employed with the company was 16.9 years.

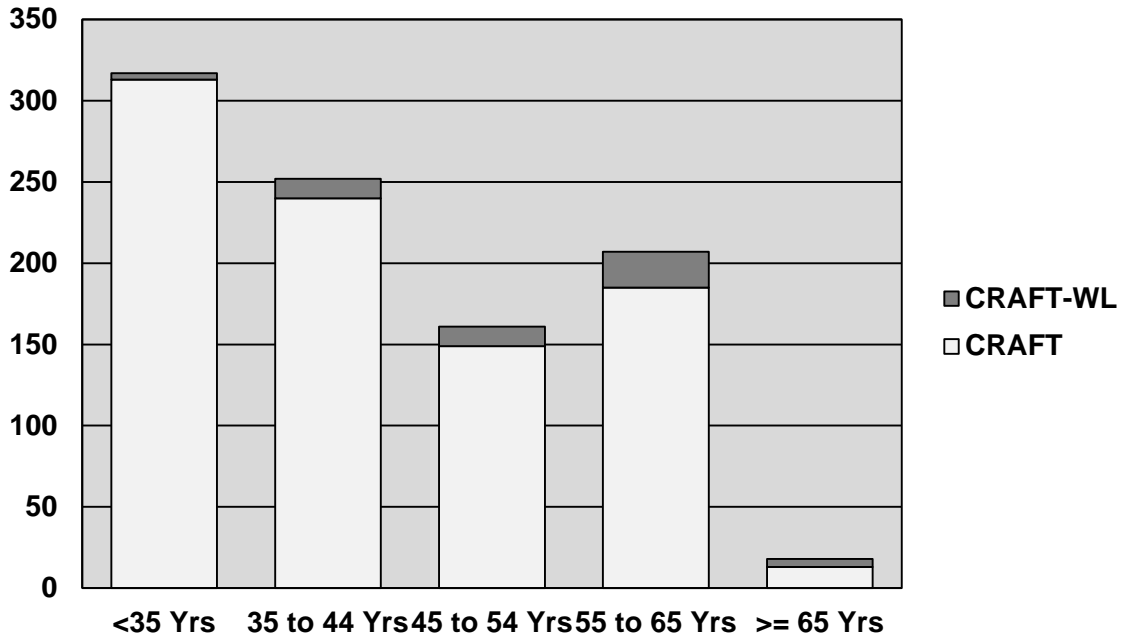


Figure 6. Age of Employees in Control Group.

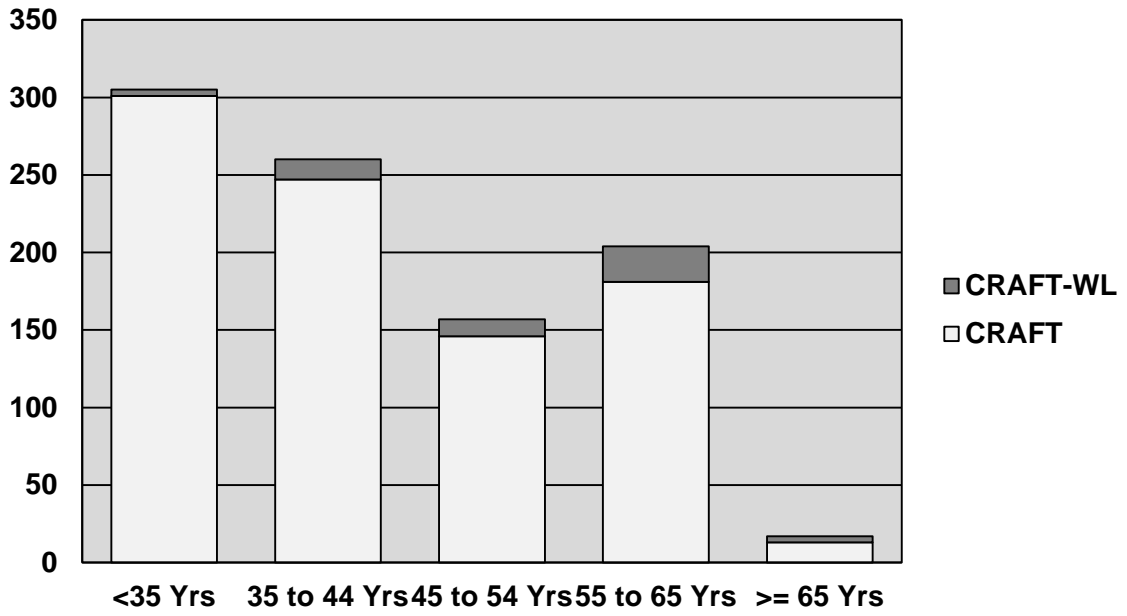


Figure 7. Age of Employees in JITT Group.

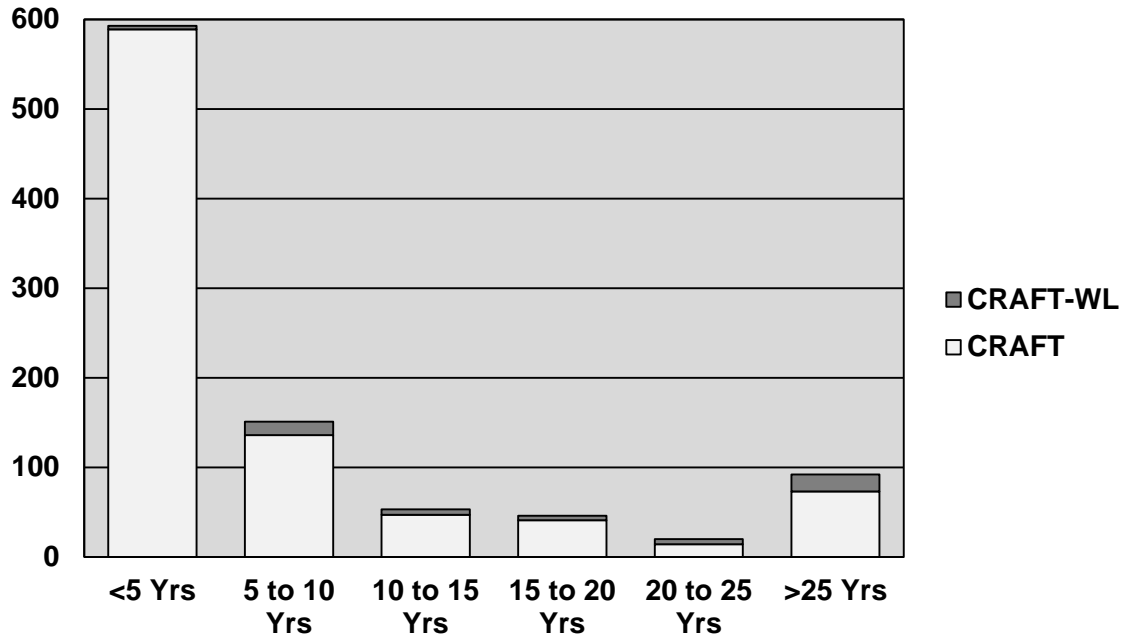


Figure 8. Number of Years Control Group Employed with Company.

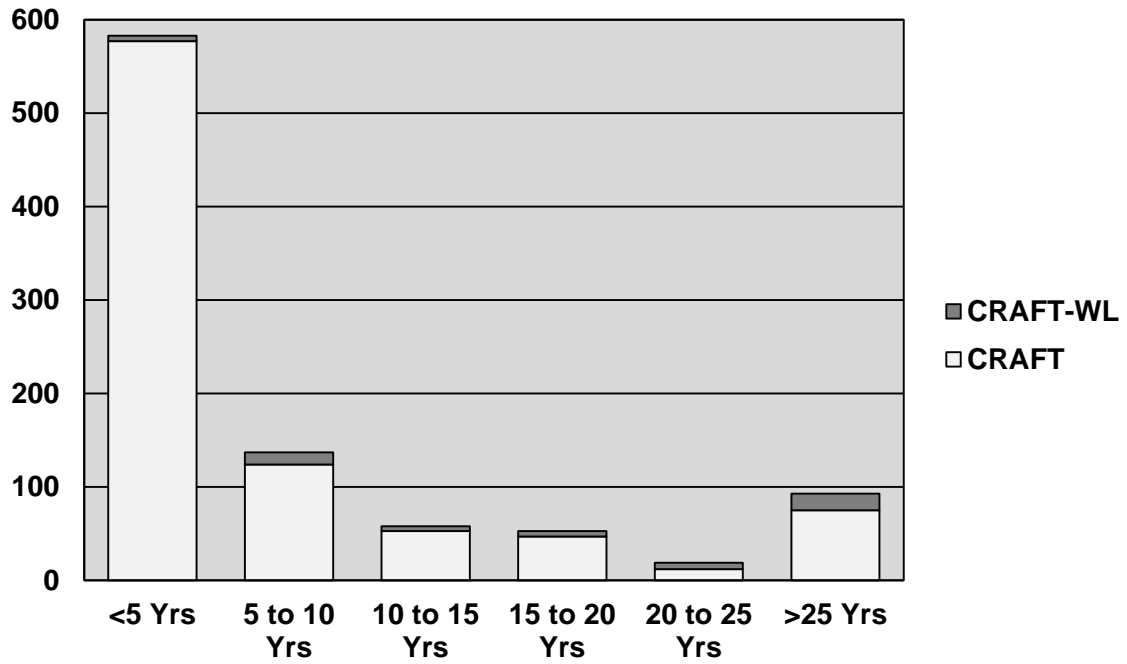


Figure 9. Number of Years JITT Group Employed with Company.

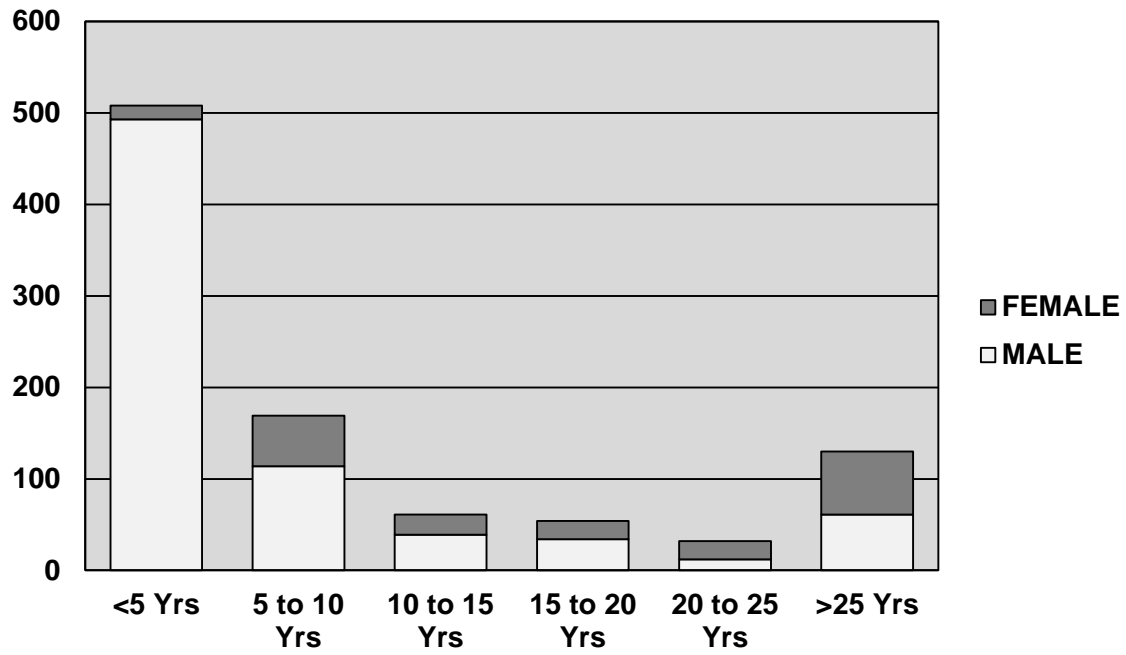


Figure 10. Gender of Control Group Employees

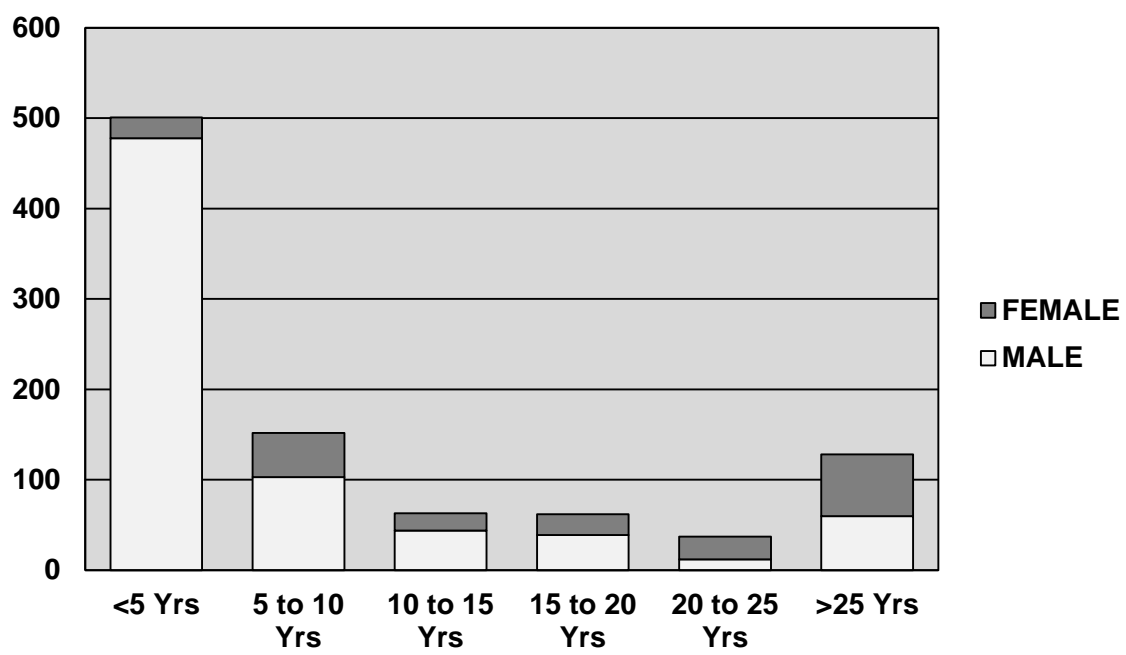


Figure 11. Gender of JITT Group Employees

Comparison of Control and JITT Groups by Gender

The researcher also performed a chi-square analysis by gender to determine if the makeup of gender was significantly different between the two groups. The chi-square test was a statistical test of significance used to determine whether or not frequency differences had occurred on the basis of chance. In comparing the number of males in the control and JITT groups, the proportion of males in the control group was found to be 79.85% out of a total of 954 personnel. The proportion of males in the JITT group was 78.05% out of a total of 943 personnel. The difference between the two groups was 1.80%, and a 95% confidence interval for this difference was -1.943% to 5.541%. The chi-square test obtained a value of 0.820, DF=1, and P=0.3653. Since this P value was greater than 0.05, the conclusion was that the two groups were not significantly different.

A chi-square analysis by gender was performed in order to demonstrate that the makeup of gender was not significantly different between the two groups.

Defect Rates

The researcher performed a chi-square analysis for each of the nine manufacturing defect error categories to evaluate hypothesis H_0 . The chi-square test was a statistical test of significance used to determine whether or not frequency differences had occurred on the basis of chance. It was a nonparametric test (no population assumptions are required for its use). Chi-square required that the data were in the nominal form of frequency counts for two or more categories, i.e., the actual number of cases (frequency of occurrence) that fall into two or more discrete categories (Huck, 2008; Sprinthall, 2007). The nine defect errors analyzed in the current study were categorical in nature, making chi-square the appropriate statistical test. Table 3 displays

the nine errors analyzed, along with a brief description and the grouping variable assigned in the data analysis process.

Table 3

Defect Error Code Descriptions and Grouping Variables

Defect/Error	Full Description	Defect?
P01	Piping is improperly located, oriented, sound shorted, or not annealed	Yes = 1 No = 2
P02	Piping components do not meet drawing requirements.	Yes = 1 No = 2
P03	Pipe hangers or hanger material are improperly installed, located, spaced, or fastened.	Yes = 1 No = 2
P04	P1 piping nondestructive test (NDT) documentation, markings, are not in accordance with procedures	Yes = 1 No = 2
P05	Pipe joint fit-up or preparation for welding/brazing is not in accordance with procedures.	Yes = 1 No = 2
P06	Pipe welding/brazing process is not in accordance with procedures.	Yes = 1 No = 2
P07	Pipe weld/braze completion is not in accordance with procedures.	Yes = 1 No = 2
P08	Mechanical fittings are not installed in accordance with procedures.	Yes = 1 No = 2
P09	O-ring not installed properly.	Yes = 1 No = 2

Table 4

Proportion of Observations with Errors for Control Group and JITT Group

Defect Code	Observations	Control Group Total	JITT Group Total
P01 Error	observations	2411	14788
	non-conformities	179	339
	ERROR%	7.42%	2.29%
P02 Error	observations	8691	16149
	non-conformities	555	624
	ERROR%	6.39%	3.86%
P03 Error	observations	8576	10113
	non-conformities	1530	1049
	ERROR%	17.84%	10.37%
P04 Error	observations	541	11805
	non-conformities	13	57
	ERROR%	2.40%	0.48%
P05 Error	observations	2878	15499
	non-conformities	70	246
	ERROR%	2.43%	1.59%
P06 Error	observations	3	151
	non-conformities	0	4
	ERROR%	0.00%	2.65%
P07 Error	observations	53335	56740
	non-conformities	2737	1709
	ERROR%	5.13%	3.01%
P08 Error	observations	10173	18645
	non-conformities	57	147
	ERROR%	0.56%	0.79%
P09 Error	observations	288	2122
	non-conformities	25	193
	ERROR%	8.68%	9.10%
Total	observations	86896	146012
	non-conformities	5166	4368
	ERROR%	5.95%	2.99%

Table 4 shows the proportion of observations with errors for the control group and the JITT group. The table shows the total number of observations and the total number of observations with non-conformances for each type of defect. The error percentage was calculated as the proportion of observations with non-conformities. The proportion of

observations with non-conformities was shown for each of the nine types of errors made and the total for each error type and the total for each group.

Hypothesis Testing and Comparing Two Proportions

The researcher tested the hypothesis in order to determine if the data showed a significant effect or could have happened by chance. Hypothesis testing was used to decide between the research hypothesis and the null hypothesis. The following hypothesis assessed the research question:

H₀1: Groups of employees receiving JITT would have no statistically significant improvements in job performance, as measured by the proportion of manufacturing error rates when compared to groups of employees receiving regularly scheduled training.

H₁1: Groups of employees receiving JITT would have statistically significant improvements in job performance, as measured by the proportion of manufacturing error rates when compared to groups of employees receiving regularly scheduled training.

In the current study, employees in the control group and JITT group received work-related training at the subject company's on-site training facility. Instruction was provided by the same group of training instructors, and each instructor taught the same course curriculum to both the control group and JITT group of employees. The training instruction which both groups of employees received was identical. The only difference was the timing of the JITT intervention, which occurred just prior to use. The current study investigated whether or not Just-in-Time Training had a significant impact on reducing manufacturing error rates at a large manufacturing organization. In the current study, a significant result was not likely to occur if the null hypothesis that groups of employees receiving JITT would have no significant improvements in job performance when measured by proportion of manufacturing error rates compared to groups of

employees who had received regularly scheduled training was true (Huck, 2008). If the null hypothesis was not true and the alternative hypothesis is true, groups of employees receiving JITT would have statistically significant differences in job performance, as measured by proportion of manufacturing error rates, compared to groups of employees receiving regularly scheduled training. The researcher would conclude with a relative certainty the observed difference was due to influences other than chance.

The manufacturing organization in the study required their quality assurance department to electronically record manufacturing error rate data for each defect type on a daily basis. The researcher retrieved information from the company database for the quantitative analysis. The researcher retrieved error rate records for each work station involved in the study and compared the actual number of manufacturing errors made by employees in the control groups that did not receive JITT to the errors made by the JITT groups that received JITT. The researcher utilized a chi-square analysis to compare the two groups in order to determine whether the null hypothesis could be rejected (Huck, 2008; Sprinthall, 2007). The actual number of errors for the control groups and JITT groups are grouped by work station. The work station number corresponded to the construction schedule and has the start and stop date when the work was completed. The average error rate was calculated for employees in the JITT groups receiving JITT and then compared to average error rates for employees in control groups that did not receive JITT and performed the same work at similar work stations. The researcher conducted similar comparisons for each work station on each of the different error types. The results of the data analysis on each of the nine types of manufacturing errors, follows next.

Comparison of Control and JITT Groups on Manufacturing Defect Errors

In comparing the number of manufacturing errors made by the control and JITT groups, the proportion of total errors made by the control group was found to be 5.95% out of 86,893 observations. The proportion of total errors made by the JITT group was 2.99% out of 146,012 observations. The difference between the two proportions is 2.96%, and a 95% confidence interval for this difference is 2.78% to 3.141%. Since the confidence interval of the difference between the two proportions did not contain the number zero, the implication was that there was a statistically significant difference between the numbers of errors made by the two groups. Conversely, if the confidence interval had contained the number zero, the implication would have been that the two groups were not significantly different. The chi-square test obtained a value of 1214.736, $DF=1$, and $P<0.0001$. Since this P value was less than 0.05, the conclusion was that the proportion of errors made by the two groups differed significantly. This supported the research hypothesis H_1 which stated groups of employees receiving JITT would have statistically significant improvements in job performance, as measured by proportion of manufacturing error rates when compared to groups of employees receiving regularly scheduled training. Table 5 provides a summary of the chi-square analysis of the control and JITT groups on manufacturing error rates.

The proportion of piping location (P01) errors made by employees was found to be significantly different at the 0.05 level. The proportion of piping location (P01) errors made by the control group was found to be 7.42% out of 2,411 observations. The proportion of total P01 errors made by the JITT group was 2.29% out of 14,788 observations. The difference between the two proportions was 5.13%, and a 95% confidence interval for this difference was 4.084% to 6.274%. The chi-square test

obtained a value of 185.171, DF=1, and $P < 0.0001$. Since this P value was less than 0.05, the conclusion was that the two proportions differ significantly. This supported the research hypothesis H_1 which stated that groups of employees receiving JITT would have statistically significant improvements in job performance, as measured by proportion of manufacturing error rates, compared to groups of employees receiving regularly scheduled training.

Table 5

Statistical Results for Chi-Square Analysis of JITT Variable by Error Type

Error type	Group	Proportion of errors	N	Pearson Chi-Square	p value
P01 Error	Control	7.42%	2,411	185.171	P<0.0001
	JITT	2.29%	14,788		
P02 Error	Control	6.39%	8,691	79.455	P<0.0001
	JITT	3.86%	16,149		
P03 Error	Control	17.84%	8,576	217.089	P<0.0001
	JITT	10.37%	10,113		
P04 Error	Control	2.4%	541	30.658	P<0.0001
	JITT	0.48%	11,805		
P05 Error	Control	2.43%	2,878	9.632	P=0.0019
	JITT	1.59%	15,499		
P06 Error	Control	0.0%	3	2.393	P=0.1219
	JITT	2.65%	151		
P07 Error	Control	5.13%	53,335	318.387	P<0.0001
	JITT	3.01%	56,740		
P08 Error	Control	0.56%	10,173	4.626	P=0.0315
	JITT	0.79%	18,645		
P09 Error	Control	8.68%	288	0.0153	P=0.9016
	JITT	9.1%	2,122		
Total	Control	5.95%	5,166	1214.736	P<0.0001
	JITT	2.99%	4,368		

The proportion of drawing requirements (P02) errors made by employees was significantly different at the 0.05 level. The proportion of drawing requirements (P02) errors made by the control group was 6.39% out of 8,691 observations. The proportion of total P02 errors made by the JITT group was 3.86% out of 16,149 observations. The difference between the two proportions was 2.53%, and a 95% confidence interval for this difference was 1.938% to 3.139%. The chi-square test obtained a value of 79.455, $DF=1$, and $P<0.0001$. Since this P value was less than 0.05, the conclusion was that the two proportions differ significantly. This supported the research hypothesis H_{11} which stated that groups of employees receiving JITT would have statistically significant improvements in job performance, as measured by proportion of manufacturing error rates, compared to groups of employees receiving regularly scheduled training.

The proportion of pipe hanger installation, (P03) errors made by employees was significantly different at the 0.05 level. The proportion of pipe hanger installation, (P03) errors made by the control group was 17.84% out of 8,576 observations. The proportion of total P03 errors made by the JITT group was 10.37% out of 10,113 observations. The difference between the two proportions was 7.47%, and a 95% confidence interval for this difference was 6.46% to 8.485%. The chi-square test obtained a value of 217.089, $DF=1$, and $P<0.0001$. Since this P value was less than 0.05, the conclusion was that the two proportions differ significantly. This supports the research hypothesis H_{11} which stated groups of employees receiving JITT would have statistically significant improvements in job performance, as measured by proportion of manufacturing error rates, compared to groups of employees receiving regularly scheduled training.

The proportion of P1 piping nondestructive test (NDT) documentation, (P04) errors made by employees was significantly different at the 0.05 level. The proportion of P1 piping nondestructive test (NDT) documentation, (P04) errors made by the control group were 2.4% out of 541 observations. The proportion of total P04 errors made by the JITT group were 0.48% out of 11,805 observations. The difference between the two proportions was 1.92%, and a 95% confidence interval for this difference was 0.794% to 3.594%. The chi-square test obtained a value of 30.658, $DF=1$, and $P<0.0001$. Since this P value was less than 0.05, the conclusion is that the proportion of errors made by the two groups differ significantly. This supported the research hypothesis H_{11} which stated that groups of employees receiving JITT would have statistically significant improvements in job performance, as measured by proportion of manufacturing error rates, compared to groups of employees receiving regularly scheduled training.

The proportion of pipe joint fit-up (P05) errors made by employees was significantly different at the 0.05 level. The proportion of pipe joint fit-up (P05) errors made by the control group was 2.43% out of 2,878 observations. The proportion of total P05 errors made by the JITT group was 1.59% out of 15,499 observations. The difference between the two proportions was 0.84%, and a 95% confidence interval for this difference was 0.269% to 1.499%. The chi-square test obtained a value of 9.632, $DF=1$, and $P=0.0019$. Since this P value was less than 0.05, the conclusion was that the proportion of errors made by the two groups differed significantly. This supports the research hypothesis H_{11} which stated groups of employees receiving JITT would have statistically significant improvements in job performance, as measured by proportion of manufacturing error rates, compared to groups of employees receiving regularly scheduled training.

The proportion of pipe welding/brazing process not in accordance with procedures, (P06) errors made by employees was not significantly different at the 0.05 level. The proportion of pipe welding/brazing process not in accordance with procedures, (P06) errors made by the control group was 0.0% out of 3 observations. The proportion of total P06 errors made by the JITT group was 2.65% out of 151 observations. The difference between the two pipe error proportions was 2.65%, and a 95% confidence interval for this difference was -68.136% to 6.645%. The chi-square test obtained a value of 2.393, DF=1, and P=0.1219. Since this P value was greater than 0.05, the conclusion is that the proportion of errors made by the two groups did not differ significantly. However, since the number of observations for the control group was not large enough for a proper statistical analysis, this comparison could have had a different outcome if there had been a larger sample.

The proportions of pipe weld/braze completion not in accordance with procedures, (P07) errors made by employees were significantly different at the 0.05 level. The proportions of pipe weld/braze completion not in accordance with procedures, (P07) errors made by the control group were 5.13% out of 53,335 observations. The proportion of total P07 errors made by the JITT group was 3.01% out of 56,740 observations. The difference between the two proportions was 2.12%, and a 95% confidence interval for this difference was 1.885% to 2.356%. The chi-square test obtained a value of 318.387, DF=1, and P<0.0001. Since this P value was less than 0.05, the conclusion was that the two proportions differed significantly. This supported the research hypothesis H_{11} which stated that groups of employees receiving JITT would have statistically significant improvements in job performance, as measured by proportion of manufacturing error rates when compared to groups of employees receiving regularly scheduled training.

The proportions of mechanical fittings not installed in accordance with procedures, (P08) errors made by employees were significantly different at the 0.05 level. The proportions of mechanical fittings not installed in accordance with procedures, (P08) errors made by the control group were 0.56% out of 10,173 observations. The proportion of total P08 errors made by the JITT group was 0.79% out of 18,645 observations. The difference between the two proportions was 0.23%, and a 95% confidence interval for this difference is 0.0248% to 0.423%. The chi-square test obtained a value of 4.626, $DF=1$, and $P=0.0315$. Since this P value was less than 0.05, the conclusion was that the two proportions differed significantly. However, since the JITT group had a higher error rate than the control group, it does not support the research hypothesis H_{11} which stated that groups of employees receiving JITT would have statistically significant improvements in job performance, as measured by proportion of manufacturing error rates when compared to groups of employees receiving regularly scheduled training. In this instance, groups of employees receiving JITT did not show statistically significant improvements in job performance, as measured by proportion of P08 manufacturing error rates, compared to groups of employees receiving regularly scheduled training.

The proportions of O-ring not installed properly, (P09) errors made by employees were not significantly different at the 0.05 level. The proportions of O-ring not installed properly, (P09) errors made by the control group were 8.68% out of 288 observations. The proportion of total P09 errors made by the JITT group was 9.1% out of 2,122 observations. The difference between the two proportions was 0.42%, and a 95% confidence interval for this difference was -3.626% to 3.677%. The chi-square test obtained a value of 0.0153, and $P=0.9016$. Since this P value was greater than 0.05, the conclusion was that the two proportions did not differ significantly. This did not support

the research hypothesis H_{11} which stated that groups of employees receiving JITT would have statistically significant improvements in job performance, as measured by proportion of manufacturing error rates, compared to groups of employees receiving regularly scheduled training. In this instance, groups of employees receiving JITT did not show statistically significant improvements in job performance, as measured by proportion of P09 manufacturing error rates, compared to groups of employees receiving regularly scheduled training.

Table 5 provides a summary of the chi-square analysis of the control and JITT groups on manufacturing error rates. Comparisons of error rates made by the control and JITT groups yielded statistically significant differences at the 0.05 level on all but two of the nine types of errors. The JITT group had a statistically significant lower proportion of errors than the control group in six of the nine error types. However, the control group had a statistically significant lower proportion of P08 errors than the JITT group. The P06 and P09 errors were the two types of errors that did not have a significant difference between the two groups.

Hypothesis H_{11} , which stated that groups of employees receiving JITT would have statistically significant improvements in job performance, as measured by proportion of manufacturing error rates, compared to groups of employees receiving regularly scheduled training was supported for process P01, P02, P03, P04, P05, P05, and P07. Process P08 contradicted hypothesis H_{11} , since the control group had a statistically significant lower proportion of P08 errors than the JITT group. Hypothesis H_{01} , which stated groups of employees receiving JITT would have no statistically significant improvements in job performance, as measured by the proportion of manufacturing error

rates when compared to groups of employees receiving regularly scheduled training was supported by process P06 and P09

Focus Groups: A Mixed-Methods Approach

The current study utilized a mixed-methods research design to determine the impact of Just-in-Time Training on improvements in job performance, as measured by proportion of manufacturing error rates. Specifically, the researcher employed a sequential explanatory design, during which quantitative data were collected and analyzed, followed by qualitative data. In the sequential explanatory design, the priority was usually given to quantitative data, with qualitative analysis supplementing quantitative analysis (Creswell & Clark, 2007; Hanson, Creswell, Clark, Petska, & Creswell 2005).

Questions Utilized in Focus Group

Since the focus group participants in the current study work together in the same department and know each other, the researcher chose to limit the length of time permitted for responding to questions to three minutes due to time constraints. The researcher provided a printed copy of the questions for each of the participants and informed the members that a summary of the results of the JITT would be shared with the group. The researcher/moderator employed five types of questions (Krueger, 1998; 2002; 2009) during the interview process: opening questions, introductory questions, transition questions, key questions, and ending questions.

The question-by-question data analysis which followed next was the result of a systematic approach to the analysis and interpretation of data (adapted from Taylor-Powell & Renner, 2003). The preliminary step for the researcher was to become as familiar as possible with the data. The recordings of the focus group sessions were

listened to several times and transcribed by the researcher. Second, the researcher focused on the analysis of the project's purpose and goals and wrote down key information. A determination of how the analysis should be focused determined a question-by-question format would be appropriate. Third, the information was then categorized. The purpose of organizing and categorizing data was to give meaning to words and phrases and identify trends, general themes, and patterns (Taylor-Powell & Renner, 2003).

Question 1: How have you been involved in Just-in-Time Training for: a.) hanger installation; b.) welding workmanship; c.) joint record card completion; and d.) fitting workmanship?

Seven of the participants indicated by a show of hands they were moderately involved with JITT, and one participant was fully involved. Each participant cited the JITT curriculum as having a significant influence on reducing manufacturing errors. Although some types of errors improved more than others during the study, the focus group discussed each of the types of JITT curriculum. At this point in the discussion, it was decided by the moderator to have each participant share their experience of the JITT in which they were most involved. Each participant had an opportunity to participate in the discussion that followed the opening question.

One participant shared how he collaborated with the instructor who was responsible for conducting the hanger installation training. The supervisor met with the instructor and explained the most frequently types of hanger defect errors which were being encountered by employees. The instructor was able to make adjustments in the way he presented the training by placing greater emphasis on the types of hangers that were expected to give the most problems during installation. Some of the other focus group participants explained/shared similar experiences with the welding workmanship, joint

record card completion, and fitting workmanship training. The JITT participants' managers shared specific details with the training instructors over concern for the most frequent types of errors which the control group experienced. This type of feedback enabled the instructors to target JITT to certain topics. For example, the instructor would place extra emphasis on the specific types of welding errors which were expected to give the most difficulty to the worker.

Another participant stated there were certain sections of the joint record card which were frequently completed incorrectly. During the JITT, the instructor highlighted the areas of the joint record card in which the workers were most likely to make mistakes. Similarly, according to participants, one of the errors that occurred most frequently during the fit-up of the pipe joints was due to the parts not being marked correctly. This information was relayed to the training instructor, who placed special emphasis on the correct procedure for marking the pipe joints.

Question 2: Think back over all the time that you've participated in JITT and tell us your most positive experience.

The researcher elicited responses from the participants by asking the following question: *In your opinion, do you think your experience with JITT was fully positive, mostly positive, somewhat positive, or not at all positive?* A show of hands indicated all eight participants had a mostly positive experience with JITT. One supervisor shared a positive experience he had with pipe hanger JITT. Prior to JITT, when a problem occurred with the technical drawings or blueprints, the manufacturing department would submit a request for someone from the engineering department to research the problem and find a solution. Often the engineering department would misinterpret some part of the drawings, causing a delay in production. One of the benefits of the pipe hanger JITT was

enabling craft to solve most of the technical problems on their own, reducing the need for engineering involvement. Another benefit of JITT was providing valuable feedback to the instructors so they could target the training on the topics that were causing the workers the most difficulty.

Question 3: Think back over the past year of the things that your organization did. What went particularly well with JITT?

The supervisors and managers reported mostly positive feelings toward implementing the JITT process in their work areas. One manager commented, “We did everything required to successfully implement the process.” Another manager stated, “The requirement for the Just-in-Time Training to be completed just prior to starting the scheduled work creates necessary time constraints that must be carefully addressed. For example, the number of personnel needing JITT need to be identified and sent to the training department in advance in order to have it scheduled at the proper time.” Another manager commented, “Occasionally something unforeseen happens at the last minute, and the start date for the schedule needs to be adjusted. When this happens, we have to stay in close contact with the training department. Sometimes a schedule change means it will be necessary to postpone and delay the start of JITT.” Another manager commented, “Occasionally, due to the large number of personnel that are currently being hired and the attrition rate, the numbers we use to determine how many personnel need JITT do not match. For example, we need to hire more people than we actually need due to the attrition rate. Historically, this is a fairly accurate prediction of how many of the new hires will make it. However, it fluctuates, and we may end up with more or less personnel to train than we originally intended.”

Question 4: What needs improvement with JITT?

Although this question appeared relatively straightforward, the participants discussed other factors which may affect how well the employees' transfer recently learned skills to the workplace. Focus group participants believed an employee's overall interest in improving their job skills, skill level prior to taking the JITT, desire to do well, home/personal life balance, as well as the attitude of their supervisor, significantly impacted JITT and employee error rates. One overall theme that emerged from the discussion was the need to use JITT more consistently.

Question 5: If you were telling a coworker or friend in your organization about Just-in-Time Training for hanger installation, welding workmanship, joint record card completion, and fitting workmanship, what would you say?

The researcher elicited responses from the participants by asking the following question: *In your opinion, would you rate the overall effectiveness and positive results attained from Just-in-Time Training in the workplace as not effective, somewhat effective, mostly effective, or fully effective for: 1) hanger installation; 2) welding workmanship; 3) joint record card completion; and 4) fitting workmanship?* All eight participants indicated by a show of hands that JITT was mostly effective.

In the discussion of joint-record card completion, one supervisor shared an interesting experience with an employee. The employee was experiencing an unusually high number of joint record card completion errors because he was not etching the fitting. When he discussed this with the employee, the supervisor was told the previous training he attended did not cover this topic. Just-in-Time Training allowed managers to take care of this problem immediately before it became a chronic and widespread issue. Other

supervisors related similar positive experiences they had with JITT and the ability to address a problem immediately.

Question 6: Suppose that you were in charge and could make one change that would make the Just-in-Time Training program better. What would you do?

The participant responses to question six echoed earlier responses. The need to use JITT regularly and consistently to address future training needs was frequently mentioned by participants. All of the participants were in agreement regarding the effectiveness of JITT. The Just-in-Time Training proved especially helpful when used as refresher training for employees who had not performed a particular type of work recently. One supervisor stated, “JITT helped me get my employees up to speed quickly before they needed to perform the work. A major benefit of JITT is it helps reduce the amount of rework due to employee errors because they now perform the work correctly the first time.”

Question 7: What can each one of us do to make the JITT program better?

The participant responses to question seven were revealing. Most of the participants agreed that they needed to be more aware of the skills required for future work and know the current capabilities of their employees. One supervisor stated that “everyone in supervision should make a deliberate effort to communicate better with their employees and strive to do a better job of listening to what their employees are telling them.” Because of the phase reviews associated with identifying the JITT needed for upcoming phases of the production schedule, training needs were identified. Open communication with employees helped to determine who needed to attend the training, based on their current level of competence. Another supervisor stated that “the most important thing is to maintain good two-way communications with everyone involved in

training. We need to make everyone aware of the types of errors that are giving us the most problems. That way we can focus our resources on improving the things which benefit us the most and minimize the training in those areas that we are not having problems.”

Question 8: How does JITT help trainees to transfer the learned skills to the workplace?

The participant responses to question eight were fairly consistent. One supervisor provided a typical response when he explained the JITT process, “Since the phase reviews help us identify the job requirements for upcoming phases of the production schedule, JITT needs are identified. The JITT is conducted as close as possible to the time when the employee will be performing the work. One thing we noticed is the employees transfer the skills to the workplace more effectively when the training is conducted immediately before they start using those skills. If it is conducted a week before it is needed, it is not as effective due to knowledge decay. We believe the amount of transfer of training decreases substantially when the skills are not immediately put to use.”

Question 9: In what way is the JITT intervention effective? Explain positive results in the workplace such as improvements in test data and reductions in re-work.

The overall results attained in the workplace were quite impressive. The study of JITT showed an improvement in error rates when applying training just prior to use of the skills. The proportion of total errors made by the control group was 5.95% out of 86,893 observations. The proportion of total errors made by the JITT group was 2.99% out of 146,012 observations, a 2.96% overall reduction in the proportion of total defect errors. Focus group participants credited the JITT with the overall improvement in first time

quality. This, in turn, led to an improvement in test data results and a reduction in the amount of re-work.

One unexpected benefit of JITT was explained by a foreman, “As a result of reviewing our future training needs, a JITT request identified training that was not being done. As a result, a whole new curriculum will be developed because of needs identified in a JITT request. Previously, personnel who performed this type of work had to learn on their own by studying technical manuals and having a subject matter expert assist them. The JITT curriculum developed will give us more flexibility with our future training needs, and we will not have to depend solely on the subject matter experts. In this particular instance, both of the subject matter experts are at or near retirement. The JITT process enables us to capture this knowledge before it leaves the company.”

Summary

In this study, quantitative analysis was utilized to test the hypothesis that Just-in-Time Training positively impacted job performance, as measured by proportion of manufacturing error rates. A qualitative analysis was used to gain additional insight into the results of the quantitative analysis. The population included day shift production personnel working in a manufacturing department of a large global security company located on the central U.S. Gulf Coast. The study consisted of a control group of employees who received regularly scheduled training and a JITT group who received Just-in-Time Training. Both groups received the same training curriculum taught by the same instructors. Quantitative analysis of the overall sample yielded significant positive results at the 0.05 level when comparing control groups that received regularly scheduled training to JITT groups that received JITT on the proportion of manufacturing errors. Pipe hanger installation (P03) and pipe weld/braze completion (P07) were two of the

most frequently occurring types of errors, and the JITT groups performed significantly better than the control groups in both instances. The only type of error where the control group performed significantly better than the JITT group was the proportions of mechanical fittings not installed in accordance with procedures, (P08) errors. Qualitative data analysis was used to supplement the quantitative analysis and helped to explain the quantitative results. Chapter V discusses implications of the results of the study and provides recommendations for future research.

CHAPTER V

SUMMARY AND DISCUSSION

Summary

The mixed-method design in this research utilized both quantitative and qualitative methods to explore the differences in job performance, as measured by proportion of manufacturing error rates between groups of employees receiving JITT compared to employees receiving regularly scheduled training. The mixed-methods approach was chosen for this study in order to provide a deeper understanding than either quantitative or qualitative methodologies alone would provide (Creswell & Clark, 2007). The study investigated the effects of Just-in-Time Training on manufacturing error rates in a large manufacturing organization located on the central Gulf Coast. In an increasingly competitive global economy, many organizations face the challenges of improving training transfer and reducing production quality problems (Burke & Hutchins, 2007; Holton, Bates & Ruona, 2000; Holton, 2005; Luscher & Lewis, 2008). However, research studies show that training adult learners continues to challenge training organizations (Beavers, 2009; Leal, 2009), and trainees fail to transfer trained skills to the job immediately after training resulting in a high percentage of loss of skills (Saks, 2002). Research shows scrap learning rates, defined as training which is successfully delivered but not applied on the job, results in high costs to organizations (Brinkerhoff, 2011; King, 2011).

Just-in-Time Training (JITT) focuses on improving training transfer immediately after training and reducing production quality problems, which many organizations and industries face (Burke & Hutchins, 2007; Holton, Bates & Ruona, 2000; Holton, 2005; Luscher & Lewis, 2008). When employees cannot put what they learned in training into

practice quickly, it is a wasted effort in both time and money. Scrap learning rates are as high as 50%-80% of all training delivered (Brinkerhoff, 2011). On-the-job training (OJT) may not be sufficient due to the ever-changing future needs and requirements of companies (Jones, 2001). The JITT derives from the need to make learning and workforce development more efficient (Burke & Hutchins, 2008) and using the training in order to meet the production and scheduling requirements that are typically found in manufacturing environments (Liu et al., 2007). Just-in-Time Training is a type of planned OJT with a greater emphasis placed on having the training administered as close as possible to the time skills are needed (Globerson & Korman, 2001; Jones, 2001). Just-in-Time Training (JITT) is a type of High Performance Work Practice (HPWP) which addresses skill-upgrading through training and is a component part of the overall solution in increasing productivity for organizations (Datta et al., 2005). Just-in-Time Training is not a radically new practice (Sung & Ashton, 2005). Just-in-Time Training provides an organization with additional tools used to improve performance (Combs, et al., 2006). However, little empirical research exists to describe the impact of Just-in-Time Training on manufacturing error rates (Jones, 2001; Salas, Tannenbaum, Kraiger, & Smith-Jentsch, 2012). Recent reports suggest that trained competencies often do not transfer to the workplace, indicating an enduring “transfer problem” (Salas, Tannenbaum, Kraiger, & Smith-Jentsch, 2012). The current study adds to the literature by empirically examining the effects of Just-in-Time Training on error rates.

Discussion

Quantitative analysis performed utilizing a Chi-Square test procedure supported the hypothesis that groups of employees receiving JITT would have statistically significant improvements in job performance, as measured by proportion of

manufacturing error rates when compared to groups of employees receiving regularly scheduled training. Results from a t-test comparison of the cohorts in the control and JITT groups revealed that the two groups were not significantly different in terms of age, number of years with the company, etc., and reduced the selection threat to statistical validity. Therefore, the researcher rejected the null hypothesis that groups of employees receiving JITT would have no statistically significant improvements in job performance, as measured by proportion of manufacturing error rates when compared to groups of employees receiving regularly scheduled training. The researcher accepted the alternative hypothesis that groups of employees receiving JITT would have statistically significant improvements in job performance, as measured by proportion of manufacturing error rates, compared to groups of employees receiving regularly scheduled training.

The researcher chose a sequential explanatory mixed-methods research design in order to gain insight from focus group participants regarding the effectiveness of using Just-in-Time Training to improve manufacturing error rates. The sequential explanatory mixed-methods research design added a qualitative element to the research and supplements and expands the quantitative data (Creswell & Clark, 2007; Hanson, Creswell, Clark, Petska, & Creswell, 2005). In the current study, the researcher followed the quantitative phase of the research with a focus group conducted with participating managers. The focus group provided additional insight and discussion regarding outside influences that could have affected the quantitative results. The focus group was conducted with the JITT group participants' managers and allowed the researcher the opportunity to gain a better understanding of the effect of the JITT instructional delivery method on quality defect error rates. Since the JITT was found to have a positive impact on the most frequently occurring errors, the focus group explored reasons why

participants thought the JITT was successful. For the errors in which JITT was found to have no (or a negative) impact, the focus group explored reasons why JITT was not successful.

After integrating the results from the quantitative and qualitative analysis, the researcher synthesized findings, conclusions, and recommendations for the current study. These items are presented below:

Finding One: Groups of employees receiving Just-in-Time Training had significant improvements in job performance, as measured by proportion of manufacturing error rates, compared to groups of employees receiving regularly scheduled training.

The subject company implemented Just-in-Time Training in an attempt to improve job performance and reduce the organization's manufacturing error rates. During the focus group, participants stated the timing of the JITT was coordinated to meet the needs of the employees. It was utilized "in response to known defects", and the training was administered to everyone on the work crew, including the foreman. Prior to initiating Just-in-Time Training, the timing of the training which employees received was "loosely" coordinated. Groups of employees in the control group received regularly scheduled training, often in response to known defects or when employees needed to renew certifications. In contrast, the timing of JITT for the groups of employees in the JITT group was carefully planned so that the training would occur just before the employee needed to use the skills. Specifically, the JITT process was structured in such a way that, one focus group participant stated, "JITT is given to employees based on when they need to use the targeted skills next. The curriculum is based on improving their skills and reducing the most frequently occurring errors." The employee's management determines

the JITT curriculum by reviewing previous similar work and identifying the skills which need improvement.

Conclusion: The focus group participants believed the structured process for conducting JITT had a significant impact on the proportion of errors made.

After discussing the JITT with the focus group participants, the researcher found support for the managers' view that the JITT process was structured in such a way that JITT had a significant impact on decreasing the proportion of errors made, as all of the employees in the JITT group received some JITT. The statistical analysis conducted by the researcher supported the hypothesized relationship between Just-in-Time Training and employee error rates. As stated previously, since the groups of employees receiving JITT showed statistically significant improvements in job performance, the research hypothesis was accepted.

Recommendation: Organizations should make a deliberate effort to formally improve communications to maximize JITT.

In the focus group discussion of JITT, one of the benefits discussed was how the JITT process helped by improving the overall level of communication with the training instructors. One supervisor stated that by improving communications and making the instructors aware of current needs, they are able to make adjustments to the training curriculum. For example, if employees experience "fit-up" problems with a certain type of silver braze joint, the supervisor can communicate that information to the training instructor. The instructor can spend more time training the workers on the requirements for that type of joint and less time on other types of materials that are not causing problems. Another participant concurred that the JITT process was structured in such a way that it made the managers more aware of the role training plays in helping to reduce

the number of errors in the processes and how better communication with the instructor can help attain more favorable performance results.

Recommendation: Replicate study in another organization.

In the current study of a single department in a large manufacturing organization, the quantitative analysis yielded performance results, and the qualitative analysis which followed provided a deeper understanding and detailed explanations of those results. The quantitative design sought to isolate the effects of Just-in-Time Training on improvements in job performance, as measured by proportion of manufacturing error rates between groups of employees receiving JITT and groups of employees receiving regularly scheduled training. The qualitative analysis indicated the treatment effects were due to the JITT. However, other variables might have potentially influenced the outcome of the results. Therefore, the researcher recommends future researchers address the isolation of other variables. The results found in the JITT group of the current study might not reoccur if other types of organizations had been studied. Replicating the study in other organizations would provide further evidence that the improvement in performance errors were due to JITT.

Finding Two: Timing of JITT possibly influenced error rate results.

The information provided in the JITT was provided to the worker only at the time of need, and not any sooner. The assumption was to provide JITT at the exact point in time to address a specific training need. Specific performance issues were addressed strategically, without unnecessary additional information, just prior to the worker using the skills.

Conclusion: Managers (focus group participants) agreed the timing of the Just-in-Time Training was beneficial and led to the improvements and contributed to the decrease in manufacturing error rates.

The quantitative analysis supported this concept, as participants in the focus group shared positive experiences and benefits of JITT and were unanimous in their belief that the reason the JITT groups did significantly better than participants in the control groups was in large part due to the timing of the training. However, due to the deliberate manipulation of the timing of the delivery of the Just-in-Time Training to just prior to employee use of skills, positive results were expected. The amount of knowledge loss from the training was minimized.

Recommendation: Replicate study controlling for treatment variations.

The researcher recommends replicating the study while controlling for the interaction of the causal relationship over treatment variations,-an effect found with one treatment variation of instructor-led JITT might not reoccur with other variations of JITT interventions such as on-the-job training (OJT) or computer-based training (CBT). In order to accomplish this task, future researchers should study the effectiveness of other JITT interventions and determine whether or not the timing of the training remains an essential treatment variation. The current researcher suggests controlling for other variations of JITT delivery methods such as OJT or CBT. The participants of the focus group expressed concerns with minimizing knowledge loss during the discussion of JITT interventions.

Finding Three: Just-in-Time Training improves the most frequently occurring types of errors.

The current study focused on the hypothesized relationship between using Just-in-Time Training as a way to reduce manufacturing errors. The JITT was a relatively short unit of instruction with defined boundaries. The JITT was specifically designed for improving worker competence to perform the required tasks for upcoming work.

Conclusion: The results of the current research study suggest instituting Just-in-Time Training reduces manufacturing error rates.

While the current study focused on the most frequently occurring types of manufacturing errors, results of the research suggest other types of manufacturing errors warrant further investigation. Focus group participants suggested the lower error rates among participants in the JITT groups were due to Just-in-Time Training. The general expectation of the focus group participants was the group receiving JITT would perform better than the control group. Therefore, Just-in-Time Training focusing on dependent variables other than the most frequently occurring errors may be worth consideration in future research

Recommendation: Replicate the study with additional dependent variables.

In addition to investigating the effects of Just-in-Time Training on P07 (Weld/Brazing) errors and P03 (Pipe Hanger), the researcher recommends replicating the study with additional dependent variables such as the less frequently occurring errors. Focus group participants stated some of the less frequently occurring errors can be extremely expensive to repair, sometimes occurring on a critical system. Further research may help to better understand the interaction of the causal relationship with outcomes, an effect found on one kind of outcome observation. Additional research will show whether or not the failure rates for one specific type of quality defect, will remain if other outcome observations such as different defects were used.

Limitations

As expected, certain limitations which exist in the current study may limit the generalization of results to other populations. Non-random assignment of participants in JITT and control groups and researcher inexperience with focus groups were recognized by the researcher as limitations of the research design at the beginning of the study.

Threats to external validity for the study include:

- 1) Interaction of the causal relationship with units (Shadish, Cook, & Campbell, 2002); the scope of the study was limited (Foss & Waters, 2007); results found in the JITT group from one department of the company in the current study might not be significantly different if other types of departments such as hull, electrical, or coatings had been studied; the purposive sampling procedure decreased the generalization of the findings (Foss & Waters, 2007).
- 2) Interaction of the causal relationship with outcomes (Shadish, Cook, & Campbell, 2002); limited data were available (Foss & Waters, 2007); an effect found on one kind of outcome observation (e.g., the data which is collected), which would show the failure rates for one specific type of quality defect might not be significant if other outcome observations such as different defects were used.
- 3) Interaction of the causal relationship over treatment variations (Shadish, Cook, & Campbell, 2002); the scope of the study was limited (Foss & Waters, 2007); an effect found with one treatment variation of instructor-led JITT might not be significantly different with other variations of JITT interventions such as OJT or CBT.

According to Shadish et al. (2002), limitations to internal validity may include:

- 1) Selection-there may be systematic differences over conditions in characteristics between the treatment cohort and the earlier control cohort that could cause the observed effect. The sampling procedure used employees from only one department, who may not be representative of the larger population of employees (Foss & Waters, 2007). Selection bias was addressed by testing of demographics in JITT treatment group and control group.
- 2) History-events that are occurring concurrently with the treatment could cause the observed effect. The quality of the manufactured product might be improving in the plant because of reasons other than the JITT.
- 3) Maturation-naturally occurring changes. The quality of the manufactured product might be improving because the employees are getting better at their jobs over time. This could be confused with the treatment effect.

Conclusion

The purpose of this study was to explore the effect of JITT on job performance in a manufacturing organization. The researcher studied and systematically measured the effects of Just-in-Time Training on job performance, as measured by proportion of manufacturing error rates, when compared to groups of employees receiving regularly scheduled training. The researcher conducted the study in a manufacturing organization located on the central Gulf Coast and employed a quasi-experimental cohort control group design model with nonequivalent groups (Shadish, Cook, & Campbell, 2002) to explore the effectiveness of JITT at the subject company. The researcher employed a cohort control group comparison of control and JITT groups for the quantitative research phase and a focus group for the qualitative research phase.

The researcher collected error rate data from the company's database and compared the error rates of the two groups by type of error made as well as by the physical location in which the work was performed. The statistics from tests of demographics of treatment and control groups indicated there was no significant difference between the make-ups of the two groups. Statistical analysis revealed significant differences between the two groups on six of the nine types of defect errors. Groups of employees receiving JITT made significantly fewer errors than employees in groups receiving regularly scheduled training on six of the nine error types. Statistical analysis revealed the groups of employees who received JITT experienced more errors than cohorts in the control group on three types of errors. However, the results were not statistically significant on two of the three types of defects receiving more errors. Of the nine possible types of defect errors, the control group had a proportionately smaller percentage of errors than the JITT group on only one type of error.

The researcher utilized a sequential explanatory mixed-methods approach and collected qualitative data through a focus group in order to help understand why Just-in-Time Training, studied in the quantitative phase, appears to significantly reduce employee errors. An analysis of the qualitative data shows that focus group participants believe that Just-in-Time Training is largely responsible for the significant differences in the proportion of error rates between the control and JITT groups. The researcher of the present study recommends future researchers conduct additional studies to further isolate the effects of Just-in-Time Training. Specifically, conducting the study with a different organization, controlling for treatment variations, and replicating the study with different treatment variations could help minimize the limitations inherent in this type of study.

Globalization of world economies and increased competition, coupled with limited resources, require companies to increase efficiencies in order to survive in today's marketplace. In today's globalized economy, ever increasing costs for Human Resource Development programs and initiatives place an increased emphasis on effectiveness (Wright et al., 2003). The demand for results continues to increase in importance in both the public and private sectors (Burke & Hutchins, 2008; Phillips & Phillips, 2007; Phillips, 2012). The aforementioned trends have increased the awareness of HRD programs and initiatives and helped to show the importance of HPWP. The increased use of HPWP, such as JITT intervention measures, improves organizational effectiveness and will become a vital part of an organization's HRD (Wright et al., 2003).

Effective training intervention indicates the HPWP process extends further than the implementation of the process within a company. Effective training means JITT intervention measures help achieve the desired results and that HPWP are endorsed by management and workers at all levels. The HPWP process needs to be responsive to change and flexible enough to evolve and adapt to constantly changing job requirements in order to remain sustainable (Boxall & Macky, 2009). Research has shown Just-in-Time Training has the potential to make organizations more profitable and is a viable performance intervention to produce effective learning and reduce training and production costs.

APPENDIX A

FOCUS GROUP INTERVIEW QUESTIONS

TYPICAL INTERVIEW QUESTIONS

1. How much have you been involved in Just-in-Time Training for: a.) hanger installation; b.) welding workmanship; c.) joint record card completion; and d.) fitting workmanship?
2. Think back over all the time that you've participated in JITT and tell us your most positive experience.
3. Think back over the past year of the things that your organization did. What went particularly well with JITT?
4. What needs improvement with JITT?
5. If you were telling a friend in your organization about Just-in-Time Training for: a.) hanger installation; b.) welding workmanship; c.) joint record card completion; and d.) fitting workmanship, what would you say?
6. Suppose that you were in charge and could make one change that would make the Just-in-Time program better. What would you do?
7. What can each one of us do to make the JITT program better?
8. How does JITT help trainees to transfer the learned skills to the workplace?
9. In what way is the JITT intervention effective? Explain positive results in the workplace such as improvements in test data and reductions in re-work.

APPENDIX B
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Author: Elwood F. Holton III

Publication: Advances in Developing Human Resources

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APPENDIX C

INSTITUTIONAL REVIEW BOARD NOTICE OF COMMITTEE ACTION



INSTITUTIONAL REVIEW BOARD
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NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 13020401
PROJECT TITLE: **An Assessment of a Just-In-Time Training
Intervention in a Manufacturing Organization**
PROJECT TYPE: Dissertation
RESEARCHER(S): Barry J. Wilkie
COLLEGE/DIVISION: College of Science & Technology
DEPARTMENT: Economic & Workforce Development
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 03/21/2013 to 03/19/2014

Lawrence A. Hosman, Ph.D.
Institutional Review Board

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