CRITICAL SUCCESS FACTORS FOR BEHAVIOR-BASED SAFETY

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SIGNIFICANT FINDINGS

Overall, the results of this research demonstrated the effectiveness of behavior-based safety (BBS) interventions for increasing safe work behaviors and reducing injuries. Without exception, organizations participating in our research realized an improvement in their safety records after implementing a BBS process. Such success, however, was not always easily achieved. This helped identify a number of factors critical to the success of an organization's BBS efforts.

The effectiveness of BBS was clearly demonstrated in Study 1 and Study 3. In Study 1, we manipulated level of employee involvement during BBS training and implementation. The strongest finding was a significant and dramatic decrease in the number of lost work days and severity of injuries after BBS training and implementation. Lost days decreased from a mean of 10.9 per month prior to the safety process to a low of 1.5 lost days per month for the 18 months after BBS was initiated. The results obtained from Study 3 provided additional support for the effectiveness of BBS interventions. Specifically, using both specific and global feedback to target a number of safety-related behaviors, the target organization not only increased frequencies of safe behaviors, but it also enjoyed a drop in injury rate of more than 50% over the 18-month intervention period.

Acknowledging the power of BBS methods for increasing employee safety, the focus of this research was to identify factors critical to BBS success. Study 1 and Study 5 demonstrated the crucial roles of personal control, interpersonal trust, management support, and BBS training. In Study 1, safety facilitators who were involved in making implementation decisions made more interpersonal audits of hearing protection use, the target behavior they selected than did those assigned their BBS procedures. Additionally, for only the empowerment or choice condition, did use of hearing protection increase significantly as a function of the observation and feedback process.

Study 5 revealed that organizations opting to make their BBS process mandatory are not necessarily sacrificing employee perceptions of empowerment and personal control. In other words, an organization can build choice into the BBS process that allows employees to experience control. For example, organizations can empower employees to choose when they perform observations, how often observations are performed, and who does the observation. In fact, Study 5 revealed that employees in organization with a mandatory process reported significantly higher levels of trust in management (both abilities and intentions), trust in coworkers abilities and intentions, and satisfaction with training.

Study 5 was also informative regarding variables that increase the likelihood of employee involvement in a BBS process. Five variables were predictive of an employee's self-reported involvement in a BBS process: a) perceived effectiveness of the BBS training, b) trust in management abilities, c) whether safety performance is used in performance appraisals, d) whether an employee received BBS training, and e) tenure with the organization. These variables accounted for 41% of the variance in self-reported involvement in a BBS process.

Finally, the current research led to the development of a "Flow of Behavior Change" model proposed to assist occupational safety and health professionals in designing interventions within their unique safety environments (see Geller, 1998c). This model hypothesizes three types of behavior, four stages of behavioral competency, and four intervention categories.

We propose there are three types of behavior: other-directed, self-directed, and automatic behavior. Whenever people learn new behaviors, these behaviors are initially *other-directed*. In other words, contingencies are externally established to direct or instruct a new target behavior.

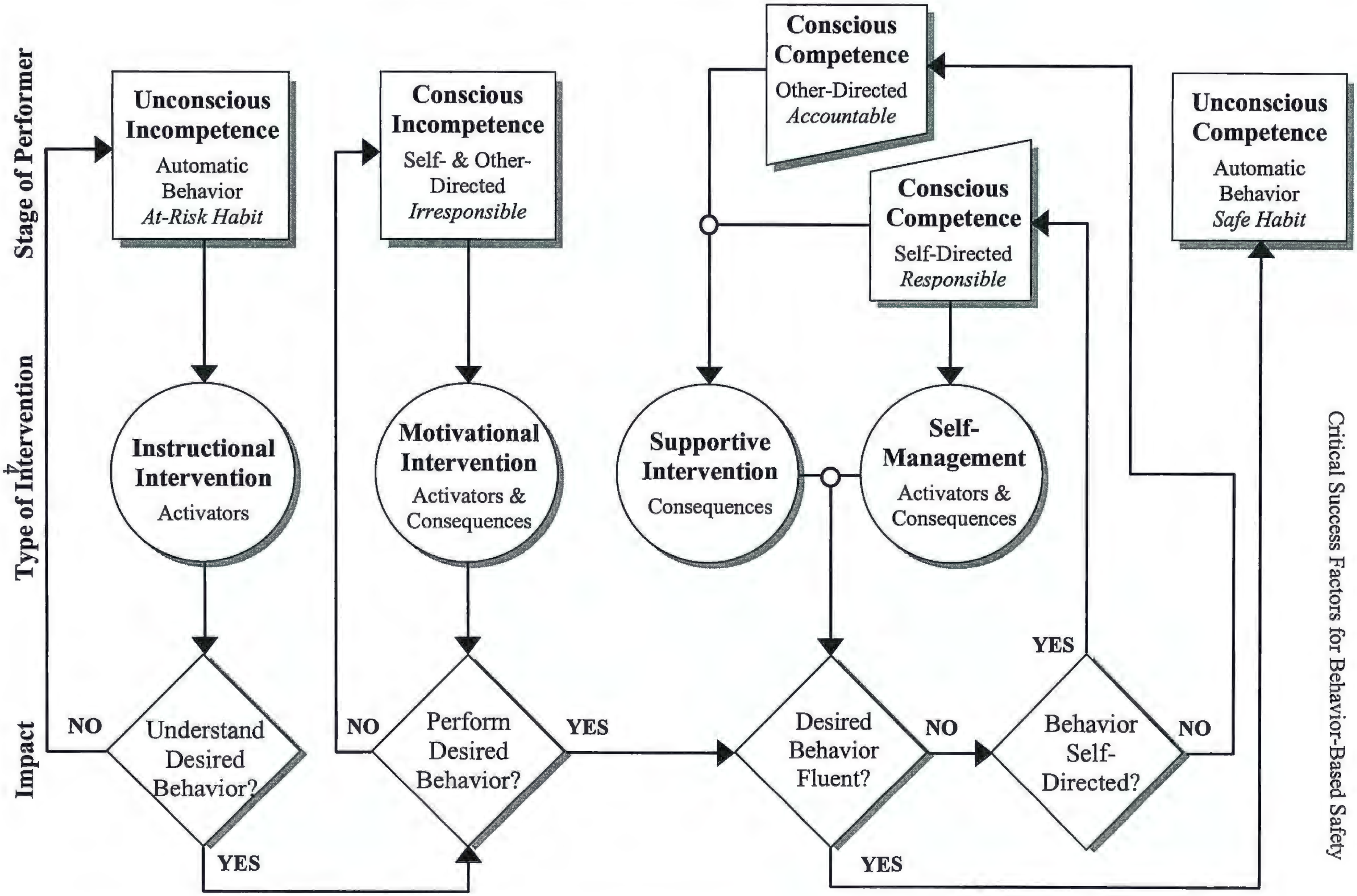
This is considered an *instructional* intervention. Once the newly acquired behavior is practiced, the individual no longer requires external direction or even motivation, only peer support from *supportive* intervention. When individuals set their own contingencies, the behavior then becomes *self-directed* (cf. Watson & Tharp, 1993). Thus, self-directed people use *self-management* intervention to guide and motivate their own behavior. After a behavior is successfully repeated over a period of time, it may become *automatic* (or habitual) where the behavior is performed without conscience thought.

We also hypothesize that individuals transition through four stages or levels of behavioral competence (unconsciously incompetent, consciously incompetent, consciously competent, and unconsciously competent) when moving from an *at-risk* habit to a *safe* habit. People in the *unconsciously incompetent* stage are hypothesized not to be aware of the risky behavior they are performing. If individuals are aware they are engaging in a risky behavior and continue regardless of this knowledge, they are classified in the *consciously incompetent* stage. Movement from this stage usually requires *motivational* intervention.

People are considered *consciously competent* when they willingly perform the desired safe behavior, but they still need to consciously think about it. They are not fluent, and need *supportive* or *self-management* intervention to reach the fourth stage. That is, when individuals no longer need to consciously think about performing safe behaviors, they are considered *unconsciously competent.*

The "Flow of Behavior Change" model (see Figure 1 on the next page) integrates the four stages of competence with the four types of intervention: instructional, motivational, supportive, and self-management. When willing learners are first acquiring new behaviors, teachers typically

The Flow of Behavior Change



rely on instructional intervention that uses activator strategies (Geller, 1996; Geller, 1998c) to move people from the unconsciously incompetent stage to the consciously competent stage. Instructional intervention can be any antecedent event that directs behavior. In industrial settings, for example, education/training sessions, training videos, or new safety policies are often used to direct new safety-related behaviors.

Some people might understand the information given during the instructional intervention, but they may not believe the information pertinent or the behavior worth the effort. For example, employees take calculated risks or shortcuts to accomplish a job faster (like not locking-out a piece of machinery). The model refers to this person as consciously incompetent. To move individuals from conscious incompetence (meaning they know what to do but do not do it) to conscious competence, the model illustrates the need for motivational intervention. Since the consciously incompetent individuals know the correct behavior, an activator strategy alone will have minimal impact (Geller et al., 1990). Using a consequence strategy along with an activator strategy is presumed to be the intervention method of choice here (Geller, 1996; 1998d).

Once individuals are performing a desired safe behavior (because of either self- or other-directions), supportive interventions can help people move from the consciously competent stage to the unconsciously competent stage (i.e., a good habit). Supportive interventions mostly involve consequence strategies that reinforce and support desired behaviors. Supportive interventions include behavior-based recognition, interpersonal praise, and peer encouragement. Furthermore, if a person is consciously competent and self-directed, a self-management intervention is hypothesized to facilitate movement to a safe-habit (i.e., unconsciously competent). This proposed "Flow of Behavior Change" model is the only occupational safety and health model that specifies the type of intervention safety professionals or managers should use as a function of an employee's competency level with regard to a certain safety-related behavior.

In sum, our findings provided a wealth of information relevant for the implementation of BBS in industrial settings. The studies reported here add to both the theoretical and practical literature in the domain of occupational health and safety. For example, researchers will find the Flow of Behavior Change model useful in planning intervention strategies and predicting their impact. And it is hoped this model will both direct and motivate follow-up research. Safety consultants and practitioners can use the success factors we've uncovered to increase the effectiveness of an industry-based BBS process.

USEFULNESS OF FINDINGS

1) A popular perception for industrial safety professionals as well as safety consultants is that BBS processes should be voluntary. The arguments advanced by proponents of this perspective is that making such a process mandatory will result in resistance or even retaliatory behaviors from employees who resent a loss in their perceptions of personal control. Our research indicates this is not necessarily the case. Employees involved in mandatory BBS processes reported more participation and greater levels of interpersonal trust. In addition, these employees reported as much satisfaction with BBS as did individuals participating in a voluntary process.
2) Effective BBS training as well as perceptions of personal control appear to be critical variables for positive employee reaction to a BBS process. In particular, mandatory processes that allow employees opportunities to customize their BBS process are likely to experience more success than organizations that do not allow for employee control.

3) It is beneficial to pay attention to possible unintended side-effects of a behavior-change intervention. For example, in Study 2, the organizational interventions targeting safety-belt use had an unwanted side-effect on turn-signal use. Turn-signal use decreased steadily throughout the course of the study, ending at a low of 34%, 16 percentage points below the baseline mean of 50%. These data, in concert with the modest increase in safety-belt use, support risk compensation theory (Peltzman, 1975).
4) Study 4 documented a wide array of opinions on the topic of BBS, including a lack of appropriate approaches toward evaluating BBS programs. This implies a need for more attention to dissemination. Over the two years of this grant, we contributed significantly to this need by writing several articles, books, and training manuals, and presenting numerous conference presentations, seminars and workshops. Please refer to **Appendix A** for a list of professional activities that disseminated the results of this research.
5) The Flow of Behavior Change model developed from this research (see Figure 1 on page 4) can be used to plan intervention strategies and predict success of existing intervention programs.

BACKGROUND AND SIGNIFICANCE

The leading the causes of death for people under the age of 38 is not heart disease or cancer, but something as common as injuries. Injuries kill more than 93,000 Americans and require an estimated 478 billion dollars in total costs each year. This averages to two people dying and over 370 people sustaining a disabling injury every 10 minutes (National Safety Council, 1998). Of the 96 million visits to the emergency room, 37% were injury related. The most common cause for people visiting the emergency room is for accidental falls (7.7 million), followed by motor vehicle crashes (4.4 million), and accidental cuts (3 million). Thus, unintentional injuries represent a serious public health problem. Cost-effective community, school, and industry-based injury prevention interventions are urgently needed to reduce injury rates.

Due to the frequency and severity of injuries, the U.S. Department of Health and Human Services has identified injury prevention as a priority for attaining the goals outlined in Healthy People 2000: National Health Promotion and Disease Prevention Objectives (1990). Every day, an estimated 10,000 to 36,000 U.S. employees are injured and 14 are killed. Moreover, an estimated 5,000 to 11,000 workers die and 2.5 to 11.3 million employees suffer non-fatal injuries (Leigh, 1995; Miller, 1997; National Institute for Occupational Safety and Health, 1998; National Safety Council, 1998; U. S. Bureau of Labor Statistics, 1997). In sum, approximately 250,000 potential productive years of life are lost annually because of premature death due to work-related injuries (Baker et al., 1992).

According to the U. S. Bureau of Labor Statistics (1998), the highest incidence rate of non-fatal occupational injuries and illnesses among goods-producing industries occur in manufacturing. The 1997 incidence rate of 12 per 100 full-time employees was followed closely by incidence rates in the wholesale and retail trades (11.9). Of the nearly two million injuries and illnesses in 1996 resulting in lost workdays, the majority were caused from overexertion (28%) and contacts with objects/equipment (26%). Although the overall 1997 rate of 3.7 lost days per 100 full-time employees has dropped since 1990, work-related injuries remain a problem.

Social and Economic Ramifications

Over and above the traumatic personal consequences experienced by employees and their friends and families due to unexpected industrial injuries and mortalities, there are also critical social and economic consequences to consider. Although pain and suffering caused by these misfortunes cannot be quantified, the social and economic costs can be estimated. The overall liability of work-related injuries in 1997 has been estimated at $128 billion (National Safety Council, 1998). This figure is an increase from the 1989 estimate of $89 billion, and is dramatically larger than the 1985 estimate of $34.6 billion (Leigh, 1995). These costs include lost wages, medical expenses, insurance claims, production delays, lost time of coworkers, equipment damage, fire losses, and indirect costs (Miller, 1997; National Safety Council, 1988).

All of these estimates are staggering and indicate the cost of industrial injuries is increasing at an alarming rate. Today it is estimated that each year employers pay approximately $200 billion in direct costs associated with injuries both on and off the job. Occupational injuries account for two-thirds of this total or nearly $128 billion annually. This amounts to over $28,000 per work-related injury and close to one million dollars per employee death. The majority of these current costs are in the form of insurance premiums for workers and their families, and workers' compensation for days lost from work (Miller, 1997; National Safety Council, 1998). It is also noteworthy that these estimates may be underestimating the true impact of industrial injuries due to problems with current surveillance techniques and the fact that many injuries are not reported (Leigh, 1995; Miller, 1997; National Committee for Injury Prevention and Control, 1989; Weddle, 1996; Wilson, 1985).

Because the manner in which employees are hurt differs so dramatically, prevention strategies need to address a myriad of different circumstances (Geller, 1996; Heinrich, 1959; Petersen, 1996; U. S. Bureau of Labor Statistics, 1997). Thus, critically examining and redefining industrial safety research to improve long-term and broad-based impact has important implications for reducing morbidity and mortality, and increasing the quality of life among American workers. As such, relevant theories of behavior analysis and social cognitive psychology were used in the research reported here to critically evaluate the long-term impact of interventions designed to improve safety-related behavior.

Injury Control Strategies

Although the overall injury and morbidity rates in industry are high, many experts believe techniques are available to prevent most injuries, whether acute or chronic. These techniques include: a) instituting a drug screening program; b) developing ergonomic and engineering strategies that decrease the probability of an employee engaging in at-risk behaviors; c) understanding the characteristics of workers most at risk for unintentional injury; d) educating and training employees regarding equipment, environmental hazards, and at-risk work practices; and e) motivating safe work behaviors through behavior-based observation and feedback. We investigated the latter in this NIOSH-funded research project. A summary of our findings is provided below in **Research Findings,** with more complete documentation of each project included in an appendix as submitted for professional publication.

Applied Behavior Analysis

Applied behavior analysis has made substantial contributions to the domain of health promotion and injury control by researching the determinants of at-risk behaviors, directing the development of effective behavior change interventions, and applying these interventions in a variety of settings like behavioral medicine (Cataldo & Coates, 1986), safety performance (Geller, 1996; Petersen, 1996), health behavior (Elder, Geller, Hovell, & Mayer, 1994), traffic safety (Geller, 1998a), environmental protection (Geller, Winett, & Everett, 1982), child safety (Roberts, Fanurik, & Layfield, 1987), and health psychology (Winett, King, & Altman, 1989).

Behavior-based approaches to injury control have a number of advantages over other approaches, including: a) they can be administered without extensive professional training; b) they can reach people in the setting where a problem occurs (e.g., community, school, workplace); and c) leaders in various settings can be taught the behavioral techniques most likely to work under relevant circumstances (Baer, Wolf, & Risley, 1968; Daniels, 1989; Geller, 1996, 1998b).

The application of applied behavior analysis principles to occupational safety and health is referred to as behavior-based safety (BBS). For the past twenty years, BBS has been used successfully in the prevention of occupational injuries (e.g., Alavosius & Sulzer-Azaroff, 1986; Geller, Davis, & Spicer, 1983; Geller, & Hahn, 1984; Komaki, Barwick, & Scott, 1978; Reber, & Wallin, 1983, 1984; Roberts & Geller, 1995; Smith, Anger, & Ulsan, 1978; Streff, Kalsher, & Geller, 1993). In fact, Guastello (1993) found by systematically reviewing 53 occupational safety and health studies since 1977, that BBS produced the highest average reduction (59.6%) in injury rate. Most of these studies, however, were simply demonstrations of techniques that had already been effective in other settings. Researchers made little procedural comparisons to guide the improvement of future intervention designs.

The antecedent-behavior-consequence model of applied behavior analysis has been applied frequently and successfully over recent years to prevent injuries. Behavior analysis has a great deal to offer the field of injury control by enhancing the understanding of the determinants of at-risk behavior, and guiding the development of effective behavior change strategies (Elder et al., 1994; Geller, 1988; Geller et al., 1989; Krause, Hidley, & Hodson, 1996; Petersen, 1989). For example, behavioral scientists have demonstrated the cost-effectiveness of: a) *participative education* to increase safety-belt use (Kello, Geller, Rice, & Bryant, 1988), b) *incentives/rewards* to increase safety-belt use (Geller, 1984; Geller & Hahn 1984; Roberts et al., 1988), c) *behavioral feedback* to increase sanitation behaviors during food preparation (Geller, Eason, Phillips, &

Pierson, 1980) and reduce driving speed (Van Houten & Nau, 1983), and d) *pledge-card commitment* strategies to increase use of personal protective equipment (Streff, Kalsher, & Geller, 1993).

Behavior-based approaches to safety focus on systematically studying the effects of various interventions by first defining the target behavior in a directly observable and recordable way. The behavior is then observed and recorded in its natural setting. When a stable baseline measure of the frequency, duration, or rate of behavior is obtained, an intervention is implemented to change the behavior in beneficial directions. This intervention typically involves changing the salience of the antecedents and/or consequences of specified target behavior(s). To determine intervention effectiveness, the frequency, duration, or rate of the target behavior is recorded during and/or after the intervention and compared to baseline measures of behavior (Daniels, 1989; Geller, 1996, 1998d). Changes in the desired direction indicate acquisition of the target behaviors.

Behavioral Feedback

One of the primary tools used to influence behavior in a BBS process is observation and feedback. Feedback can be based on individual or group performance. It can be given publicly or privately, and it is often combined with an education or training program (e.g., Zohar, Cohen, & Azar, 1980). The behavior change literature has shown consistent benefits of posting or communicating information regarding at-risk behaviors for individuals, groups, and entire communities.

Van Houten and his colleagues (Van Houten & Nau, 1983; Van Houten, Nau, & Marini, 1980) found decreased speeding following the road display of daily percentages of drivers exceeding the posted speed limit. Similarly, Jonah (1989) and Geller (1996) reported significant increases in safety-belt use following the use of roadway signs to post "percentage of drivers wearing safety belts yesterday." More recently, Ludwig and Geller (1997) used behavior-based feedback combined with goal-setting to increase complete stopping at intersections by the pizza deliverers at two separate pizza stores. Although it is generally agreed that feedback is a viable method for improving individual as well as group performance, there remains some controversy regarding the form feedback should take. Specifically, while some argue feedback is most effective for long-term behavior change when presented in a global fashion (Bandura, 1986, 1997), others maintain feedback needs to be behaviorally specific for optimal effectiveness (Frederiksen, Richter, Johnson, & Solomon 1982).

Those who claim feedback is most effective as a global score presume such a presentation will result in feedback receivers being more cognizant of all potential behaviors being targeted. Due to this generalized awareness, they will adjust all behaviors, and demonstrate greater and longer-lasting improvement (Baer, Wolf, & Risley, 1968, 1987). In contrast, individuals supportive of specific feedback maintain that individuals cannot improve their performance unless they are aware of exactly what is being observed (Frederiksen et al., 1982). Our NIOSH-funded research addressed the global versus specific feedback question by comparing the relative effects of both in an industrial setting (see Study 3 and **Appendix E**).

Intrinsic versus Extrinsic Motivation

All complex organizations incorporate some form of external control or accountability system (Dose & Klimoski, 1995). Some investigators (e.g., Deci & Ryan, 1987; Kohn, 1993; Lepper, Greene, & Nisbett, 1973) have reported that external control of behavior through either punishment or reinforcement will undermine an individual's natural desire (sense of responsibility) to engage in a particular behavior. These researchers claim individuals will react against contingencies they perceive as controlling. For example, when people are paid to engage in a particular behavior, they justify their behavior by focusing on the reward they received for engaging in that behavior and not on some internal desire (or responsibility) to make the response.

According to the social psychological principles of discounting and cognitive dissonance (Festinger, 1957), individuals will perceive the target behavior as being less attractive because of the external controlling contingencies, especially if the accountability requirements are perceived as self-serving on the part of management (Dose & Klimoski, 1995). Thus, once the contingencies have been withdrawn, individuals are less likely to engage in the previously reinforced behavior. Perceptions of choice within a safety process could prevent the undermining of intrinsic motivation and thus enhance the probability of behaviors necessary to maintain a safety intervention program.

Because the behaviors needed to sustain a safety process are often inconvenient and uncomfortable, they may require support by some type of extrinsic (or external) intervention. The key is to provide enough external control to support the safety process, but not too much to undermine the internal desire to maintain a safe work culture. This can be accomplished by carefully structuring outcome expectations through role clarification and task specification (Dose & Klimoski, 1995). Such strategies could include participative or mandated goal-setting (Ludwig & Geller, 1997), commitment strategies (Geller & Lehman, 1991; Streff, Kalsher, & Geller, 1993), or consequence procedures, including both reward and punishment techniques.

In a comprehensive review of 28 employer-based programs to motivate safety-belt use, Geller, Rudd, Kalsher, Streff, and Lehman (1987) found reward strategies to be more effective than punishment strategies, and more effective than commitment strategies in the short term.

However, commitment strategies were most effective at maintaining long-term behavior change. Thus, it could be speculated that these interventions facilitated workers' sense of responsibility toward the safety process by enhancing personal control and outcome expectancies through self-management.

The research we have performed over the past two years has allowed us to make some comparisons between organizations that mandate some level of performance in their BBS processes versus organizations that rely solely on voluntary participation. As such, we have been able to investigate various interpersonal and behavioral outcomes associated with both approaches. In addition, our findings have practical implications for individuals or groups planning to implement an industry-based BBS process.

SPECIFIC AIMS OF THE FUNDED RESEARCH

Our specific aims were prompted by our review of the literature summarized above, and have both practical and theoretical ramifications. From a practical perspective, we proposed to: a) develop flexible procedures for implementing an employee-driven BBS process to reduce at-risk work behaviors and increase safe work practices; b) derive guidelines to increase employee involvement in a long-term BBS process; c) demonstrate both short and long-term effects of a BBS process on work practices, attitudes, person states, and injuries; d) study indirect behavioral effects of a behavioral observation and feedback process (i.e., determine whether targeting certain work behaviors for an intervention process will influence other safety-related behaviors); and e) determine the extent to which line workers can implement an objective and reliable behavior-monitoring process as an integral aspect of their job assignments.

From a theoretical perspective, we proposed to a) compare hypotheses derived from basic learning theory (i.e., response generalization) with those from danger compensation or risk homeostasis theory; b) study the role of certain individual factors (i.e., self-esteem, self-efficacy, personal control, optimism, and belongingness) derived from personality/social theory as predictors of involvement in a safety process, and as person states hypothesized to change as a function of involvement in an intervention process; c) compare the validity of intrinsic motivation theory (from cognitive science) versus extrinsic contingencies (from behavioral science) as foundations for a long-term intervention process; and d) develop the construct of empowerment as a feeling state of individuals which is potentially increased by perceptions or expectancies of self-efficacy, personal control, and optimism. Consequently, the overarching purpose of the research reported here was not only to develop a set of guidelines for designing a practical long-term intervention process to reduce the risk of unintentional injury in the workplace, but also to develop theory and principles for maximizing the cost effectiveness, ecological validity, and potential for organizational institutionalization of injury prevention countermeasures.

The results documented here demonstrate we have accomplished our major specific aims. In addition, we have been able to disseminate much of our findings through presentations, workshops, and professional publications. A list of our professional activities related to this NIOSH-funded research is included in **Appendix A.**

Unfortunately, due to circumstances beyond our control, we were unable to answer some of our research questions. Specifically, a large portion of our survey data was destroyed by the organization responsible for scoring them. In other words, we got employees from 16 organizations to compete a variety of individual difference questionnaires but this data could not be analyzed because of a test scoring facility's disastrous error. A letter from this organization explaining the unfortunate destruction of our data is included in **Appendix B.**

RESEARCH FINDINGS

A more detailed report for each of the studies described in this section can be found in the appendices as the research was documented for professional dissemination.

STUDY 1: THE POWER OF CHOICE: OPTIMIZING INVOLVEMENT IN A BBS PROCESS

(See **Appendix C** for a complete report as submitted for publication in *Journal of Safety Research.*)

The literature has demonstrated straightforward and unmistakable benefits of a BBS approach to reducing injuries in industry (cf. Guastello, 1993). Most of these studies, however, were simply demonstrations of techniques that had already been effective in other settings. No significant procedural comparisons were made to guide the improvement of future intervention designs. Research in the area of BBS needs to ask and answer questions regarding the design of more effective and longer-term intervention processes (NIOSH, 1998). This was the prime purpose of Study 1. Specifically, we evaluated the extent that employee involvement increases the impact of a BBS process. We predicted that involving employees in BBS safety training and implementation planning would lead to more beneficial impact of the training and greater participation during the implementation of a BBS process.

Method

Subjects and Setting

Subjects were 476 hourly and salary employees at an engine bearing manufacturing plant in southwest Virginia. The population of employees ranged in age from 19 to 63 years (M = 42), and employee tenure at the facility ranged from six months to more than 25 years (M = 16). The proportion of hourly to salary workers was approximately five to one, and the workforce and hours worked were stable throughout the course of the study.

Procedure

The BBS process began by training volunteer safety facilitators from representative work areas on first shift (n=8) and second shift (n=6) in the basic principles and procedures of this approach. Topics included: a) defining target behaviors, b) developing checklists to record occurrences of target behaviors, c) designing interventions to improve safety-related behaviors, d) charting progress in a time-series, and e) giving effective behavioral feedback. Following two intensive eight-hour education/training sessions for the safety facilitators, the remaining employees across three shifts received a four-hour version of BBS education/training.

Education/Training Manipulation

The format and style of the education/training sessions were manipulated to investigate the impact of employee participation during BBS training. The materials for all sessions, however, were held constant. Four research associates, experienced at conducting safety seminars, presented the sessions in randomized pairs. The material covered in plant-wide training paralleled that provided to the safety facilitators, but in abbreviated form.

Choice Condition

Throughout the course of the two eight-hour safety facilitator and four-hour plant-wide education/training sessions, the safety trainers in the Choice condition asked questions of participants, requested relevant stories, and facilitated discussions and interpersonal involvement with group exercises (n=230 on Shift 1). All sessions were held during the regular shift of the scheduled employees, and concluded with a written test of key safety concepts, principles, and procedures.

Assigned Condition

The training sessions were identical to the *Choice* sessions in every way except the trainers in the *Assigned* condition presented the safety material in a lecture format without asking questions or facilitating participant input (n=246 on Shifts 2 and 3).

These four-hour training sessions were conducted for 12 *Choice* groups and 14 *Assigned* groups, ranging in size from 7 to 30 individuals (M = 19). To assess the impact of the two training approaches, three variables were measured: the amount of verbal participation, participants' reported satisfaction with the training, and the participants' retention of key information presented.

Evaluation Procedures

To assess the impact of the two training approaches, three variables were measured: the amount of verbal participation, participants' reported satisfaction with the training, and the participants' retention of key information presented. To assess verbal participation, trained research assistants attended all sessions across both conditions and independently recorded the frequency of all verbal behaviors from the employees directed to the trainers. The verbal behaviors included questions asked, questions answered, and reactive statements. These observations were recorded unobtrusively on a data collection sheet attached to a notebook, giving the impression the observers were taking notes. Questions or comments which were not relevant to the training material or directed to individuals other than the trainer presenting information were not recorded. Interobserver agreement was assessed on a session-by-session basis by dividing the number agreements by number of agreements plus disagreements and multiplying that calculation by 100. Over all education/training sessions, the research assistants agreed on over 90% of their observations. Following the education/training sessions, employees received a questionnaire assessing their satisfaction, perceptions of participation, and knowledge retention. The names of the participants did not appear on any test document or session evaluation.

BBS Implementation

Several involvement manipulations were made to give Shift 1 facilitators (n=8) various opportunities to make key decisions in their BBS process. Specifically, during separate Shift 1 safety meetings, Shift 1 safety facilitators selected: a) the initial safety-related behavior (hearing protection) to be observed plant-wide, b) the design of the checklist used to make the observations of the target behavior, c) the schedule for behavioral observations by facilitator, d) the target number of behavioral observations per week, e) the design and location of group feedback charts displaying on-going measures of plant-wide hearing protection use, f) the protocol for safety slogan contest, and g) the design and color of safety shirts offered plant-wide. The choices made by Shift 1 safety facilitators were yoked to Shift 2 safety facilitators (n=6), in that both shifts implemented the same process customized by Shift 1.

For nine weeks the safety facilitators of the Shift 1 workers (n=230) and Shift 2 workers (n=210) made behavioral observations on hearing protection. Observations were made on behavioral checklists designed by the Shift 1 facilitators and distributed to Shift 2 facilitators. On each shift, one facilitator was responsible for collecting completed observation cards. These data were collected two times a month at facilitator meetings scheduled and led by a research assistant.

These data were graphed and posted on a safety bulletin board located at the highly traveled entrance to the production areas. Facilitator involvement was assessed by the number of observations taken on each shift.

Results

Participation in Training

Analysis of variance (ANOVA) was used to evaluate differences in the mean number of verbal responses per shift, with Shift 1 in the Choice condition and Shifts 2 and 3 receiving the Assigned condition. A one-way ANOVA on verbal behaviors for training format (Choice vs. Assigned) indicated that participants in the Choice condition exhibited significantly more verbal behaviors than participants in the Assigned condition, F (2, 395) = 38.9, $p < .001$.

Analyses were also conducted on each type of verbal response: questions answered, reactive statements, and questions asked. A one-way ANOVA of questions answered per Shift (Shift 1 vs. Shift 2 vs. Shift 3) indicated that participants in the Choice condition answered significantly more questions than participants in the Assigned condition, F (2, 395)= 40.6, $p < .001$. A one-way ANOVA of reactive comments per Shift (Shift 1 vs. Shift 2 vs. Shift 3) indicated that participants in the Choice condition made significantly more comments than participants in the Assigned condition, F (2, 395) = 19.1, $p < .001$. A one-way ANOVA of questions asked per Shift (Shift 1 vs. Shift 2 vs. Shift 3) indicated no significant difference in the average number of questions asked by participants in the Choice and Assigned conditions, $p > .05$.

The post-session questionnaires included: a) an 18-item knowledge test, b) a 5-item measure of perceived involvement, and c) a one-item measure of satisfaction with the training. One-way ANOVAs by Shift (Shift 1 vs. Shift 2 vs. Shift 3) indicated no significant differences between the knowledge scores of participants in the Choice and Assigned groups, nor the participants' perceptions of involvement, $p > .05$. The ANOVA of participants' self-reported satisfaction with the training process revealed that participants in the Choice condition (i.e., Shift

1) were more satisfied with the training process than Shift 3 participants in the Assigned condition, F (2, 438) = 5.04, $p < .05$. However, the satisfaction rating of Shift 2 participants in the Assigned condition was not significantly different from the Shift 1 participants in the Choice condition, $p > .05$.

Behavioral Observations

Over a nine-week observation and feedback period, Shift 1 facilitators (n = 8) made significantly more observations per week than Shift 2 facilitators (n = 6), t (16) = 3.05, $p < .05$. An observation was defined as the single occurrence of recording hearing protection as safe versus at-risk on a critical behavior checklist. Finally, Shift 1 facilitators conducted significantly more observations per person each week than the Shift 2 facilitators, t (16) = 3.05, $p < .05$.

Effects on Lost Workdays

Figure 2 depicts a cumulative record of this organization's lost workdays for 18 months prior to (n=197) and 18 months following (n=26) the BBS process. The figure shows a marked decrease in lost days due to injuries following the introduction of BBS

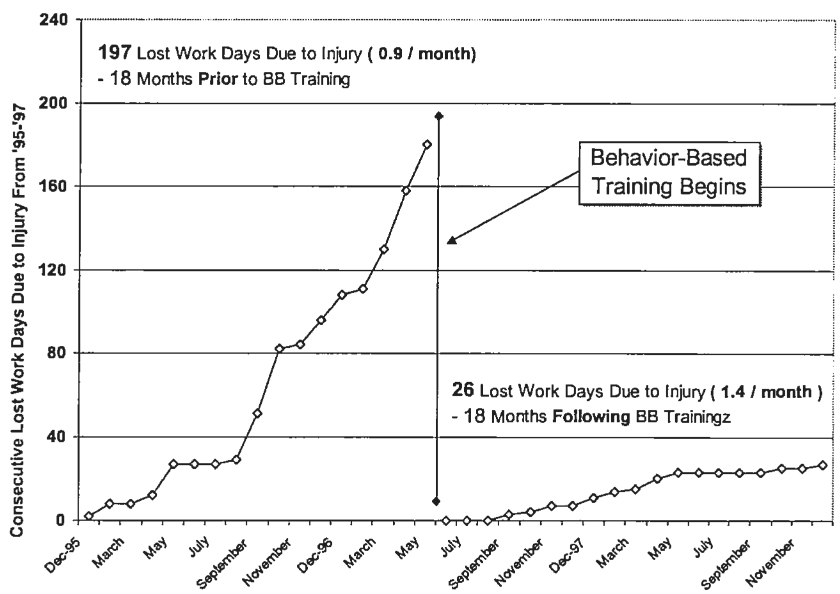


Figure 2: *Cumulative Lost Work Days Due to Injury '95-'97*

education/training, observation/feedback for hearing protection, and several additional intervention processes. A mean of 10.9 lost days per month occurred prior to BB safety; whereas after the intervention, a mean of 1.5 days were lost per month due to injury.

Discussion

Our manipulation of involvement was successful during the education/training sessions in that a significantly greater number of employees answered questions, made comments, and asked questions. However, results did not support the hypothesis that participative training would be more effective and appreciated than nonparticipative training. The lack of significant differences between conditions regarding information retention, satisfaction, and involvement suggest that: a) group participation may not be directly measurable by verbal behavior alone, b) the nature of the training material itself may have involved the workers regardless of their verbal responses, or c) Choice training simply may not be more effective than Assigned training in terms of information retention and personal satisfaction.

Our results and literature review do suggest, however, it is advantageous to facilitate employee ownership of the BBS process. This was evident in the current research by the impact the Choice condition had on employee observations of the targeted safety-related behavior. Although facilitators in the Choice condition did not report feeling more involved, nor demonstrated greater knowledge of the training material presented, they did make significantly more behavioral observations. Thus, the benefit of the involvement manipulation was manifested during the implementation of a BBS process.

This study manipulated level of employee involvement during BBS education/training and identified at least one factor that may increase the impact of a BBS process. Specifically, when employees are given the opportunity to make key choices in the development and implementation of the safety process, they will contribute more to the process. This is as predicted by the social psychological principle of consistency (Cialdini, 1993).

The reduction in lost-time injuries plant-wide strongly suggests the BBS process did much more than increase the use of hearing protection. The plantwide safety training and the regular meetings to discuss the ear protection data probably increased awareness of general safety concerns throughout the facility. The BBS interventions certainly gave the employees the impression that management has increased the priority level of safety. Perceptions of management support, combined with success at performing behavioral observations, may have increased employees' general efficacy regarding their safety performance.

Thus, consistent with Bandura (1997), as the workers experienced success making observations on a single target behavior, they stretched the boundaries of their behavioral routines and incorporated the BBS principles beyond the use of hearing protection. Specifically, after the plant-wide safety education/training and the increased focus on using hearing protection, the safety facilitators implemented several other BBS interventions. For example, all employees participated in a plant-wide safety slogan contest with the winning slogan ("Bearings in Mind: Safety First!") being awarded a $50 gift certificate in a public celebration. The employees printed the slogan on a 3-foot by 8-foot banner and displayed it at the entrance to the manufacturing areas.

In addition to the slogan contest, employees on both Shifts 1 and 2 performed distinct interventions in their work areas that targeted various behaviors they considered critical for improving their safety. With each intervention, the work area met to define the target behavior, develop observation checklists and procedures, and decide how to intervene and test the intervention for impact. In the plant-wide education/training, this BBS continuous improvement process was referred to as DO IT for define, observe, intervene, and test (Geller, 1996).

Finally, after the BBS education/training, plant-wide interventions were implemented to increase safety-belt use. These interventions included written prompts, assigned goals, safety-belt use feedback, promise-card commitments, and incentives to buckle-up. Regardless of intervention strategy, all safety-belt promotions were built around the theme of "Safety is Not Only for the Workplace," a slogan suggested by employees during the BBS education/training. The safety-belt intervention materials were highly visible, and may have served as additional reminders of the organization's increased commitment to safety.

It is suggested that many occupational injuries go unreported (Leigh, 1995; Miller, 1997; Weddle, 1996; Wilson, 1985). Therefore, using a safety metric that is difficult to hide or cover up, such as lost-time injuries, probably provides a more accurate picture of the impact of a safety process than a record of minor or OSHA recordables. As such, following the introduction of BBS there was a dramatic decrease in lost workdays due to injury (from 197 to 26). This prominent reduction in lost workdays was reported by the organization to save approximately $200,000 in workman's compensation (Nunes, 1998). This speaks to the impact on the plant's bottom line of the BBS education/training, subsequent observation and feedback strategies, and various employee-driven BB interventions.

STUDY 2: ATTEMPTS TO INCREASE SAFETY-BELT USE IN AN INDUSTRIAL SETTING

(See **Appendix D** for a compete report as currently under review for publication in the *Journal of Organizational Behavior Management.*)

The use of shoulder and lap belts is the single most protective behavior that can be conveniently taken to reduce the risk of death or injury in a vehicle crash. It is estimated that vehicle safety belts saved 10,414 lives in 1996 and 90,425 lives since 1975 (National Highway Traffic Safety Administration, 1998). It is predicted that a one percent increase in safety-belt use nationwide would save 200 lives per year (Sleet, 1987), and an increase in nationwide belt use from the current level of 68% to 90% will save 1,500 lives in 1999 (Nichols, 1998). Thus, increasing the use of vehicle safety belts could also save some of the $54.8 million spent annually by employers for on- and off-the-job vehicle crashes.

Intervention Effectiveness

Multiple Intervention Levels

Over two decades of behavior change research at corporate and community sites led to the development of the *multiple intervention level* (MIL) hierarchy depicted in Figure 3. This model is used to categorize behavior change approaches and evaluate the cost-effectiveness of successive intervention strategies to alter the behavioral patterns of large numbers of individuals (Geller, 1998a, c; Geller et al., 1990).

A MIL approach to public health has critical implications for evaluating the cost-effectiveness of a behavior-based safety program. According to the MIL, antecedent strategies such as education, training, written prompts, and assigned goals are lower level interventions reaching a maximum number of people. Laws, policies or mandates which threaten a consequence are more intrusive and therefore are higher level interventions. Behavioral goal-

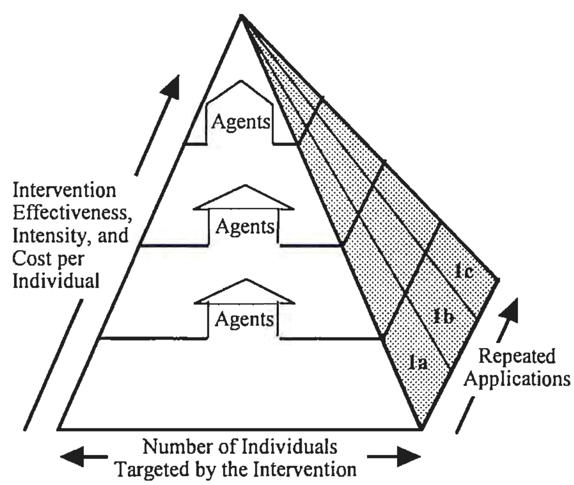


Figure 3: ***Multiple intervention level*** *hierarchy*

setting and feedback as well as incentive/reward programs are considered at the same level as disincentive/penalty programs. This research teseted the utility of the MIL as a heuristic to understand behavior change by sytematically implementing a series of interventions over the course of two years to increase safety-belt use among industry workers.

Method

Subjects and Setting

Subjects were 556 hourly and salary employees at an engine bearing manufacturing plant in southwest Virginia. The population of employees ranged in age from 19 to 63 years, and employee tenure at the facility ranged from six months to more than 25 years. The proportion of hourly to salary workers was approximately five to one.

Data Collection

Throughout the regular work week, trained research assistants sat in two distinct parking lots of the facility during the first shift arrival, second shift arrival/first shift departure times for hourly workers, and at the arrival and departure times for salary employees. Observers collected data on driver safety-belt and turn-signal use. To assess inter-observer reliability, a second independent observer collected data with the primary observer on 30 percent of all observation sessions. As it was impossible to record data on every vehicle entering or leaving the parking lots, the primary observer identified vehicles to observe by calling out the make and color of the vehicle to be observed (e.g., the red pick-up) as it passed an obvious stationary landmark. Interobserver reliability exceeded 90% for both safety-belt and turn-signal use.

Intervention Techniques

After four weeks of baseline observations, a series of progressively more invasive interventions was implemented at the facility over a two-year period. The interventions were as described below and occurred in the order listed.

Written prompt

Attached to the paychecks of all wage employees was a flyer displaying the logo of the industry and a message selected by a safety steering committee of wage workers which read: "We Buckle-Up Because Safety is Not Only for the Workplace." Three weeks later the flyer was attached to the paychecks of all salary employees. After ten weeks of individual prompts, the same message was displayed plantwide on table tents in the workers' cafeteria, in bathrooms above hand dryers, and on doors located in strategic places throughout the plant. Damaged and missing flyers were replaced throughout the plantwide Prompt condition. The total duration of the written prompt intervention period was approximately 16 weeks.

Safety slogan and celebration

A celebration announcing the winner of a plantwide safety slogan contest was scheduled near the Christmas Holidays. This celebration consisted of rewarding the winner with a $50 gift certificate to a store of his or her choice. At this event, Vince and Larry (the famous "Crash Test Dummies") made an appearance to distribute posters featuring two prominent Virginia Tech football players encouraging safety-belt use. To increase involvement, the celebration occurred after the first workshift and before the second workshift, and included refreshments and photograph sessions with the dummies. The winning slogan ("Bearings in Mind, Safety First!") was printed on a 3 foot by 8 foot banner and displayed for eight weeks above the main exit from the plant floor.

Assigned goal

After the Slogan and Celebration intervention and a six-week Withdrawal period, a specific, difficult but attainable goal for plantwide safety-belt use was set. Flyers displaying the plant logo, winning safety slogan, and the goal of 80% safety-belt use were posted on table tents in the cafeteria, in bathrooms above hand dryers, and on doors located in strategic places throughout the plant. These flyers were inspected weekly by research assistants and the plant safety manager for damage and loss. Damaged and missing flyers were replaced throughout this intervention phase. The goal was set approximately 25% above the current percentage of belt use.

Goal plus feedback

Sixteen weeks after the Assigned Goal phase, feedback was included on flyers displayed weekly along with a reminder of the plant's belt-use goal. Flyers were posted in the same locations and fashion as in the Assigned Goal intervention described above with one noteworthy exception --feedback on the plantwide safety-belt use from the previous week was included on each flyer. This feedback was updated weekly, and new flyers were posted during the first shift each Monday as during the Assigned Goal phase. After an initial period of feedback, the flyers appeared in bright colors which were changed weekly to attract attention. This phase lasted approximately 16 weeks.

Promise card

Written buckle-up promise cards (as described in Geller & Lehman, 1991) were distributed to all employees with their paychecks. The promise cards contained the company logo, the winning safety slogan, and a formal statement pledging to use a vehicle safety belt throughout a two-week period. The promise also included a location for the employees to sign, and a box they could check if they would allow their card to be posted in the plant. After the second week of the pledge period, the promise cards with this box checked (n = 200, 82% of the signed promises) were laminated on a 4 foot by 4 foot poster-board and displayed on the plant safety bulletin board.

Blank pledge cards were distributed next to the posted promise cards and labeled "Second-Chance Pledges." The initial pledge period was extended an additional two weeks. New promises (n = 31) were posted (with approval) at the time they were signed. The flyers displaying the safety-belt use goal and behavioral feedback were posted as described above throughout this four-week pledge period.

Promise plus incentive/reward

This intervention was identical to the promise-card commitment described above, except combined with the promise was an incentive to sign the promise and buckle-up during the four-week pledge period. Specifically, it was announced on flyers attached to the paychecks of all employees, on table tents in the workers' cafeteria, and on signs posted in bathrooms above hand dryers and on doors located in strategic places throughout the plant that a cash prize would be awarded to one winner of a random drawing of a signed promise card. The amount of the cash prize was determined by the increase in mean safety-belt use among all plant employees. Specifically, $20 was added to the lottery prize for every percentage point increase in safety-belt use above the pre-promise baseline. The prize was awarded one week following the pledge period in a public drawing conducted by the first author and the plant safety manager. A member of the plant's safety team drew the winning card.

Withdrawal

A withdrawal period marked by removal of all intervention materials occurred after the plant Safety-Slogan Contest, the Promise Card, and Promise Card plus Incentive/Reward interventions. Each withdrawal lasted approximately six weeks.

Results

Safety-Belt Use

Figure 4 displays the weekly percentage of safety-belt use for all employees throughout the 24 months of this field study. Vertical lines indicate the introduction of a new intervention or withdrawal as described above. Horizontal lines depict the mean belt-use percentage for each specific phase. The number of observations per phase is indicated within each intervention

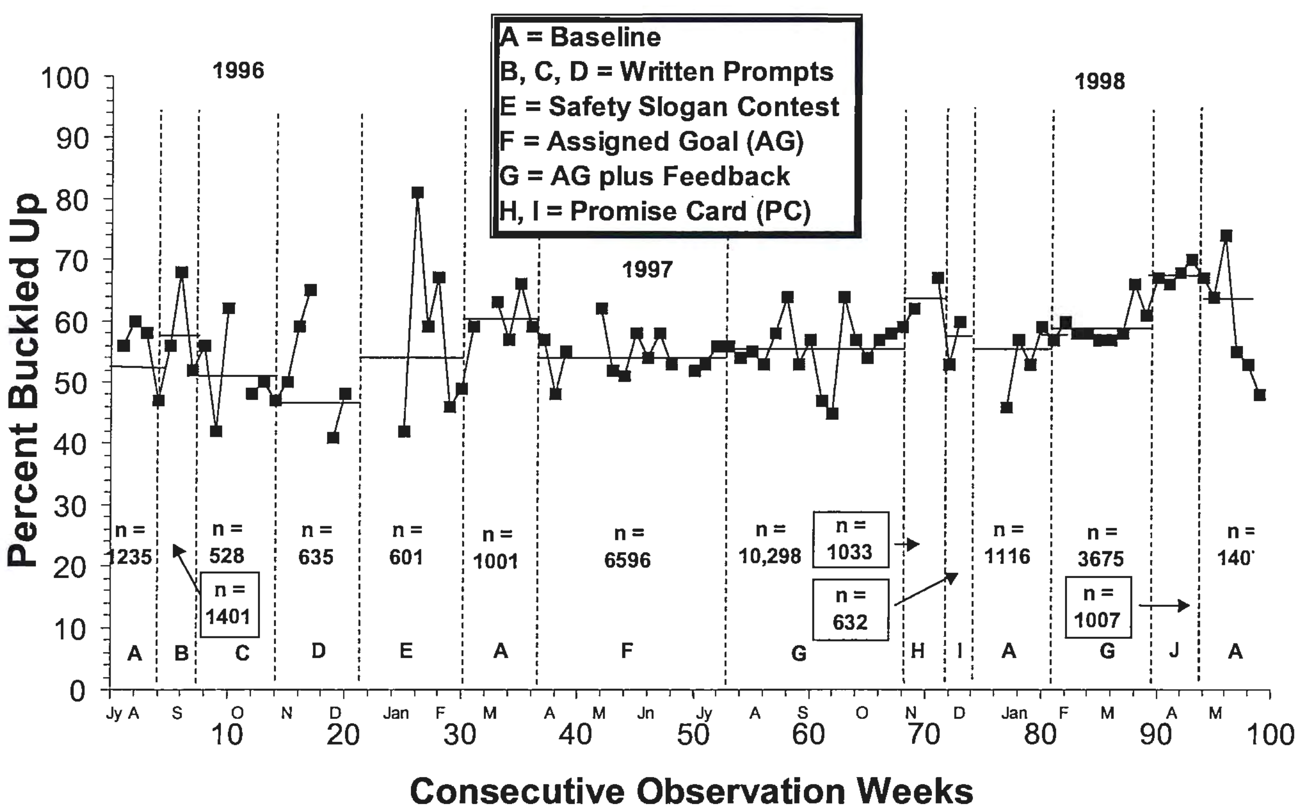


Figure 4: *Weekly percentage of safety-belt use for all employees throughout the 24-month study*

condition. The month of data collection is provided below the x-axis, and the corresponding year is noted in the body of the figure.

A visual inspection of the data indicates a lack of marked increases in safety-belt use per intervention phase, even as the interventions became more intrusive. A noteworthy exception was the modest increase in plantwide belt use to 68% (n = 1007) as a result of the Promise plus Incentive/Reward intervention. As shown in Figure 4, this effect continued for up to three weeks following the termination of the pledge period. Interestingly, only 213 (38%) promise cards were signed during the Promise plus Incentive/Reward period. Of these, only 88 were signed by employees who had not signed a promise card during the prior Promise-Only intervention.

A close look at the data indicates that another modestly effective intervention was the Safety Slogan contest and Celebration. This intervention resulted in an immediate increase in safety-belt use for six weeks to 53% (n = 601) and a longer-term maintenance of 61% (n =1001) during a subsequent six-week return to baseline. These increases resulted after three attempts to prompt the use of safety belts resulted in a decrease in safety-belt use to 47% (n = 635) during the plantwide Prompt condition.

The only other intervention that had any desired effect was the Promise Card. Two-hundred and forty-four (44%) of the workers signed the buckle-up promise. This strategy increased safety-belt use to 64% (n = 1033) during the two-week Promise period. However, upon posting the promises publicly, use of safety-belts dropped to 57% (n = 632), just below the level obtained during the second Assigned Goal plus Feedback phase (59%, n = 3675).

Overall, the gain in safety-belt use over the course of two years was approximately 15 percentage points or approximately 30 percent above the initial baseline level of 52% (n = 1235 observations) to 67% (n = 1193) through the first three weeks of the Follow-Up. The six week follow-up mean was 65% (n = 1407), 25 percent above the baseline two years earlier.

Turn-Signal Use

Figure 5 displays the weekly percentage of turn-signal use for all employees throughout the 24 months of this field study. Vertical lines indicate the introduction of a new intervention to increase safety-belt use or a return to baseline, and horizontal lines represent the mean turn-signal use percentage for each specific phase of the research. The number of observations per phase is indicated within each intervention condition. The month of data collection is provided below the x-axis and the corresponding year is noted in the body of the figure.

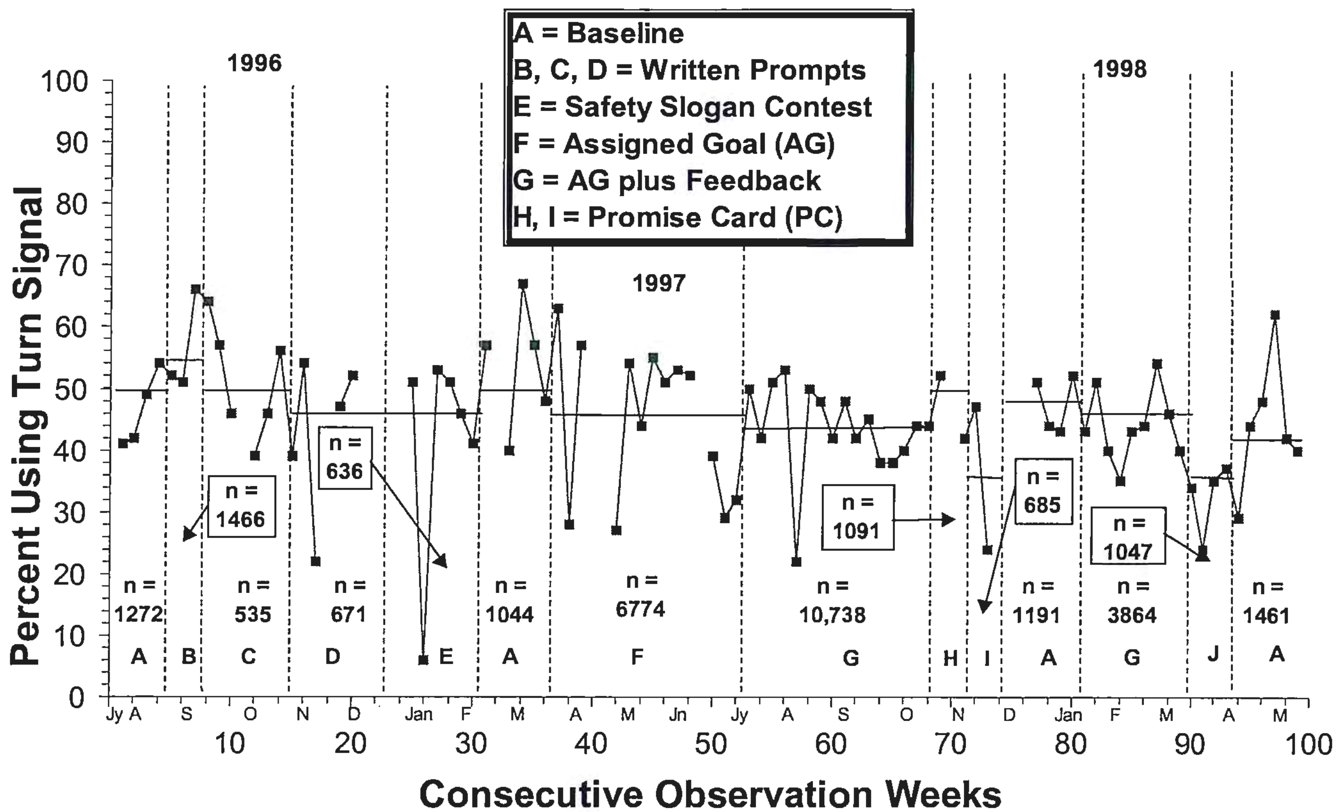


Figure 5: *Weekly percentage of turn-signal use for all employees throughout the 24 month study*

Although not targeted, turn-signal use decreased steadily throughout the course of the research. More precisely, visual inspection of the data indicates that turn-signal use did not deviate markedly in any phase from the baseline mean of 50% (n = 1272), but did trend downward to a low of 34% (n = 1363) during the Incentive/Reward intervention. A Pearson's product moment correlation of turn-signal use with safety-belt use resulted in a significant negative correlation ($r = -.28$, $p < .05$) for observations up to Week 75. The correlation from Week 75 through Follow-Up was stronger ($r = -.38$, $p < .05$) and is reflected in Figure 5 by an eight percentage point decrease in turn-signal use and a ten percentage point increase in safety-belt use from Week 80 through the first half of Follow-Up.

Discussion

Overall, these data support the MIL hierarchy (Geller, 1998a; Geller et al., 1990). That is, one could argue that the antecedent strategies used to motivate safety-belt use in the current research are all first level interventions, less powerful than Virginia's BUL. As such it follows that the hard-core resisters, not influenced by the BUL, would not be influenced by repeated applications of lower-level interventions. As suggested by the MIL, the modest improvements seen in the use of safety belts may have been, in part, due to the involvement of belt users as supportive intervention agents to get some part-time users to buckle-up more consistently.

Modeling appropriate behavior has been shown to increase the likelihood of others emitting the desired response by: a) demonstrating the ease at which it can be done; b) making more salient the costs versus benefits of the target behavior; and c) changing cultural norms regarding the behavior (Bandura, 1997). Indeed, the results of the current research indicate that the interventions requiring at least minimal individual involvement (i.e., Slogan Contest, Promise

Card, and Promise Card plus Incentive/Reward) were most effective at increasing the use of safety belts.

Fifteen years ago a similar behavioral intervention at this same facility increased safety-belt use from 17.4% to 50.6% among salary workers, and from 3.4% to 5.5% for hourly workers. As there was no safety-belt use law in 1982, the incentive was enough to provide the motivation to produce some desired behavior change. The baseline level of 52% belt use in the current study was only slightly higher than the intervention levels obtained in 1982. This suggests that those workers not motivated to avoid the improbable fine of $25 were not likely to buckle up for the remote probability of winning the raffle drawing. These individuals need more intrusive and intensive interventions to motivate them to change. This is as predicted by the MIL hierarchy proposed by Geller et al. (1990) and refined by Geller (1998a).

In Conclusion

The failure of the various behavioral interventions to increase vehicle safety-belt use at an industrial site can be explained by considering the state of those workers not currently buckling up. The employees at this facility have been informed many times about the value of safety belts, and they know how to buckle up. In fact, given that a safety-belt use law has been in effect in Virginia since 1989, vehicle occupants are willfully taking two calculated risks when they don't buckle up. They risk a $25 fine and the likelihood of being more seriously injured in a vehicle crash.

To increase safety-belt use among those who know what to do but don't, a behavioral intervention needs to be motivational. And the motivational contingencies need to be more powerful (soon, certain, and significant) than any other intervention currently in place to increase the safe behavior. Thus, it can be argued that our various instructional interventions were irrelevant, and for most non-users of safety belts, the consequences of our motivational intervention were not significant enough. The incentive/reward program was no more intrusive than the current BUL in Virginia, and thus did not involve a higher level of the MIL hierarchy (Geller, 1998a).

STUDY 3: SPECIFIC VS. GLOBAL FEEDBACK: COMPARING RELATIVE EFFECTIVENESS

(See **Appendix** E for a complete report as included in an accepted proposal for a Ph.D. dissertation.)

The beneficial impact of feedback on organizational safety performance is well established. Improvements in safety-related behaviors following BBS feedback have been demonstrated in a number of organizational settings including: a plastics manufacturing plant (Sulzer-Azaroff & De Santamaria, 1980), a metal fabrications plant (Zohar, Cohen & Azar, 1980), a bakery (Komaki, Barwick & Scott, 1978), a public work's department (Komaki, Heinzmann & Lawson, 1980), a university chemical laboratory (Sulzer-Azaroff, 1978), and a university cafeteria (Geller, Eason, Phillips, & Pierson, 1980). As researchers point out, "Informational feedback on performance has been shown to be a simple, effective, and durable method for promoting safety" (Fellner & Sulzer-Azaroff, 1984, p. 7).

Two common factors influencing the successful use of behavioral feedback in applied settings are global and specific feedback. However, the relative impact of global *versus* specific feedback has not been specifically evaluated in the safety literature. To our knowledge, this study represents, the first empirical test of global versus specific safety feedback on safety performance.

Method

Participants were 40 front-line workers at a soft-drink bottling plant in Southwestern Virginia. The employees were observed by trained behavioral observers from a large southeastern university using a critical behavior checklist (CBC). The observations occurred twice a day (once per shift) and each observation period lasted approximately one hour. Items included on the checklist were: personal protective gear, lifting, fork truck driving, and general safety (e.g., cutting away from body). For each behavioral category, trained observers marked either "safe" or "at risk" for the safety-related behaviors performed by the employees. At the end of each week, an overall "percent safe" score (total safe observations/total observations X 100) for the week was tallied for the group. This served as the dependent variable. Agreement between observers was calculated each week and was above 85% for all behaviors observed.

For 15 weeks, a baseline period was established to determine percent safe scores for the targeted behaviors. This baseline period was followed by an intervention period in which participants were made aware of the specific behaviors that were being observed with the CBC. They were observed for ten weeks following this 'awareness intervention.' After this period, the first 'feedback intervention' was introduced. Shift 1 participants received global feedback (aggregated across behaviors), whereas Shift 2 received specific behavioral feedback for each CBC category (with no global feedback).

This CBC feedback was provided in weekly meetings and took the form of graphs that showed weekly changes in percent safe scores. For the Global Feedback condition, a single graph was provided each week. For the Specific Feedback condition, four graphs (one for each behavior) were provided each week. Behavioral observations with the first feedback intervention lasted six weeks. Following this, the second feedback intervention was introduced.

With the second feedback intervention, Shift 1 participants received specific behavioral feedback and Shift 2 participants received global behavioral feedback. In other words, the feedback conditions for the two shifts were reversed for the second feedback intervention. The second feedback intervention lasted six weeks. Next, the Withdrawal phase of the experiment consisted of 17 weeks in which observations were made following the removal of BBS performance feedback with both shifts. Finally, after a six-month period without observations, the eight week follow-up phase was implemented.

Results

The current study used a 2 Feedback Level (global, specific feedback) X 6 Phase (baseline, awareness, intervention 1, intervention 2, withdrawal, follow-up) repeated measures ANOVA to determine the relative impact of global versus specific behavior-based feedback on safety performance.

Behavior-based safety awareness and feedback led to more frequent safe behavior occurrences over baseline for Shift 2, but not Shift 1. For Shift 2, percent safe scores were higher for the specific versus global feedback condition. No other significant differences were found and no evidence of response generalization was demonstrated. Descriptive statistics are provided below.

Shift 1

Phase	**Mean Percent Safe Score Across All Behaviors**	**Standard Deviation**
1 (Baseline)	**80.2**	**9.4**
2 (Awareness)	**81.0**	**6.1**
3 (Global Feedback)	**85.5**	**4.3**
4 (Specific Feedback)	**82.2**	**7.2**
5 (Withdrawal)	**79.1**	**7.7**
6 (Follow-Up)	**78.5**	**10.0**

Shift 2

Phase	Mean Percent Safe Score Across All Behaviors	Standard Deviation
1 (Baseline)	67.9	4.8
2 (Awareness)	81.3	6.1
3 (Global Feedback)	81.5	10.1
4 (Specific Feedback)	74.8	6.1
5 (Withdrawal)	77.1	6.0
6 (Follow-Up)	77.8	12.0

Discussion

Clear distinctions regarding the relative effectiveness of global versus specific feedback were not found. This may be because participants did not receive BBS training prior to the experiment. This may have limited participants' understanding of behavioral observation and feedback and their overall 'buy-in' into the process. Comprehensive BBS training prior to the experimental manipulation would have likely led to stronger results. However, it's possible global and specific feedback work equally well in influencing safety performance. Our data indicate this may have been the case in that both procedures improved performance beyond baseline levels for Shift 2. For 18 months prior to and 18 months during the study, the overall frequency of recordable injuries at this facility fell by more than 50%. The dissertation proposal developed from this research (see **Appendix E**) will continue the study of potential differential effects of global versus specific feedback.

STUDY 4: A NATIONWIDE SURVEY OF SAFETY PROFESSIONALS

(See **Appendix F** for a complete report as published in the *Proceedings of the Professional Development Conference of the American Society of Safety Engineers*, June 1998.)

Safety professionals were solicited for input through a nationwide survey published in *Industrial Safety and Hygiene News (ISHN)*, a monthly magazine for safety professionals with 62,000 company subscribers. The survey was designed to assess readers' knowledge and interest in BBS, and to explore ideas for improving the communication and implementation of BBS principles and procedures for reducing industrial injuries. The survey also allowed us to begin constructing a database of organizations currently active in BBS efforts.

A total of 162 completed surveys were returned to us by mail or fax. An appreciation of the BBS approach was shown by 80% (n=129) of the respondents answering "yes" to the question "Do you believe behavior-based safety is a viable approach for reducing at-risk work behaviors and activities?" (Only 3% responded "no" to this question; the rest said they didn't know). In addition, more participants responded "no" (48%) than "yes" (34%) to the question, "Do you think a safety program should put more direct focus on attitudes than on behaviors?" This is interesting because it not only shows preference for a BBS approach, it reflects a shift from the traditional policy and educational approach to injury prevention.

The astute reader will note, however, that the sample of surveys we analyzed was not random and was likely biased toward the BBS approach. The survey was presented within the context of research aimed at discovering how to make the BBS approach more effective. Thus, it's likely most people who took the time to complete and return the survey were at least interested in this particular approach to industrial safety. In fact, several respondents asked specifically to be included in our sample of organizations to visit for an on-site evaluation of factors contributing to the impact of a BBS process. Thus, compared to the average reader of *ISHN*, those who answered the questions and returned our survey were probably more informed about BBS and had higher confidence in the effectiveness of BBS. Even with this positive bias, however, the survey revealed some misperceptions about BBS which can limit its application for safety improvement.

What is Behavior-Based Safety?

The first part of the survey asked respondents to give their impression of BBS by checking all of the items they believe are true from a list of 16 possible characteristics. In general, the respondents' selections indicated accurate knowledge of BBS, but there were a few notable exceptions.

The three items selected most often as representing BBS were: 1) an intervention approach for increasing safe behavior (selected by 143 respondents); 2) an observation and feedback process (n=130); and 3) a tool for managing safety (n=114).

Relatively fewer respondents considered other characteristics of BBS to be relevant. Specifically, only 42 of the 162 respondents considered BBS an approach useful for investigating injuries. Only 88 respondents (54%) felt BBS is useful for evaluating safety achievement, and 99 respondents (61%) considered BBS an intervention approach for decreasing at-risk behavior.

It is likely people have a rather narrow viewpoint regarding BBS. This limited perspective is also reflected in numerous safety articles, sales pitches from safety consultants, and presentations at safety conferences. In fact, BBS is much more than a tool for doing observation and feedback. It is actually "a general philosophy that can be applied to many aspects of safety management." This general definition was actually the most accurate item on our survey checklist, and was checked by 71% of the respondents.

Principle versus Application

Most survey respondents were aware that BBS focuses on positive consequences to influence behavior change, since only four individuals indicated that BBS was "an approach focusing on the use of punishment to decrease unsafe behavior." However, a different story emerged when the survey asked respondents to check which techniques were actually used in their plant "to influence safety-related behaviors in the workplace."

Activators (or antecedent strategies) were most popular, with policies (n=149), posted safety signs (n=124), demonstrations (n=108), and lectures (n=102) leading the list. Goal-setting, feedback, and incentive/reward programs were used frequently, but more companies focused on outcome ("accidents or injuries") rather than process ("safety-related behaviors or activities") when setting goals (n=95 vs. 48), when giving group feedback (n=83 vs. 60), when giving individual feedback in coaching sessions (n=96 vs. 74), and when rewarding people for safety improvement (n=72 vs. 56).

The absence of affirmation for many behavioral techniques was quite revealing, and inconsistent with an appreciation for BBS principles. For example, the most cost-effective BBS approaches to improve safety are behavioral goal-setting and feedback for individuals and groups, yet these intervention approaches were being used at less than half of the sites represented by the survey respondents. It was encouraging, however, that almost two-thirds of the sample (n=102) use safety steering committees to manage their safety programs.

Only 15% (n=24) of the respondents indicated they monitor "percent safe behavior" to assess the success of their safety programs. The traditional outcome measures were most popular, with 77% (n=125) using OSHA recordables, 75% (n=122) using lost-time accidents, 42% (n=68) using total recordable injury rate, and 44% (n=66) using total recordable rate, including illness. Interestingly, slightly more respondents reported they use attitude or perception surveys (17%) than percent safe behaviors (15%).

Implications

The responses of those who completed and returned our BBS survey published in *ISHN* reflected appreciation for a BBS approach to injury prevention, but they also demonstrated substantial misunderstanding and misapplication. A majority of respondents, for example, perceived BBS as an observation and feedback tool rather than a general approach to improving the human dynamics of safety, relevant for ergonomics, injury analysis, and the design of incentive/reward programs.

Even with substantial appreciation for behavioral observation and feedback as a way to increase safe behavior, relatively few respondents indicated use of a relevant metric for monitoring the success of a behavior-improvement process. Thus, while safety leaders are increasing their belief in the power of observation and feedback to improve behavior, companies are apparently slow to apply appropriate feedback measures to evaluate and improve their safety programs. This is likely not due to inconsistencies between people's beliefs and behaviors, but rather to management system variables that prevent a paradigm shift from an outcome-based and reactive evaluation process to one focused on up-stream process activities that contribute to the prevention of workplace illnesses and injuries.

STUDY 5: A NATIONWIDE ANALYSIS OF BBS PROCESSES

(See **Appendix G** for a complete report as currently under review for publication in *Journal of Safety Research*, and an accepted Ph.D. dissertation based on this research).

For this study, it was originally proposed that ten companies reporting exemplary success implementing a BBS process and ten companies reporting unsuccessful implementation of a BBS process be selected for site visits. We quickly found that distinguishing between an effective BBS process and an ineffective BBS process was not simple. The majority of organizations returning surveys reported a decrease in incident and injury rate. And companies with a poor safety record were not apt to volunteer for a safety visit. As an alternative approach, we decided to approach site visits with the perspective of identifying themes or patterns of factors related to success vs. failure.

Although BBS methods are consistently effective at increasing the occurrence of safe behaviors, they can only work if used throughout an organization. In other words, if employees do not "buy-in" to BBS process, participate actively in observation and feedback sessions, and help to implement BBS intervention procedures, any research describing the impact of this approach is academic (pun intended). Therefore, a primary objective of the current research was to begin the process of identifying organizational and interpersonal variables that inhibit versus facilitate employee involvement in a BBS process.

Subjects and Setting

Participation was solicited through survey research conducted in a professional safety journal, as well as through attendance at professional safety conferences and workshops. The participants were employees working at 20 different industrial sites. From these 20 organizations, 245 employees (221 male, 24 female) participated in 31 focus-group sessions. About 80% of these participants were male, a male-to-female ratio that paralleled to workforce. All 20 of the sites visited were involved in an employee-driven BBS process that was at least one year old. Each BBS process included interpersonal observation and feedback with a checklist of specific safe and at-risk behaviors.

Procedures

During scheduled site visits to all 20 participating organizations, data were collected by two researchers via two distinct methods: focus group discussions and perception surveys. Focus groups were performed at each site visited. One focus group per site involved only members of the safety steering committee, while the other involved a random selection of hourly employees. While this should have resulted in 40 focus group sessions, nine of the sites visited did not have an intact safety committee. Therefore a total of 31 focus groups were performed (20 with hourly employees and 11 with safety-committee members). Focus groups ranged in size from four to 22 with the mean size being 10.

The focus group sessions lasted approximately 90 minutes, during which employees were asked a series of prepared questions designed to solicit their opinions regarding the necessary ingredients for an effective employee-driven BBS process. These questions asked of all groups are listed in the Results Section with a summary of the responses. All responses were simultaneously recorded on data collection sheets by both researchers.

After completing both focus groups, researchers left a perception survey with each organization. The contact person at each organization was instructed to get as many employees as possible to complete the surveys. If it was not possible to survey all employees, the contact person was asked to obtain a representative sample of every work area. When completed, the surveys were mailed directly to the researchers for analysis.

Results

Focus Groups

Two steps were used to analyze information gathered during focus groups. First, researchers looked at the employee responses for all questions as recorded by both focus-group facilitators. Only those responses that appeared on both of the data sheets were retained for analysis. Second, for the first five questions each response was classified as a positive, negative, or neutral statement by two researchers. Neither researcher was aware of how the other was classifying any of the responses. Only if a statement was classified as positive, negative, or neutral by both researchers was it retained. Only 12 responses were eliminated as a result of this process.

For Questions 6-8 (explained below) the responses were categorized as a behavior-based factor, a person-based factor, or an environment-based factor. The classification was performed by two subject-matter experts and consensus was reached on each item. The results obtained from the focus groups are reported separately for each question.

Question 1: How do you feel about the observation and feedback process used in your behavior-based safety process?

A total of 104 comments (56 positive, 37 negative, 11 neutral) were recorded. The most frequent positive comments indicated a perception that observation and feedback is beneficial because it increases one's awareness of safe and at-risk behaviors (17 comments, 15 focus groups, 14 organizations). The second most frequent response implied the observation and feedback process facilitated positive attitudes among employees (8 comments, 6 focus groups, 5 organizations). Specifically, employees indicated it has increased trust, comfort with coworkers, and even pride. A smaller number of responses indicated that such a process increased individual accountability (3 comments, 3 focus groups, 2 organizations).

The most frequent negative comment revealed a perception that ulterior motives are behind the observation and feedback process (15 comments, 9 focus groups, 8 organizations). For example some of these comments indicated employees only participate in the process to "rat" on other employees (7 comments, 5 focus groups, 5 organizations) or as an excuse to give negative feedback to someone they do not like (4 comments, 4 focus groups, 4 organizations). This was reflected in statements like "Inappropriate feedback is often given;" "I give permission to be observed, then I'm made to look bad;" "The observers are looking for negatives." A few other negative comments implied employees participating in the process are simply looking for overtime (2 comments, 2 focus groups, 2 organizations), trips to conferences (1 comment), or just trying to make themselves look good (1 comment). Other negative comments suggested the observation and feedback process was inconvenient (9 comments, 8 focus groups, 6 organizations). In other words, the observation and feedback process was perceived as just one more thing to do on top of all the other responsibilities.

Question 2: Is participation in the observation and feedback process mandatory or voluntary?

The workers interviewed at 12 organizations indicated their process was voluntary, whereas those at 8 organizations indicated participation was either "expected" or mandatory. For each organization, a "positive regard score" was calculated for the observation and feedback process. This was accomplished by subtracting the total number of negative comments made about observation and feedback from the number of positive comments given about this BBS process. The positive regard scores per organization were then correlated with type of process (mandatory vs. voluntary). The correlation between using voluntary observation processes and positive regard was -.304. Suggesting a trend toward more positive regard for an observation and feedback process that is mandated.

Question 3: What role should management play in your behavior-based safety process?

There were 50 total responses obtained (23 positive, 15 negative, 12 neutral) for this question. Content analyses of focus group responses revealed only three organizations (15%) with more negative than positive comments regarding management involvement in the BBS process.

With regard to direct management involvement in the interpersonal observation and feedback process, reactions were mixed. Six employee groups from six organizations suggested the more management is involved the better (as evidenced by the quote "They should to be involved because a team means everyone."). Nine employee groups from 8 organizations felt direct management involvement was a bad idea, as reflected in a common statement "Less management involvement is better, support is good if direct involvement is minimal." These groups pointed to issues of trust as crucial in determining their perceptions. Management involvement should follow successful efforts to build interpersonal trust. It should be noted these organizations stressed the importance of management's role as supportive rather than directive.

Question 4: How do supervisors influence your behavior-based safety process?

This question was added after the first four site visits had already been completed. Therefore, focus groups from 16 of the 20 organizations had a chance to respond. From those 16 organizations, only 12 had a position analogous to a front-line supervisor. From these, the employees participating in the focus groups for 11 organizations stressed the importance of the front-line supervisors. At each site it was stated specifically if front-line supervisors do not support the process it will not be effective.

Question 5: What are your perceptions of the behavior-based safety steering committee?

A content analysis of the 87 responses (33 positive, 36 negative, 18 neutral) revealed focus group employees at the majority of organizations tended to have overall positive perception of the safety steering committee (16 comments, 15 focus groups, 12 organizations). While some of these comments were general commendations such as "I think there doing a good job (9 comments, 9 focus groups, 8 organizations)." Other remarks in this category revealed employees on the steering committees were viewed as well intentioned and serious about safety (7 comments, 7 focus groups, 7 organizations).

The most common negative responses centered on perceptions that employees on the steering committees tend to be "out of touch" and spend too much time in meetings (8 comments, 7 focus groups, 6 organizations). Another complaint with the safety steering committees was that they were composed of safety "spies" or safety "rats" (4 comments, 4 focus groups, 3 organizations). Finally, it was also commented that employee participation in steering committee meetings was responsible for morale and production problems (4 comments, 3 focus groups, 3 organizations).

Question 6: How would you improve your behavior-based safety process?

Of the 103 to this question most were categorized as environment-based (n = 72). The second greatest number of responses were classified as behavior-based (n = 23), and the fewest classified as person-based (n = 8).

The most common environment-based responses indicated that employees would improve the BBS process by using more and better incentives to motivate participation (11 comments, 11 focus groups, 10 organizations) and making sure everyone had adequate training (11 comments, 9 focus groups, 6 organizations). Additional remarks indicated a need to improve the quality of machinery being used (9 comments, 7 focus groups, 6 organizations). Also, the idea of simplifying the behavioral checklist was given several times (6 comments, 6 focus groups, 6 organizations).

The most common behavior-based suggestion was a need to increase levels of employee participation (8 comments, 8 focus groups, 7 organizations). Other recommendations included increasing the occurrence of positive feedback (2 comments, 2 focus groups, 2 organizations), and firing any at-risk workers (2 comments, 2 focus groups, 2 organizations). All eight responses categorized as person-based focused on ensuring proper employee attitudes. Beyond more effective training, however, employees did not specify how to improve attitudes.

Question 7: What are the biggest obstacles your behavior-based safety process has faced?

Of 133 responses recorded, the majority of BBS obstacles were environment-based (n=67). The next highest number of responses were classified as person-based factors (n=47), and the fewest number of responses were classified as behavior-based responses (n=19).

The most common environment-based barrier was lack of management support (22 comments, 20 focus groups, 18 organizations). For some, lack of support meant employees were not given the time to perform observations (8 comments, 8 focus groups, 7 organizations), or there was not enough money to give the process requisite resources (8 comments, 8 focus groups, 7 organizations), or even that management did not show they believed in the process (4 comments, 4 focus groups, 2 organizations). Additional remarks indicated that previous unsuccessful initiatives had made many employees cynical regarding the success of the behavior-based process (10 comments, 10 focus groups, 10 organizations). Also, there was a fairly consistent distaste for the extra paperwork involved (6 comments, 6 focus groups, 6 organizations), especially if the behavioral checklists were complex.

Among the person-based factors, the most frequently mentioned obstacle was a lack of trust (12 comments, 12 focus groups, 12 organizations). According to focus groups at more than 50 percent of the organizations, lack of trust between coworkers, and between line workers and supervisors was perceived as crucial for many of the set backs experienced relevant to the BBS process. Another frequent person-based obstacle was discomfort associated with having another individual observe one's work practices (8 comments, 8 focus groups, 8 organizations). A number of comments also indicated that getting employees to buy-in to the process was a challenge (5 comments, 5 focus groups, 5 organizations). It seems many employees had trouble seeing what was in it for them.

The smallest number of obstacles was classified as behavior-based responses. The most common behavior-based barrier was a lack of participation (5 comments, 4 focus groups, 4 organizations). Other responses in this category targeted poor communication (3 comments, 3 focus groups, 3 organizations), and a tendency to focus on negative as opposed to positive feedback (3 comments, 2 focus groups, 2 organizations).

Question 8: What are the key ingredients for success in a behavior-based safety process?

Categorization of 152 responses revealed a majority of BBS key ingredients were person-based factors (n=57), followed by environment-based factors (n=53), and then behavior-based factors (n=42). Individual responses were examined within each of these factors to determine which were most common.

For person-based factors the most frequent key ingredient was interpersonal trust (13 comments, 13 focus groups, 13 organizations). Other responses to this question indicated a BBS process would more likely succeed if employees had a positive attitude (5 comments, 5 focus groups, 5 organizations), and if BBS procedures were approached with an open mind (4 comments, 4 focus groups, 4 organizations).

For behavior-based factors, getting employee participation was the number one response (11 comments, 11 focus groups, 11 organizations), followed by the notion that teamwork was needed for success (6 comments, 6 focus groups, 6 organizations), and then open communication (5 comments, 5 focus groups, 4 organizations).

The most commonly mentioned environment-based factor for success was support (18 comments, 18 focus groups, 18 organizations). Whether time, money, or just a supportive climate, employees indicated that without management support a behavior-based process will fail. Other responses which were repeated included a need for everyone to be properly trained (5 comments, 5 focus groups, 5 organizations), and that participation in the observation and feedback process had to be on a voluntary basis (4 comments, 4 focus groups, 4 organizations). Three of the latter comments came from organizations with a voluntary process, and one came from an organization with a mandatory process.

Perception Survey Results

701 perception surveys were returned that were acceptable for analysis. These surveys were returned from 15 of the 20 participating organizations. (The employees at four organizations failed to complete and return the surveys, and for one organization the returned surveys were completed incorrectly.)

Predicting involvement in a BBS process

A forward entry regression analysis was performed to determine variables most predictive of involvement in the safety process. Level of involvement for each employee was determined by summing the three involvement items constructed specifically for this study. Five variables: a) perceptions of the BBS training received, b) trust in management abilities, c) perceptions that safety is used in performance appraisals, d) whether or not the employee was educated in the BBS process, and e) tenure with the organization contributed significantly to predicting self-reported levels of involvement. These variables accounted for 41% of the variance in self-reported involvement in the BBS process.

Participation and satisfaction in a voluntary versus a mandatory BBS process

Employees in the mandatory processes reported significantly higher rates for giving and receiving positive behavior-based feedback as well as significantly lower rates for receiving negative behavior-based feedback. In addition, employees in mandatory BBS processes also demonstrated significantly greater levels of trust in management (both abilities and intentions), trust in coworkers (both abilities and intentions), and overall satisfaction with the BBS training received.

Discussion

The tremendous improvements in safety and performance of the companies who have implemented BBS processes has given this approach to safety management credibility and status (Geller, in press). Unfortunately, little objective research has been performed to elucidate the organizational factors that can facilitate successful implementation of a BBS approach. Instead, many organizations are left to muddle through the unending case-study literature provided by safety consultants. Although such literature may be enlightening and informative to some degree, it does not adequately inform readers of the underlying organizational processes that lead to successful BBS implementation. The current empirical investigation was a first step in understanding what factors are critical for successful implementation of a BBS process.

Based on the findings of this research we would like to offer a framework for understanding why some BBS processes succeed and others fail. Analogous to the way in which we analyzed the focus group discussions, we propose the BBS Success Triad illustrated in Figure 6.

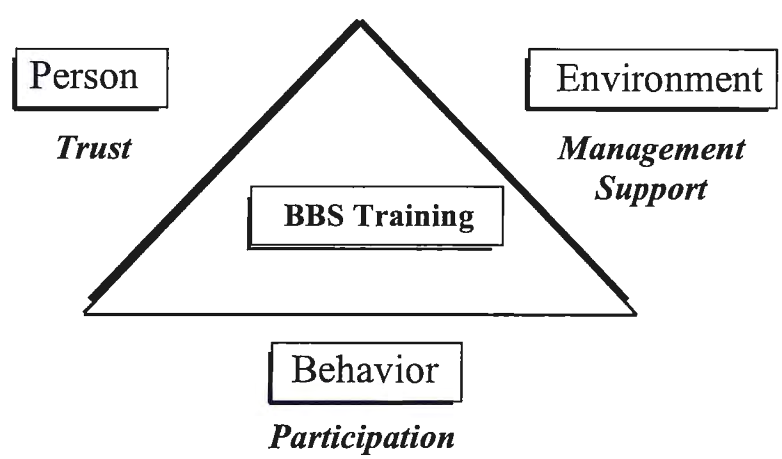


Figure 5: *Behavior-Based Safety Success Triad*

The three sides of this triangle are dynamic and interactive. When one changes the others are influenced.

The BBS Safety Success Triad is based not only on the results from 31 focus groups, but also from the analysis of 701 perception surveys (from 15 organizations). On the person side of the triangle is interpersonal trust; on the environment side of the triangle is management support; and on the behavior side of the triangle is employee participation/involvement. Training is in the middle of the triangle because of its critical role in facilitating all three sides of the triangle. During training all employees receive the principles, procedures, and tools of a BBS process, and management receives the rationale and the method for supporting BBS. Proper training convinces participants that the process works and the people can implement it. This is necessary for self-efficacy (Bandura, 1997), a person state deemed necessary for any positive change among individuals

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APPENDICES

APPENDIX A:

PROFESSIONAL SCHOLARSHIP DIRECTLY RELATED TO FUNDED RESEARCH

Professional Scholarship Directly Related to Funded Research

(January, 1996 - Present)

Publications in Refereed Journals (3)

Geller, E. S. (1997). Key processes for continuous safety improvement: Behavior-based recognition and celebration. *Professional Safety, 42*(10), 40-44.

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Clarke, S. W., Geller, E. S., Pettinger, Jr., C. B., DePasquale, J. P., & Glindemann, K. E. (September, 1996). *Critical success factors for behavior-based safety.* Poster presented at the 16th annual convention of the Florida Association for Behavior Analysis, Daytona Beach, FL.

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Videotapes and Training Materials (7)

DePasquale, J. P., Pettinger, C. B., Boyce, T. E., Williams, J. H., & Geller, E. S. (June, 1996). *Achieving a Total Safety Culture Through Employee Involvement.* Employee training manual developed for the National Institute for Occupational Safety & Health (for Grant # 1 R01 OH03374-01).

Pettinger, C. B., Boyce, T. E., DePasquale, J. P., Williams, J. H., & Geller, E. S. (June, 1996). *Achieving a Total Safety Culture Through Employee Involvement.* Facilitator two-day training manual developed for the National Institute for Occupational Safety & Health (for Grant # 1 R01 OH03374-01).

Geller, E. S. (1997). *Actively Caring for Safety: The Psychology of Injury Prevention.* Blacksburg, VA: Safety Performance Solutions [Twelve 30-min. audiotapes with workbook to teach principles and procedures for preventing unintentional injury at work, at home, and on the road.]

Geller, E. S. (1997). *Practical Behavior-Based Safety.* Neenah, WI: J. J. Keller & Associates, Inc. [A 25-min. instructional videotape introducing the behavior-based approach to occupational safety and health. The tape features excerpts from a series of my live presentations, and accompanies four instructional manuals.]

Geller, E. S. (1998). *Integrating Behavior-Based Safety for Safety Committees.* Neenah, WI: J.J. Keller & Associates [instructional video and 75-page workbook].

Geller, E. S. (1998). *Integrating Behavior-Based Safety for Regulatory Compliance.* Neenah, WI: J.J. Keller & Associates [instructional video and 75-page workbook].

Geller, E. S. (1998). *Integrating Behavior-Based Safety for Incident Analysis.* Neenah, WI: J.J. Keller & Associates [instructional video and 75-page workbook].

Presentations at Professional Research Conferences (33) – Chronological Order

Pettinger, C. P., DePasquale, J. P. (October, 1997). *Keeping people safe: A systematic examination of both training & feedback strategies to get the job done for safety.* Paper Presented at the 2nt Annual Behavior NOW Conference, Houston, TX.

DePasquale, J. D., Walker, J., Chevaillier, C. R., Michael, P. G., Francisco, D., & Guillaumot, J. J. (1997, March). *Increasing safe driving behaviors with a critical behavior checklist.* Poster presented at the 9th Annual Convention for the Society for Behaviorology, Plymouth, MA.

Pettinger, C. P., DePasquale, J. P., Boyce T. E., Williams, J. H., & Geller, E. S. (April, 1997). *Critical success factors for increasing safe work practices: A systematic evaluation of real-world application.* Paper Presented at the 12th Annual Convention for the Society for Industrial Organizational Psychologists, St. Louis, MO.

Williams, J. H., Pettinger, C. P., Clarke, S. W., & Chevaillier, C. R. (April, 1997). *Participative versus non-participative approaches to safety training: Comparative impact on satisfaction and information retention.* Paper Presented at the 12th Annual Convention for the Society for Industrial Organizational Psychologists, St. Louis, MO.

Pettinger Jr., C. B., Williams, J. H., Boyce, T. E., & Ford, D. K. (April, 1997). *DO IT for safety: A process of continuous improvement.* Paper presented at the 43rd Annual Convention for the Southeastern Psychological Association, Atlanta, GA.

Williams, J. H., Pettinger Jr., C. B., Boyce, T. E., & Fortney, J. N. (April, 1997). *Participative versus non-participative safety training: Information retention versus satisfaction.* Paper presented at the 43rd Annual Convention for the Southeastern Psychological Association, Atlanta, GA.

DePasquale, J. P., Glindemann, K. E., Fortney, J. N., Williams, J. H., & Gershenoff, A.B. (1997, April). *Relative application and perceived value of various approaches to improve occupational safety: A nationwide survey of safety professionals*. Paper Presented at the 12th Annual Convention for the Society for Industrial Organizational Psychologists, St. Louis, MO.

Ford, D. K., Martin, H., & Cecil, C. (1997, April). *The DO IT process: A bottom-up process for injury prevention.* Paper presented at the 1st Annual Meeting of The Virginia Collegiate Psychology Conference, Blacksburg, VA.

Geller, E. S. (1997, April). *Applying behavioral science to improve safety for individuals and organizations.* Symposium Discussant at the 43rd Annual Meeting of the Southeastern Psychological Association, Atlanta, GA.

Geller, E. S. (1997, April). *Large-scale intervention to improve health, safety, and the environment.* Symposium Chair at the 43rd Annual Meeting of the Southeastern Psychological Association, Atlanta, GA.

Pettinger, C. B., DePasquale, J. P., Williams, J. H., & Geller, E. S. (1997, April). *Critical success factors for increasing safe work practices: A systematic evaluation of real-world application.* Presentation at the Annual Meeting of the Society for Industrial Organizational Psychology, St. Louis, MO.

Pettinger Jr., C. B., Williams, J. H., Boyce, T. E., & Ford, D. K. (1997, April). *DO IT for safety: A process of continuous improvement.* Paper presented at the 43rd Annual Convention for the Southeastern Psychological Association, Atlanta, GA.

Williams, J. H., Pettinger, C. B., Chevaillier, C. R., & Geller, E. S. (1997, April). *Participative approaches to safety training: Comparative impact on satisfaction and information retention.* Symposium presentation at the Annual Meeting of the Society for Industrial Organizational Psychology, St. Louis, MO.

Alavosius, M., Geller, E. S., Hantula, D., Harshberger, D., Hopkins, B. L., O'Toole, M. F., Sulzer-Azaroff, B., & McSween, T. (1997, May). *Behavioral safety comes of age.* Panel Discussion at the 23rd Annual Convention of the Association for Behavior Analysis, Chicago, IL.

Chevaillier, C.R., Williams, J. H., Michael, P.G., Pettinger Jr., C. B., & Boyce, T.E. (May, 1997). *Involve them and they'll understand: A systematic test of this training slogan.* Paper presented at the 23rd Annual Convention for the Association for Behavior Analysis, Chicago, IL.

Geller, E. S. (1997, May). *From productivity to delivery: Intervening to improve occupational safety.* Symposium Chair at the 23rd Annual Convention of the Association for Behavior Analysis, Chicago, IL.

Ludwig, T. D., & Dodd, J. R. (1998, April). *Applied behavior analysis and industrial/organizational psychology: Intervening for occupational safety and health.* Invited address for the North Carolina Applied Behavior Analysis Conference, Raleigh, NC.

Wiegand, D. M., Williams, J. H., & Olson, T. M. (April, 1998). *Assessing the effectiveness of different feedback strategies in industrial settings.* Paper to be presented at the Annual Meeting of the Virginia Psychological Association, Charlottesville, VA.

Rowe, M. P., Boyce, T. E., Powell, B. M., & Shaddix, V. K. (April, 1998). *A systematic evaluation of intervention strategies to increase safety-belt use: Implications for large scale industrial safety.* Poster to be presented at the Annual Meeting of the Virginia Psychological Association, Charlottesville, VA.

Rowe, M. P., Williams, J. H., Grossman, B. M., & Montgomery, J. H. (May, 1998). *Is too much enough?: Specific versus global feedback for safety performance.* Poster to be presented at the Annual Meeting of the American Psychological Society, Washington, D.C.

Pettinger, C. B., Jr., Michael, P. G., & Buscemi, N. V. (May, 1998). *Critical success factors for behavior-based safety: Does employee involvement make a difference?* Paper presented at the 24th Annual Convention of the Association for Behavior Analysis, Orlando, FL.

DePasquale, J. P., Williams, J. H., Pettinger, C. B., Jr., Ford, D. K., & Glindemann, K. E. (May, 1998). *In search of safety excellence: A comparative analysis of current behavior-based safety efforts.* Paper presented at the 24th Annual Convention of the Association for Behavior Analysis, Orlando, FL.

Pettinger, Jr., C. B., Williams, J. H., Ford, D. K., Geller, E. S. (March, 1999). *A comparison of techniques for reducing injuries in industrial settings.* Paper to be presented at the annual convention of the Southeastern Psychological Association, Savannah, GA.

Ringler, J., Jackson, A., Torregrossa, W., Ford, D. K. & Williams, J. H. (March, 1999). *Optimizing feedback to improve safety performance.* Paper to be presented at the annual convention of the Southeastern Psychological Association, Savannah, GA.

DePasquale, J. P. & Geller, E. S. (March, 1999). *Organizational culture and behavior-based safety: Making safety work.* Paper to be presented at the Work, Stress, Health, '99: Organization of Work in a Global Economy conference sponsored by NIOSH & APA, Baltimore, MD.

Williams, J. H., Clarke, S. W., & Geller, E. S. (March, 1999). *Feedback specificity and safety performance.* Paper to be presented at the Work, Stress, Health, '99: Organization of Work in a Global Economy conference sponsored by NIOSH & APA, Baltimore, MD.

Pettinger, C. B., Jr., DePasquale, J. P., Boyce, T. E., & Williams, J. H., (March, 1999). *Effects of employee involvement on behavior-based safety.* Paper to be presented at the Work, Stress, Health, '99: Organization of Work in a Global Economy conference sponsored by NIOSH & APA, Baltimore, MD.

Clarke, S. W., & Geller, E. S. (March, 1999). *Safety self-management: A case study of self-observation, self-recording & group feedback.* Paper to be presented at the Work, Stress, Health, '99: Organization of Work in a Global Economy conference sponsored by NIOSH & APA, Baltimore, MD.

Boyce, T. E., & Geller, E. S. (March, 1999). *Exploring relationships between personality and driving with intelligent transportation systems.* Paper to be presented at the Work, Stress, Health, '99: Organization of Work in a Global Economy conference sponsored by NIOSH & APA, Baltimore, MD.

Williams, J. H., Pettinger, C. B., Chevaillier, C. R., & Geller, E. S. (1999, March). *Behavior-based feedback and industrial safety: An investigation of variables to improve direct and indirect impact.* Symposium presentation at the Annual Meeting of the Society for Industrial Organizational Psychology, Atlanta, GA.

DePasquale, J. P., Pettinger, C. B., Jr., Boyce, T. E., & Williams, J. H. (May, 1999). *Critical success factors for behavior-based safety: A final report.* Paper to be presented at the 25th Annual Convention of the Association for Behavior Analysis, Chicago, IL.

Geller, E. S. (May, 1999). *Intervening for large-scale behavior change: Building a unified model for improving occupational safety and health interventions.* Paper to be presented at the 25th Annual Convention of the Association for Behavior Analysis, Chicago, IL.

Williams, J. H., Ford, D. K., Torregrossa, W., Ringler, J., Jackson, A., & Littleton, L. (May, 1999). *Safety performance and behavioral feedback.* Paper to be presented at the 25th Annual Convention of the Association for Behavior Analysis, Chicago, IL.

Presentations at Professional Safety Conferences in 1997 (18) – Chronological Order

Geller, E. S. (1997, January). *Cultivating a Total Safety Culture through employee empowerment*. Keynote presentation for Exxon Safety Conference, Los Angeles, CA.

Geller, E. S. (1997, March). *Empowering people to actively care for safety and health.* Invited keynote presentation for the Texas Safety Association 58th Annual Southwest Conference & Exposition, Houston, TX.

Geller, E. S. (1997, April). *The psychology of safety: Part 1 & 2.* Two keynote addresses at the 13th Annual Governor's Safety and Health Conference and Exposition, Louisville, KY.

Geller, E. S. & Petersen, D. (1997, April). *Searching for improved metrics for occupational safety and health*. Special report to the National Advisory Committee for NIOSH (National Institute for Occupational Safety and Health) and OSHA (Occupational Safety and Health Administration), U.S. Department of Labor, Washington, DC.

Geller, E. S. (1997, April). *The psychology of cultivating interdependency for occupational health and safety*. Two keynote addresses for the Kentucky Governor's Safety and Health Conference, Louisville, KY.

Geller, E. S. (1997, May). *Developing interpersonal control of industrial safety*. Keynote address for the First Annual Behavior-Based User's Conference sponsored by Safety Performance Solution, Florida Power & Light, Coco Beach, FL.

Geller, E. S. (1997, May). *Introduction to behavior-based health and safety: What's all the fuss about?* Roundtable Forum at the American Industrial Hygiene Conference and Exposition, Dallas, TX.

Geller, E. S. (1997, June). *The social dynamics of safety*. Keynote address at the 36th Annual Professional Development Conference and Exposition for the American Society of Safety Engineers, New Orleans, LA.

Geller, E. S. (1997, August). *Ten axioms to follow for continuous safety improvement.* Two three-hour presentations to participants invited by J. J. Keller & Associates, Inc., Madison, WI.

Daniels, A., Geller, E. S., Krause, T., & McSween, T. E. (1997, October). *What is behavior-based safety, anyway?* Panel discussion at Behavioral Safety Now: A National Conference sponsored by the Cambridge Center for Behavioral Studies, Houston, TX.

Geller, E. S. (1997, October). *How to increase actively caring for behavior-based safety.* Four-hour workshop at Behavioral Safety Now: A National Conference sponsored by the Cambridge Center for Behavioral Studies, Houston, TX.

Clarke, S. W. (1997, November). *Applications of behavior-based safety for the pharmaceutical industry.* Two-hour presentation at the Great Lakes Regional Conference of the International Society of Pharmaceutical Manufacturers, Cleveland, OH.

Geller, E. S. (1997, October). *Sustaining a caring safety culture.* Keynote luncheon speech at the Champions of Safety 1997 Conference sponsored by Occupational Hazards magazine, Pittsburgh, PA.

Geller, E. S. (1997, October). *Actively caring for safety: A call to action.* Keynote address for Behavioral Safety Now: A National Conference sponsored by the Cambridge Center for Behavioral Studies, Houston, TX.

Geller, E. S. (1997, October). *Taking interpersonal control of safety.* Keynote presentation at the 85th Annual Congress of the National Safety Council, Chicago, IL.

Geller, E. S. (1997, October). *Involving people in achieving a Total Safety Culture.* Keynote presentation at the 85th Annual Congress of the National Safety Council, Chicago, IL.

Geller, E. S. (1997, September). *Actively caring for a Total Safety Culture.* Day-long seminar for Travelers Property Casualty, Houston, TX.

Geller, E. S. (1997, September). *Actively caring for a Total Safety Culture.* Day-long seminar for Travelers Property Casualty, Seattle, WA.

Workshops/Seminars at Professional Safety Conferences in 1997-98 (7) – Chronological Order

Geller, E. S. (1997, May). *The psychology of safety and health.* One day PDC workshop at the American Industrial Hygiene Conference and Exposition, Dallas, TX.

Geller, E. S. (1997, June). *The psychology of occupational safety: How to improve workplace behaviors and attitudes.* Two-day workshop for the American Society of Safety Engineers, Dallas, TX.

Geller, E. S. (1997, July). *Actively caring for a Total Safety Culture.* Day-long seminar for Travelers Property Casualty, Cincinnati, OH

Geller, E. S. (1997, July). *Actively caring for a Total Safety Culture.* Day-long seminar for Travelers Property Casualty, Philadelphia, PA.

Geller, E. S. (1997, September). *Actively caring for a Total Safety Culture*. Day-long seminar for Travelers Property Casualty, Houston, TX.

Geller, E. S. (1997, September). *Actively caring for a Total Safety Culture*. Day-long seminar for Travelers Property Casualty, Seattle, WA.

Geller, E. S., & DePasquale, J. P. (1998, October). *Identifying factors that facilitate behavioral safety: An up-date of NIOSH supported research*. Workshop presentation at the Third Annual Behavioral Safety NOW conference, Dallas, TX.

Workshops/Seminars in Industry in 1997 (10)

Geller, E. S. (1997, March). *Cultivating interdependency for safety and health promotion*. Two-hour workshop for Hewlett-Packard managers and supervisors, Santa Rosa, CA.

Geller, E. S. (1997, June). *How to actively care for industrial safety*. Two four-hour seminar presentations for employees at Bell Helicopter Textron, Inc., Dallas, TX.

Geller, E. S. (1997, June). *Principles and methods of behavior-based safety*. One-day workshop for Bridgestone Firestone, Nashville, TN.

Geller, E. S. (1997, June). *Principles and procedures for involving people in safety improvement.* Day-long seminar for Travelers Property Casualty, Charlotte, NC.

Geller, E. S. (1997, August). *Behavior-based coaching for injury prevention.* Four-hour seminar for safety team leaders of Monsanto Chemical Company, St. Louis, MO.

Geller, E. S. (1997, September). *Principles and methods of behavior-based safety*. Four-hour seminar for ARCO Marine, Long Beach, CA.

Geller, E. S. (1997, September). *Making a difference with behavior-based safety. Day*-long seminar for employees at Boeing, Seattle, WA.

Williams J. H. (1997, November). *Developing a behavior-based safety program*. One-day workshop at Coca-Cola Consolidated of Roanoke, Roanoke, VA.

Pettinger, C. B. (1997, December). *Using self-management to reduce workplace injuries among solitary workers*. Two-hour workshop for Wisconsin Electric, Milwaukee, WI.

Williams J. H., & Clarke, S. W. (1997, December). *Developing a behavior-based safety program*. One-day workshop at Coca Cola Consolidated of Roanoke, Roanoke, VA.

APPENDIX B:

LETTER OF EXPLANATION FROM UNIVERSITY OF SOUTH FLORIDA

Office of the Dean
Undergraduate Studies
University of South Florida
4202 East Fowler Avenue
Tampa, Florida 33620-6920
(813) 974-4051

October 5, 1998

To Whom It May Concern:

In May of this year, Safety Performance Solutions sent a set of surveys for our department to scan. We scanned the surveys and returned the data set on a diskette to Mr. Jason Depasquale in early June. As a normal process for our department, we held the forms for 30 days and then disposed of them.

In mid July, we were informed of an error in the data and were requested to re-scan the forms. Unfortunately, we had already recycled them.

We sincerely regret any problems we have caused and in an effort to avoid future occurrences, have initiated a requirement that customers be notified prior to the disposal of their forms.

If you have any further questions, please feel free to contact me at 813-974-5299.

Sincerely,

Larry B. Smith

Larry Smith
Assistant Director

APPENDIX C:

BEHAVIOR-BASED SAFETY AND EMPLOYEE INVOLVEMENT: DIFFERENTIAL EFFECTS DURING TRAINING VERSUS IMPLEMENTATION

Complete report as submitted for publication in
Journal of Safety Research

Running head: INVOLVEMENT IN BEHAVIOR-BASED SAFETY

Behavior-Based Safety and Employee Involvement: Differential Effects during Training versus Implementation

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Center for Applied Behavior Systems

Virginia Polytechnic Institute and State University

Abstract

A behavior-based safety (BBS) process was introduced at a southeastern manufacturing facility. Employee involvement (i.e., choice vs. assigned) was manipulated during BBS education/training and during implementation of a BBS process. During BBS education/training sessions, employees in the Choice condition (first shift, n=230) were asked for suggestions concerning their company's safety process, with employees in the Assigned condition (second & third shifts, n=246) having no input. The involvement manipulation continued by having the first shift safety facilitators (n=8) design and make all choices concerning the BBS process, while second shift facilitators (n=6) were Assigned the specifics of the safety process. During the BB education/training sessions, there were no group differences regarding information retention, satisfaction, or perceived involvement. However, over a nine-week period, safety facilitators in the Choice condition participated significantly more in a BBS observation/feedback intervention than those in the Assigned condition. Throughout a one-year period of BBS interventions, the company's lost-time injuries decreased from 10.9 to 1.5 per month with an estimated $200,000 savings in workman's compensation costs. Implications for designing BBS interventions, increasing employee participation, and ultimately, institutionalizing a BBS process are discussed.

The leading cause of death for people under the age of 38 is not heart disease nor cancer, but something as common as injuries. Injuries kill more than 93,000 Americans and require an estimated $478 billion dollars in total costs each year. Due to the frequency and severity of injuries, the U.S. Department of Health and Human Services has identified injury prevention as a priority for attaining the goals outlined in Healthy People 2000: National Health Promotion and Disease Prevention Objectives (1990). Every day, an estimated 10,000 to 36,000 U.S. employees are injured and 14 are killed. Moreover, an estimated 5,000 to 11,000 workers die and 2.5 to 11.3 million employees suffer non-fatal injuries. More specifically, employees in manufacturing facilities who sustain non-fatal injuries have an average of 101 lost workdays per 100 employees each year (Leigh, 1995; Miller, 1997; Nation Institute for Occupational Safety and Health, 1998; National Safety Council, 1998; U. S. Bureau of Labor Statistics, 1997). Thus, unintentional injury represents a serious public health concern, and theory-driven injury prevention research is needed to improve the effectiveness of current safety and health interventions.

From the early 1900s to the present time, employers and safety practitioners have adopted a safety philosophy represented by three words beginning with the letter "E" – engineering, education, and enforcement (Geller, 1996; Guastello 1993; Heinrich, Petersen, & Roos, 1980; Petersen, 1996; Wilde, 1998). To make a difference in the health and safety of employees, the three Es of safety focus on: 1) developing engineering strategies to make tools and equipment safer to use; 2) educating and training employees regarding engineering safe guards, environmental hazards, policies and procedures; and 3) enforcing the safety-related policies and procedures related to operating equipment, wearing proper personal protective equipment, and handling specific hazardous substances.

Although the three E's have had a dramatic impact on the safety of employees, recent research has suggested that the most effective workplace safety interventions involve the workers in the design and implementation of a organization's safety process, as opposed to the more traditional "top-down" safety programs (Daniels, 1989; Geller, 1996, 1998c, d; McSween, 1995; Petersen, 1996). Safety processes grounded in the principles of behavioral science facilitate "bottom-up" employee involvement and perceptions of personal control.

Applied Behavior Analysis

Applied behavior analysis has made substantial contributions to the domain of health promotion and injury control by researching the determinants of at-risk behaviors, directing the development of effective behavior change interventions, and applying these interventions in a variety of domains like behavioral medicine (Cataldo, & Coates, 1986), safety performance (Geller, 1996; Petersen, 1996), health psychology (Elder, Geller, Hovell, & Mayer, 1994; Winett, King, & Altman, 1989), traffic safety (Geller, 1998a), environmental protection (Geller, Winett, & Everett, 1982), and child safety (Roberts, Fanurik, & Layfield, 1987).

Behavior-based approaches to injury control have a number of advantages over other approaches, including: a) they can be administered without extensive professional training; b) they can reach people in the setting where a problem occurs (e.g., community, school, workplace); and c) leaders in various settings can be taught the behavioral techniques most likely to work under relevant circumstances (Baer, Wolf, & Risley, 1968; Daniels, 1989; Geller, 1996, 1998b, d). Research has also shown this approach to be cost effective, primarily because BBS techniques are straightforward and relatively easy to administer, and because intervention progress can be readily assessed by indigenous personnel (e.g., Daniels, 1989; Geller, 1996; Geller et al., 1982; Sulzer-Azaroff & De Santamaria, 1980).

The application of applied behavior analysis principles for occupational safety and health is commonly referred to as behavior-based safety (BBS). Over the past 20 years, BBS has been used successfully in the prevention of occupational injuries (e.g., Alavosius & Sulzer-Azaroff, 1986; Geller, & Hahn, 1984; Komaki, Barwick, & Scott, 1978; Krause, Hidley, & Hodson, 1996; Reber, & Wallin, 1983, 1984; Smith, Anger, & Ulsan, 1978). In fact, Guastello (1993) found by systematically reviewing 53 occupational safety and health studies since 1977, that BBS had the highest average reduction of injury rate (59.6%). Most of these studies, however, were simply demonstrations of techniques that had already been researched in other settings. Researchers in BBS have not systematically evaluated different implementation procedures and therefore can provide limited guidance for improving a BBS protocol.

Research in the area of BBS needs to ask and answer questions regarding the design of more effective and longer-term intervention processes (National Institute for Occupational Safety & Health, 1998). This was the prime purpose of the research reported here. Specifically, we studied the extent that employee involvement increases the impact of BBS training and implementation. We predicted a participative approach to education and training would be more effective than a standard lecture format, and that involving employees in the design and implementation of a BBS process would lead to greater impact than following the traditional strategy of top-down safety assignments.

Method

Subjects and Setting

Subjects were 476 hourly and salary employees at an engine-bearing manufacturing plant in southwest Virginia. The population of employees ranged in age from 19 to 63 years (M = 42), and employee tenure at the facility ranged from six months to more than 25 years (M = 16). The proportion of hourly to salary workers was approximately five to one, and the workforce and hours worked were stable throughout the course of the study.

Procedure

The BBS process began by training volunteer safety facilitators from representative work areas on first shift (n=8) and second shift (n=6) in the basic principles and procedures of this approach. Topics included: a) defining target behaviors, b) developing checklists to record occurrences of target behaviors, c) designing interventions to improve safety-related behaviors, d) charting progress in a time-series format, and e) giving effective behavioral feedback. Following two intensive eight-hour education/training sessions for the safety facilitators, the remaining employees across three shifts received a four-hour version of BBS education/training.

Education/Training Manipulation

The format and style of the education/training sessions were manipulated to investigate the impact of employee participation during BBS training. The materials for all sessions, however, were held constant. Four research associates, experienced at conducting safety seminars, presented the sessions in randomized pairs. The material covered in plantwide training paralleled that provided the safety facilitators, but in abbreviated form.

Choice condition. Throughout the course of the two eight-hour safety facilitator and four-hour plantwide education/training sessions, the safety trainers in the Choice condition asked questions of participants, requested relevant stories, and facilitated discussions and interpersonal involvement though group exercises (n=230 on Shift 1). All sessions occurred during the regular shift of the scheduled employees, and concluded with a written test of key safety concepts, principles, and procedures.

Assigned condition. The Assigned education/training sessions were identical to the Choice sessions except the trainers in the Assigned condition presented the safety material in a lecture format without asking questions or facilitating input from participants (n=246 on Shifts 2 and 3). The four-hour education/training sessions were conducted for 12 Choice groups and 14 Assigned groups, ranging in size from 7 to 30 participants (M=19).

Evaluation procedures. To assess the impact of the two training approaches, three variables were measured: the amount of verbal participation, participants' reported satisfaction with the training, and the participants' retention of key information presented. To assess verbal participation, trained research assistants attended all sessions across both conditions and independently recorded the frequency of all verbal behaviors from the employees that were directed to the trainers. The verbal behaviors included questions asked, questions answered, and reactive statements. These observations were recorded unobtrusively on a data collection sheet attached to a notebook, giving the impression the observers were taking notes. Questions or comments irrelevant to the training material or directed to individuals other than the trainer presenting information were not recorded. Interobserver agreement was assessed on a session-by-session basis by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. Across all education/training sessions, the research assistants agreed on over 90% of their observations. Following the education/training sessions, employees received a questionnaire assessing their satisfaction, perceptions of participation, and knowledge retention. The names of the participants did not appear on any test document or session evaluation.

BBS Implementation

Many involvement manipulations were made to give Shift 1 facilitators (n=8) opportunities to make key decisions in the implementation of their BBS process. Specifically, during separate Shift 1 safety meetings, Shift 1 safety facilitators selected: a) the initial safety-related behavior (hearing protection) to be observed plantwide, b) the design of the checklist used to make observations of the target behavior, c) schedules for behavioral observations by facilitators, d) the target number of behavioral observations per week, e) the design and location of group feedback charts displaying on-going measures of plantwide hearing protection use, f) the protocol for a safety slogan contest, and g) the design and color of special safety shirts distributed plantwide. The choices made by Shift 1 safety facilitators were yoked to Shift 2 safety facilitators (n=6), in that both shifts implemented the same process customized by Shift 1. Table 1 outlines the involvement manipulations during the education/training sessions, and during the implementation of the BBS process.

Insert Table 1 about here

For nine weeks, safety facilitators (n=14) made a total of 5466 behavioral observations of the hearing protection use of employees on Shifts 1 (n=230) and 2 (n=210). On each shift, one safety facilitator was responsible for collecting completed observation cards. These data were collected two times a month at facilitator meetings that were also attended by the first and/or second author. Following a three-week baseline period, hearing protection data were graphed and posted on a safety bulletin board located at the main entrance to the manufacturing areas. Facilitator involvement was assessed by the number of observations conducted per shift.

To assess the reliability of the safety facilitator observations, trained research assistants also made behavioral observations on employee hearing protection use. Research assistants made these observations throughout the manufacturing facility at randomized times across first and second shifts over a four-week period. Interobserver agreement was recorded for 30% of the observations made by the research assistants. During these reliability sessions, two research assistants observed the same employees and recorded their hearing protection use independently. Following the observation sessions, the research assistants compared their observations and noted interobserver agreement. Over the four-week period, research assistants agreed on over 90% of these observations.

Results

Participation in Training

Analysis of variance (ANOVA) was used to evaluate differences in the mean number of verbal responses per shift, with Shift 1 in the Choice condition and Shifts 2 and 3 receiving the Assigned condition. A one-way ANOVA on verbal behaviors for training format (Choice vs. Assigned) indicated that participants in the Choice condition exhibited significantly more verbal behaviors than participants in the Assigned condition, F (2, 395) = 38.9, $p < .001$. Shift means and standard deviations are presented in Table 2.

Insert Table 2 about here

Analyses were also conducted on each type of verbal response: questions answered, reactive comments, and questions asked. As shown in Table 2, a one-way ANOVA of questions answered per Shift (Shift 1 vs. Shift 2 vs. Shift 3) indicated that participants in the Choice condition answered significantly more questions than participants in the Assigned condition, F (2, 395)= 40.6, $p < .001$. The analysis of reactive comments indicated that participants in the Choice condition made significantly more comments than participants in the Assigned condition, F (2, 395) = 19.1, $p < .001$. The ANOVA for questions asked indicated no significant difference across shifts, $p > .05$.

The post-session questionnaires included: a) an 18-item knowledge test, b) a 5-item measure of perceived involvement, and c) a one-item measure of satisfaction with the training. As shown in Table 2, one-way ANOVAs by Shift (Shift 1 vs. Shift 2 vs.

Shift 3) indicated no significant differences between the knowledge scores of participants in the Choice vs. Assigned condition, nor the participants' perceptions of involvement, $p > .05$. The ANOVA of participants' self-reported satisfaction with the training process revealed that participants in the Choice condition (i.e., Shift 1) were more satisfied with the training process than Shift 3 participants in the Assigned condition, $F(2, 438) = 5.04$, $p < .05$. However, the satisfaction ratings of Shift 2 participants in the Assigned condition were not significantly different from the Shift 1 participants in the Choice condition, $p > .05$.

Behavioral Observations

Over a nine-week observation and feedback period, Shift 1 facilitators (n = 8) made significantly more observations per week than Shift 2 facilitators (n = 6), $t(16) = 3.05$, $p < .05$. An observation was defined as the single occurrence of recording hearing protection as safe versus at-risk on a critical behavior checklist. Additionally, Shift 1 facilitators conducted significantly more observations per person each week than the Shift 2 facilitators, $t(16) = 3.05$, $p < .05$. Table 3 contains the means and standard deviations associated with these analyses.

Insert Table 3 about here

Plantwide Hearing Protection

Following a three-week baseline period, hearing protection use observed by safety facilitators was graphed separately and posted for Shifts 1 and 2 (intervention phase). During the baseline period, there were no differences between Shift 1 safe hearing protection use (82%, n=618) verses Shift 2 (84%, n=758). Following the posting of employee hearing protection use, a significant improvement was only observed on Shift 1 [χ^2 (2, n=5466) = 6.00, $p < .05$]. When employee observations of the average hearing protection use by week was compared with the averages observed by the research assistants, no significant differences were found between groups ($p > .05$).

Lost Workdays

Figure 1 depicts a cumulative record of this organization's lost workdays for 18 months prior to and 18 months following the BBS process. The figure shows a marked decrease in lost days due to injuries following the introduction of BBS education/training, observation/feedback for hearing protection, and several additional intervention processes. A mean of 10.9 lost days per month occurred prior to BB safety; whereas after the intervention, a mean of 1.5 days per month were lost due to injury.

Insert Figure 1 about here

Discussion

Our manipulation of involvement during the education/training sessions was apparently successful, since the Choice groups answered significantly more questions, asked significantly more questions, and made significantly more comments. However, our evaluation of training impact did not support the hypothesis that participative training would be more effective and appreciated than nonparticipative training. The lack of significant group differences for information retention, satisfaction, and perceived involvement suggest that: a) involvement differences may not be reflected entirely by verbal behavior, b) the nature of the training material itself may have involved the workers cognitively if not verbally, or c) a participation format might not be more effective than a lecture approach, at least with regard to information retention and personal satisfaction.

The current research does suggest, however, it is advantageous to facilitate employee ownership and involvement when implementing a BBS process. This was evident by the differential amount of behavioral observations performed by safety facilitators in the Choice versus Assigned condition. Although facilitators in the Choice condition did not report feeling more involved, nor did they demonstrate greater knowledge of the BBS information presented, they did conduct significantly more interpersonal observations. Thus, the benefit of the involvement manipulation was manifested during the operation of a BBS observation and feedback process.

Our comprehensive review of the research literature revealed convincing evidence that a behavioral approach to occupational safety can be extremely effective at reducing at-risk behavior and workplace injuries. A key ingredient of most effective BBS interventions has been a behavioral observation and feedback process (cf. Geller, 1996, 1998d). In other words, participants need a mechanism for learning what to do differently in order to prevent the possibility of personal injury. Little is known, however, about the best way to design and deliver a BBS observation and feedback process, nor has there been any systematic study of the role of training participation on the subsequent application of BBS.

This study manipulated level of employee involvement during BBS education/training and identified at least one factor that may increase the impact of a BBS process. Specifically, when employees are given the opportunity to make key choices in the development and implementation of the safety process, they will contribute more to the process. This is as predicted by the social psychological principle of consistency (Cialdini, 1993). In other words, research in social psychology has shown that people have a desire to maintain a consistency between their cognitions and behaviors (cf. Festinger, 1957). Consistency is a valued commodity in our society (Cialdini, 1993), and people have been previously reinforced for maintaining a consistency between what they say and what they do (Rogers-Warren & Baer, 1976).

It is intuitive that when workers are responsible for selecting a safety behavior to target, deciding how to observe and record that behavior, and planning how to intervene and chart progress, they are likely to engage in the behaviors they have selected and are asking others to perform. Additionally, according to self-efficacy theory, people given choice in an improvement process will select solutions they perceive to be within their realm of capabilities (Bandura, 1997). Thus, self-efficacy and consistency theories likely contributed to the greater number of behavioral observation made by safety facilitators in the Choice than Assigned condition.

Ludwig and Geller (1997) also found special benefits of a Choice over an Assigned intervention in a pizza delivery setting. More specifically, pizza deliverers who participated in a goal-setting intervention to increase their complete intersection stops also increased their use of safety belts and turn signals (nontargeted behaviors) during the intervention phase. Conversely, employees assigned the same goal for intersection stops, increased that target behavior, but actually decreased their use of safety belts and turn signals during the assigned goal intervention phase for intersection stops. Consistent with the findings of Ludwig and Geller (1997), it can be speculated that the intervention targeting hearing protection in the current research generalized to other safety-related behaviors and thus contributed to the marked reduction in workplace injuries.

The reduction in lost-time injuries plantwide strongly suggests the BBS process did much more than increase the use of hearing-protection. The plantwide safety training and the regular meetings to discuss the hearing protection data probably increased awareness of general safety concerns throughout the facility. The BBS interventions certainly gave the employees the impression that management has increased the priority level of safety. Perceptions of management support, combined with success at performing behavioral observations, may have increased employees' general efficacy regarding their safety performance.

Thus, consistent with Bandura (1997), as the workers experienced success making observations on a single target behavior, they stretched the boundaries of their behavioral routines and incorporated the BBS principles in other safety-related circumstances. For example, after the all-employee safety education/training and the increased focus on using hearing protection, all employees were urged to participate in a plantwide safety slogan contest with the winning slogan ("Bearings in Mind: Safety First!") being awarded a $50 gift certificate in a public celebration. Safety facilitators printed the slogan on a 3-foot by 8-foot banner and displayed it at the entrance to the manufacturing areas.

Throughout the 18 months following BBS training, employees on both Shifts 1 and 2 performed distinct interventions in their work areas that targeted various behaviors they considered critical for improving their safety. With each intervention, the work area met to define the target behavior, develop observation checklists and procedures, and decide how to intervene and test the intervention for impact. During education/training this BBS continuous improvement process was referred to as DO IT for define, observe, intervene, and test (Geller, 1996).

A series of plantwide interventions were also carried out to increase safety-belt use. These interventions included written prompts, assigned goals, safety-belt use feedback, promise-card commitments, and incentives to buckle-up. Regardless of intervention strategy, all safety-belt promotions were built around the theme of "Safety is Not Only for the Workplace," a slogan suggested by employees during the BBS education/training. The safety-belt intervention materials were highly visible, and may have served as additional reminders of the organization's increased commitment to safety.

It is suggested that many occupational injuries go unreported (Leigh, 1995; Miller, 1997; Weddle, 1996; Wilson, 1985). Therefore, using a safety metric that is difficult to hide or cover up, such as lost-time injuries, probably provides a more accurate picture of the impact of a safety improvement process than a record of minor or OSHA recordables. As such, following the introduction of BBS there was a dramatic decrease in lost workdays due to injury (from 197 to 26). This prominent reduction in lost workdays was reported by the organization to save approximately $200,000 in workman's compensation (Nunes, 1998). This speaks to the impact on the plant's bottom line of the BBS education/training, subsequent observation and feedback strategies, and various employee-driven BBS interventions.

The most successful safety processes motivate "employees themselves to apply the techniques throughout their workplace" (Geller, 1996, p. 31), and thus effective procedures and support systems may vary dramatically across cultures. This study provides some support for providing employees choice during the design and administration of a BBS process. Our results also support the efficacy of the BBS approach to reducing workplace injuries, and demonstrate the potential benefits for incorporating involvement strategies in the customization of BBS processes for particular organizational cultures and work areas. It is hoped that our research will spark interest in understanding the mechanisms by which a successful technology may be made more effective and practical for long-term application.

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Table 1

Involvement manipulations across BBS education/training sessions and process implementation

CHOICE CONDITION	ASSIGNED CONDITION
(Shift 1, n=230) Education/Training	(Shifts 2&3, n=246)
Trainers in the Choice condition: 1) asked employees questions, 2) asked employees opinions, 3) encouraged discussion, 4) conducted group exercises, and 5) asked for safety process suggestions.	Trainers in the Assigned condition: 1) did not ask questions and only lectured, 2) did not solicit employee opinions, 3) lectured without discussion, 4) gave examples of exercises completed by Shift 1 employees, and 5) did not prompt employees for safety process suggestions.
(Shift 1, n=8) Implementation	(Shift 2, n=6)
Facilitators in the Choice condition: 1) chose initial target behavior, 2) designed checklist, 3) decided observation schedule, 4) chose target number of observations, 5) chose design and location of data charts, 6) designed safety slogan contest, and 7) designed safety shirts.	Facilitators in the Assigned condition: 1) were told target behavior to observe, 2) were given checklists for observations, 3) were told how often to observe, 4) were told how many observations were required per week, 5) were given blank data charts and told where to post them, 6) had no input in contest, and 7) had no input on shirts.

Table 2

Mean and standard deviation of measures taken to evaluate impact of the Choice vs. Assigned condition during education/training

Dependent Measure	Shift 1 (n=168) (Choice)	Shift 2 (n=119) (Assigned)	Shift 3 (n=111) (Assigned)
Number of Answers (per participant)	M = 4.02 * SD = 6.06	M = 0.34 SD = 0.85	M = 0.38 SD = 0.93
Number of Comments (per participant)	M = 2.34 * SD = 3.54	M = 0.67 SD = 1.39	M = 0.73 SD = 1.54
Number of Questions (per participant)	M = 0.14 SD = 0.50	M = 0.08 SD = 0.30	M = 0.08 SD = 0.36
Total Verbal Behaviors (per session)	M = 6.50 * SD = 8.80	M = 1.09 SD = 1.97	M = 1.19 SD = 2.44
Percent Correct on Test	M = 66.7% SD = 20.47	M = 68.9% SD = 18.20	M = 66.5% SD = 17.90
Perceptions of Involvement (5-point Likert scale)	M = 2.56 SD = 1.08	M = 2.42 SD = 0.89	M = 2.30 SD = 0.91
Satisfaction of Training (5-point Likert scale)	M = 3.44 * SD = 1.20	M = 3.20 SD = 1.37	M = 2.95 SD = 1.45

M = mean, SD = standard deviation, * $p < .05$

Table 3

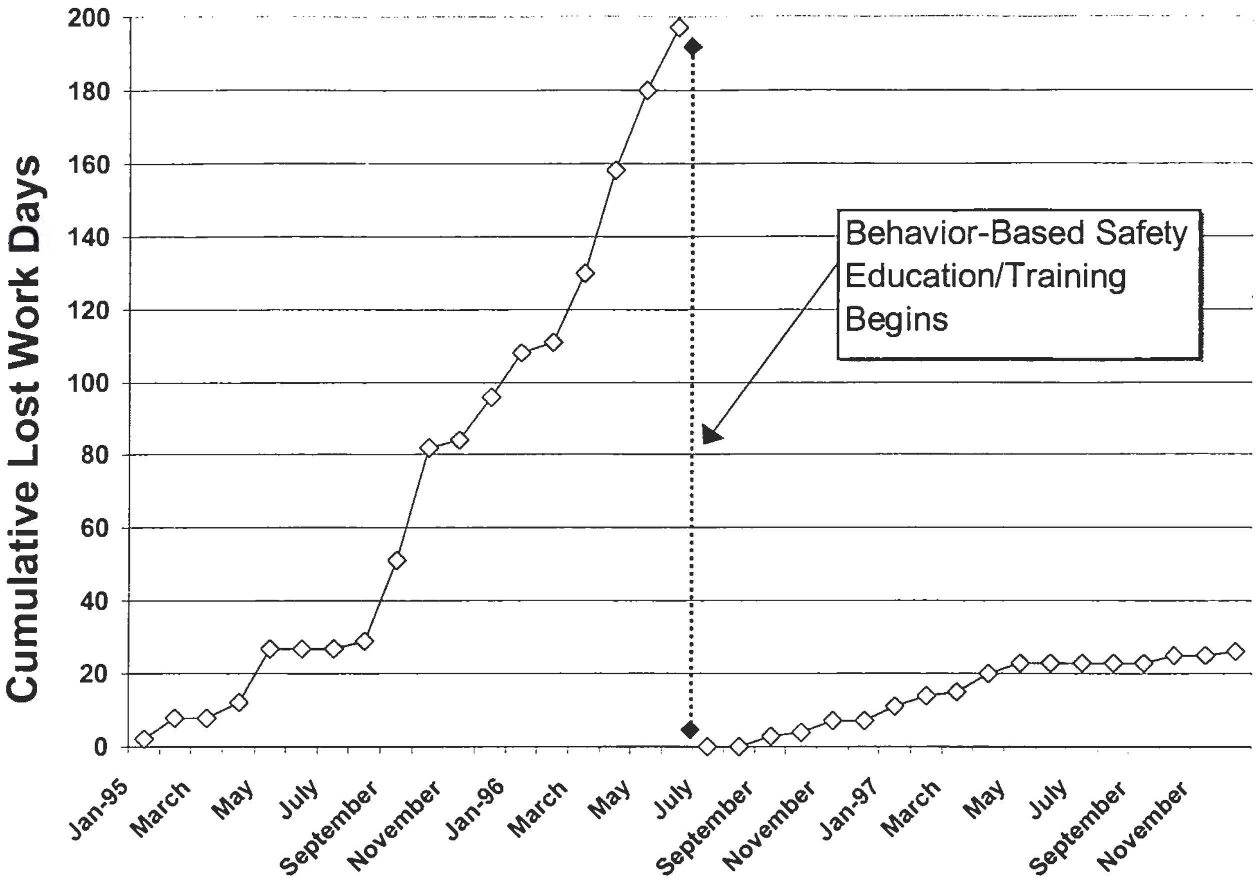
Mean number of observations by facilitators during the nine-week intervention period

Dependent Measure	Shift 1 Facilitators (n=8) (Choice)	Shift 2 Facilitators (n=6) (Assigned)
Observations per Week	M = 422.9 * SD = 135.7	M = 245.0 SD = 110.2
Observations per Facilitator	M = 10.6 * SD = 3.4	M = 6.1 SD = 2.8
Percentage of Shift	M = 36.8% * SD = 11.8%	M = 23.3% SD = 10.5%

M = mean, SD = standard deviation, * $p < .05$

Figure Caption

Figure 1. A cumulative record of plantwide lost workdays before and after BBS training and process implementation.


Cumulative Lost Work Days
200
180
160
140
120
100
80
60
40
20
0
Behavior-Based Safety Education/Training Begins
Jan-95
March
May
July
September
November
Jan-96
March
May
July
September
November
Jan-97
March
May
July
September
November

APPENDIX D:

ATTEMPTS TO INCREASE VEHICLE SAFETY-BELT USE AMONG INDUSTRY WORKERS: WHAT CAN WE LEARN FROM OUR FAILURES?

Compete report as currently under review
for publication in the
Journal of Organizational Behavior Management

Running head: INCREASING VEHICLE SAFETY-BELT USE

Attempts to Increase Vehicle Safety-Belt Use Among Industry Workers: What Can We Learn From Our Failures?

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Abstract

A multiple intervention level (MIL) hierarchy was evaluated with systematic implementation of successive interventions over a period of two years. Applications of written prompts, goal-setting, goal-setting plus feedback, and promise-card commitment interventions did not significantly impact the safety-belt use of 556 employees at a manufacturing industry in southwest Virginia. A modest increase in safety-belt use (from 59% to 68%) occurred only when a promise-card commitment strategy was combined with an incentive/reward strategy. These data support the MIL hierarchy which suggests that repeated attempts to affect behavior change with interventions at the same level of intrusiveness will not impact people uninfluenced by the first attempt at that level. A flow of behavior change model (Geller, in press) is used to explain the impact of interventions on people at different stages of readiness for behavior change and to extend the MIL hierarchy. Suggestions are given for selecting the most appropriate behavior change strategy for large-scale applications.

The use of shoulder and lap belts is the single most protective behavior that can be conveniently taken to reduce the risk of death or injury in a vehicle crash. It is estimated that vehicle safety belts saved 10,414 lives in 1996 and 90,425 lives since 1975 (National Highway Traffic Safety Administration, 1998). And, it is predicted that a one percent increase in safety-belt use nationwide would save 200 lives per year (Sleet, 1987). Thus, increasing the use of vehicle safety belts could also save some of the $54.8 million spent annually by employers for on- and off-the-job vehicle crashes.

Belt-Use Laws

Although safety-belt use has increased dramatically in virtually every state that has passed a belt use law (BUL), much more must be done. For example, during the last six months of 1985, observations of safety-belt use by front-seat occupants in 17 states without a BUL revealed 21.6% buckled up (Zeigler, 1986). In contrast, mean post-BUL belt use across states with BULs was 48% in 1986 (Campbell, Stewart, & Campbell, 1987) and 47% in 1987 (Campbell, Stewart, & Campbell, 1988). In 1989, the 19-city survey conducted by the National Highway Traffic Safety Administration (NHTSA) found an average of 50.4% safety-belt use across the 13 cities with a BUL, and 33.4% belt use in the 6 cities located in states without BULs. The most recent statistics indicate the nationwide average for safety belt use is 67% among adults, and 80% for children, although child safety seats are misused 50% of the time (Nichols, 1998).

Intervention Effectiveness

A multiple intervention level (MIL) hierarchy. Over two decades of behavior change research at corporate and community sites led to the development of the *multiple intervention level* (MIL) hierarchy depicted in Figure 1. This model is used to categorize behavior change approaches and evaluate the cost-effectiveness of successive intervention strategies to alter the behavioral patterns of large numbers of individuals (Geller, 1998a; Geller et al., 1990).

Insert Figure 1 about here

The MIL hierarchy is characterized by dividing intervention strategies into multiple tiers or levels, each defined by certain dimensions of intervention effectiveness. At the first (bottom) level, the interventions are least intrusive and target the maximum number of people. At this level the intervention is designed to have maximum large-scale appeal and minimum individual-to-individual contact.

Those individuals affected at a particular intervention level may benefit from repeated exposure to similar interventions (as booster sessions), but it's assumed most individuals uninfluenced by the first exposure to a particular intervention will not be influenced by repeated exposure to interventions at the same level of intrusiveness. Thus, these individuals require a higher-level (more intense) intervention. Successively higher intervention levels are more costly and intrusive, but they are needed for "hard core" problem individuals. Often these problem persons are at greatest risk for injury (Campbell et al., 1987). The MIL model also proposes that individuals influenced at a particular level of the intervention hierarchy become intervention agents for the next level of intervention (cf. Katz & Lazarfeld, 1955). Thus, a MIL approach to public health has critical implications for evaluating the cost-effectiveness of a behavior-based safety program.

According to the MIL, antecedent strategies such as education, training, written prompts, and assigned goals are lower level interventions reaching a maximum number of people. Laws, policies or mandates which threaten a consequence are more intrusive and therefore are higher level interventions. Behavioral goal-setting and feedback as well as incentive/reward programs are considered at the same level as disincentive/penalty programs.

Previous Attempts to Increase Safety-Belt Use

Interventions successful at increasing safety-belt use have included: a) participative education (Cope, Smith, & Grossnickle, 1986; Ludwig & Geller, 1991), b) modeling (Geller, 1990), c) pledge-card commitments (Geller & Lehman, 1991; Geller et al., 1989; Kello, Geller, Rice, & Bryant, 1988), d) community-based feedback (Geller, 1996; Grant, 1990), and e) community-based incentives/reward strategies (Geller, 1983; Geller, Davis & Spicer, 1983; Geller, Paterson, & Talbott, 1982; Rudd & Geller, 1985).

A comprehensive review of 28 employer-based programs to motivate safety-belt use found incentive/reward strategies more effective than pledge-card commitment strategies (Geller & Lehman, 1991) in the short-term, but commitment strategies were most effective in maintaining long-term behavior change (Geller, Rudd, Kalsher, Streff, & Lehman, 1987). These results suggest that extrinsic rewards may not be an optimal approach for motivating lasting behavior change, but as predicted by the MIL model they may be needed to motivate behavior change among individuals not influenced by lower level interventions.

Geller et al. (1983) used an incentive/reward program to increase the use of safety belts ($n = 450$ employees) at the same industrial site studied in the current research. Their intervention involved the delivery of flyers to drivers entering and exiting the plant parking lots. The flyers explained that a special symbol was printed on flyers given to drivers using their safety belts and certain combinations of symbols could be collected and exchanged for free dinners. The incentive flyer intervention was followed by an immediate prize condition during which buckled drivers were stopped when arriving at the plant and given coupons for a free dinner at a local restaurant. Mean use of safety belts among salary workers increased from a baseline of 17.4% to 50.6% during the intervention phase. The same incentive program only increased belt use among wage employees from a baseline mean of 3.4% to 5.5% during the intervention phase.

Response Generalization versus Risk Compensation

Most researchers intervene upon, measure, and report their findings on a single target response, failing to consider that a variety of responses may covary as a function of similar reinforcement histories. Specifically, if safety practices covary in a reliable fashion, then intervening to increase one desired behavior may have indirect effects on other desired safety behaviors within a functional response class. This behavioral covariation can occur in one of two ways, resulting in either an increase in non-targeted safety-related behaviors (response generalization, Bandura, 1969; Carr, 1988) or a decrease in non-targeted safety-related behaviors (risk compensation, Peltzman, 1975; or risk homeostasis, Wilde, 1982).

Support for risk compensation was found by Streff and Geller (1988) who had subjects operate a 5-hp go-cart on a closed track without a safety belt (for 15 laps) and then buckled up (for 15 laps). These subjects increased their driving speed significantly when using a safety belt, compared with subjects who were not buckled up for all 30 laps in the go-cart. In addition, changes in subjects' perceived risk obtained prior to each run of 15 laps matched their speed differences. That is, risk compensation was shown for both covert and overt behaviors in this within-subject manipulation of perceived risk. Further evidence for risk compensation was found by Janssen (1994) using a real car on real roads. Compared to measures taken when unbuckled, hardcore non-users of safety belts when buckled drove faster, followed more closely behind vehicles in front of them, changed lanes at higher speeds, and braked later when approaching obstacles.

Recent field studies of injury control intervention have supported response generalization over risk compensation. For example, previous research has found that: a) an intervention that increased safety-belt use among pizza deliverers was associated with a concomitant increase in turn-signal use (Ludwig & Geller, 1991); b) an intervention that increased complete intersection stops among pizza deliverers was associated with a concomitant increase in both safety-belt use and complete intersection stops (Ludwig & Geller, 1997); and c) an intervention that increased use of personal protective equipment on the job (i.e., use of safety glasses) resulted in a significant increase in safety-belt use when arriving to and departing from work (Streff, Kalsher, & Geller, 1993). The current research assessed response generalization versus risk compensation by monitoring the use of safety belts and turn signals, but targeting only safety-belt use.

Consequently, this long-term study had four primary objectives: a) to investigate the use of safety belts among industry workers at the same industry studied by Geller et al. (1983) after a decade of culture change, influenced in part by a state BUL, b) to test the impact of several common behavior change techniques on use of safety belts by industry employees, c) to evaluate the MIL hierarchy, and d) to study the covariation between an intervention target (safety-belt use) and another safety-related behavior (turn-signal use).

Method

Subjects and Setting

Subjects were 556 hourly and salary employees at an engine bearing manufacturing plant in southwest Virginia. The population of employees ranged in age from 19 to 63 years, and employee tenure at the facility ranged from six months to more than 25 years. The proportion of hourly to salary workers was approximately five to one.

Data Collection

Throughout the regular work week, trained research assistants sat in two distinct parking lots of the facility during the first shift arrival, second shift arrival/first shift departure times for hourly workers, and at the arrival and departure times for salary employees. Observers collected data on driver safety-belt and turn-signal use. To assess inter-observer reliability, a second independent observer collected data with the primary observer on 30 percent of all observation sessions. As it was impossible to record data on every vehicle entering or leaving the parking lots, the primary observer identified vehicles to observe by calling out the make and color of the vehicle to be observed (e.g., the red pick-up) as it passed an obvious stationary landmark. Interobserver reliability exceeded 90% for both safety-belt and turn-signal use.

Intervention Techniques

After four weeks of baseline observations, a series of progressively more invasive interventions was implemented at the facility over a two-year period. The interventions were as described below and occurred in the order listed.

Written prompt. Attached to the paychecks of all wage employees was a flyer displaying the logo of the industry and a message selected by a safety steering committee of wage workers which read: "*We Buckle-Up Because Safety is Not Only for the Workplace.*" Three weeks later the flyer was attached to the paychecks of all salary employees. After ten weeks of individual prompts, the same message was displayed plantwide on table tents in the workers' cafeteria, in bathrooms above hand dryers, and on doors located in strategic places throughout the plant. Damaged and missing flyers were replaced throughout the plantwide Prompt condition. The total duration of the written prompt intervention period was approximately 16 weeks.

Safety slogan and celebration. A celebration announcing the winner of a plantwide safety slogan contest was scheduled near the Christmas Holidays. This celebration consisted of rewarding the winner with a $50 gift certificate to a store of his or her choice. At this event, Vince and Larry (the famous "Crash Test Dummies") made an appearance to distribute posters featuring two prominent Virginia Tech football players encouraging safety-belt use. To increase involvement, the celebration occurred after the first workshift and before the second workshift, and included refreshments and photograph sessions with the dummies. The winning slogan ("Bearings in Mind, Safety First!") was printed on a 3' by 8' banner and displayed for eight weeks above the main exit from the plant floor.

Assigned goal. After the Slogan and Celebration intervention and a six-week withdrawal period, a specific, difficult but attainable goal for plantwide safety-belt use was set. Flyers displaying the plant logo, winning safety slogan, and the goal of 80% safety-belt use were posted on table tents in the cafeteria, in bathrooms above hand dryers, and on doors located in strategic places throughout the plant. These flyers were inspected weekly by research assistants and the plant safety manager for damage and loss. Damaged and missing flyers were replaced throughout this intervention phase. The goal was set approximately 25% above the current percentage of belt use.

Goal plus feedback. Sixteen weeks after the Assigned Goal phase, feedback was included on flyers displayed weekly along with a reminder of the plant's belt-use goal. Flyers were posted in the same locations and fashion as in the Assigned Goal intervention described above with one noteworthy exception --feedback on the plantwide safety-belt use from the previous week was included on each flyer. This feedback was updated weekly, and new flyers were posted during the first shift each Monday as during the Assigned Goal phase. After an initial period of feedback, the flyers appeared in bright colors which were changed weekly to attract attention. This phase lasted approximately 16 weeks.

Promise card. Written buckle-up promise cards (as described in Geller & Lehman, 1991) were distributed to all employees with their paychecks. The promise cards contained the company logo, the winning safety slogan, and a formal statement pledging to use a vehicle safety belt throughout a two-week period. The promise also included a location for the employees to sign, and a box they could check if they would allow their card to be posted in the plant. After the second week of the pledge period, the promise cards with this box checked ($n = 200$, 82% of the signed promises) were laminated on a 4'by 4' poster-board and displayed on the plant safety bulletin board.

Blank pledge-cards were distributed next to the posted promise cards and labeled "Second-Chance Pledges." The initial pledge period was extended an additional two weeks. New promises ($n = 31$) were posted (with approval) at the time they were signed. The flyers displaying the safety-belt use goal and behavioral feedback were posted as described above throughout this four-week pledge period.

Promise plus incentive/reward. This intervention was identical to the promise-card commitment described above, except combined with the promise was an incentive to sign the promise and buckle-up during the four-week pledge period. Specifically, it was announced on flyers attached to the paychecks of all employees, on table tents in the workers' cafeteria, and on signs posted in bathrooms above hand dryers and on doors located in strategic places throughout the plant that a cash prize would be awarded to one winner of a random drawing of a signed promise card. The amount of the cash prize was determined by the increase in mean safety-belt use among all plant employees. Specifically, $20 was added to the lottery prize for every percentage point increase in safety-belt use above the pre-promise baseline. The prize was awarded one week following the pledge period in a public drawing conducted by the first author and the plant safety manager. The winning card was drawn by a member of the plant safety team.

Withdrawal. A withdrawal period marked by removal of all intervention materials occurred after the plant Safety-Slogan Contest, the Promise Card, and Promise Card plus Incentive/Reward interventions. Each withdrawal lasted approximately six weeks.

Results

Safety-Belt Use

Overall, our observations revealed remarkable increases from 1982 in baseline safety-belt use plantwide (52%, n = 1235). Recall that more than a decade earlier, Geller et al. (1983) reported that baseline belt use among hourly and salary workers at this same facility was 3.4 % and 17.4%, respectively.

Figure 2 displays the weekly percentage of safety-belt use for all employees throughout the 24 months of this field study. Vertical lines indicate the introduction of a new intervention or withdrawal as described above. Horizontal lines depict the mean belt-use percentage for each specific phase. The number of observations per phase is indicated within each intervention condition. The month of data collection is provided below the x-axis, and the corresponding year is noted in the body of the figure.

Insert Figure 2 about here

A visual inspection of the data indicates a lack of marked increases in safety-belt use per intervention phase, even as the interventions became more intrusive. A noteworthy exception was the modest increase in plantwide belt use to 68% (n = 1007) as a result of the Promise plus Incentive/Reward intervention. As shown in Figure 2, this effect continued for up to three weeks following the termination of the pledge period. Interestingly, only 213 (38%) promise cards were signed during the Promise plus Incentive/Reward period. Of these, only 88 were signed by employees who had not signed a promise card during the prior Promise-Only intervention.

A close look at the data indicates that another modestly effective intervention was the Safety Slogan contest and Celebration. This intervention resulted in an immediate increase in safety-belt use for six weeks to 53% (n = 601) and a longer-term maintenance of 61% (n =1001) during a subsequent six-week return to baseline. These increases resulted after three attempts to prompt the use of safety belts resulted in a decrease of safety-belt use to 47% (n = 635) during the plantwide Prompt condition.

The only other intervention that had any desired effect was the Promise Card. Two-hundred and forty-four (44%) of the workers signed the buckle-up promise. This strategy increased safety-belt use to 64% (n = 1033) during the two-week Promise period. However, upon posting the promises publicly, use of safety-belts dropped to 57% (n = 632), just below the level obtained during the second Assigned Goal plus Feedback phase (59%, n = 3675).

Overall, the gain in safety-belt use over the course of two years was approximately 15 percentage points or approximately 30 percent above the initial baseline level of 52% (n = 1235 observations) to 67% (n = 1193) through the first three weeks of the Follow-Up. The six week follow-up mean was 65% (n = 1407), 25 percent above the baseline two years earlier.

Turn-Signal Use

Figure 3 displays the weekly percentage of turn-signal use for all employees throughout the 24 months of this field study. Vertical lines indicate the introduction of a new intervention to increase safety-belt use or a return to baseline, and horizontal lines represent the mean turn-signal use percentage for each specific phase of the research. The number of observations per phase is indicated within each intervention condition. The month of data collection is provided below the x-axis and the corresponding year is noted in the body of the figure.

Insert Figure 3 about here

Although not targeted, turn-signal use decreased steadily throughout the course of the research. More precisely, visual inspection of the data indicates that turn-signal use did not deviate markedly in any phase from the baseline mean of 50% (n = 1272), but did trend downward to a low of 34% (n = 1363) during the Incentive/Reward intervention. A Pearson's product moment correlation of turn-signal use with safety-belt use resulted in a significant negative correlation ($r = -.28$, $p < .05$) for observations up to week 75. The correlation from Week 75 through Follow-Up was stronger ($r = -.38$, $p < .05$) and is reflected in Figure 3 by an 8 percentage point decrease in turn-signal use and a 10 percentage point increase in safety-belt use from Week 80 through the first half of Follow-Up.

Discussion

Overall, these data support the MIL hierarchy (Geller, 1998a; Geller et al., 1990). That is, one could argue that the antecedent strategies used to motivate safety-belt use in the current research are all first level interventions, less powerful than Virginia's BUL. As such it follows that the hard-core resisters, not influenced by the BUL, would not be influenced by repeated applications of lower-level interventions. As suggested by the MIL, the modest improvements seen in the use of safety belts may have been, in part, due to the involvement of belt users as supportive intervention agents to get some part-time users to buckle-up more consistently.

Modeling appropriate behavior has been shown to increase the likelihood of others emitting the desired response by: a) demonstrating the ease at which it can be done; b) making more salient the costs versus benefits of the target behavior; and c) changing cultural norms regarding the behavior (Bandura, 1997). Indeed, the results of the current research indicate that the interventions requiring at least minimal individual involvement (i.e., Slogan Contest, Promise

Card, and Promise Card plus Incentive/Reward) were most effective at increasing the use of safety belts.

Fifteen years ago a similar behavioral intervention at this same facility increased safety-belt use from 17.4% to 50.6% among salary workers, and from 3.4% to 5.5% for hourly workers. As there was no safety-belt use law in 1982, the incentive was enough to provide the motivation to produce some desired behavior change. The baseline level of 52% belt use in the current study was only slightly higher than the intervention levels obtained in 1982. This suggests that those workers not motivated to avoid the improbable fine of $25 were not likely to buckle up for the remote probability of winning the raffle drawing. These individuals need more intrusive and intensive interventions to motivate them to change. This is as predicted by the MIL hierarchy proposed by Geller et al. (1990) and refined by Geller (1998a).

The role of the MIL hierarchy in predicting the impact of specific intervention strategies to promote desired behavior change may be explained by the "Flow of Behavior Change" model proposed recently by Geller (in press). Specifically, the impact of a particular intervention depends on the type of behavior targeted: other-directed, self-directed, or automatic, and the type of intervention used to increase behavior: instructional, motivational, supportive, or self-management.

All voluntary behavior starts at the other-directed stage. It is improved by an instructional or motivational intervention. Instructional interventions are essentially activators or antecedent conditions, and work when the target individual is unaware of a certain desired behavior and is willing to improve. These intervention procedures include: education, training, and directive feedback. They are effective in introducing a new behavior, and in moving an undesirable automatic behavior (bad habit) to the self-directed stage (Geller, in press). But, for this to happen, the individual must be willing to learn. If target individuals resist the instruction by continuing to perform the undesirable behavior, continued instructional intervention will probably not work. In safety we call this behavior a calculated risk (Geller, 1998b), which usually requires a motivational intervention for correction. These strategies are typified by incentive/reward and disincentive/penalty contingencies which announce a certain consequence following the occurrence or nonoccurrence of a specified behavior.

The antecedent strategies used in the current study (i.e., written prompts and assigned goals) clearly represent instructional interventions easy to implement on a large scale. According to the MIL hierarchy, repeated attempts at instruction should not have much impact on those individuals not initially influenced. The Virginia BUL is a higher level motivational intervention, and those uninfluenced by this disincentive/penalty program will likely not buckle-up for an instructional intervention. These individuals need a higher level (more intrusive) motivational intervention.

People who internalize instructions and make adjustments in their behavior as a result of an instructional intervention might need a supportive intervention to become more fluent. Thus, supportive interventions help to transition behavior from the self-directed to automatic stage. Supportive interventions include rewarding feedback or social recognition for desired behaviors, thus providing reinforcing consequences to increase response rate. This can lead to fluency of the safe behavior (Geller, in press).

In the current study, the information provided by the percent safe feedback presumably *supported* the behavior of those already using their safety belts, although perhaps not on every trip. This intervention was not powerful enough to *motivate* non-users to start buckling up. Specifically, feedback added to the instructional assigned goal intervention did not increase plantwide safety-belt use. This result contradicts previous findings (e.g., Sulzer-Azaroff, Loafman, Merante, & Hlavacek, 1990) which suggested that timely feedback would have an additive effect on assigned goals. Furthermore, the motivational incentive/reward intervention had only minimal impact, theoretically because for most people the contingency was at the same MIL as the Virginia BUL.

Response Generalization

From a plantwide perspective, the negative correlation between the use of safety belts and turn signals, exemplified by the overall increase in safety-belt use (25% over initial baseline) coupled with the overall decrease in turn-signal use (22% below initial baseline) supports risk compensation (RC) theory (Peltzman, 1975). Specifically, this theory proposes that when people perceive themselves to be more safe, they compensate by taking more risks. Strongest evidence for RC theory occurred during the last four phases of the research. The systematic inverse relationship between the use of safety belts and turn signals across these phases of research is the defining characteristic of the RC effect (a.k.a. risk homeostasis, Wilde, 1982). This is a similar finding to that of Ludwig and Geller (1997) who found risk compensation in the form of a decrease in turn-signal use when employees were given a top-down goal-setting intervention to increase their complete vehicle stops at intersections.

In Conclusion

The failure of the various behavioral interventions to increase vehicle safety-belt use at an industrial site can be explained by considering the state of those workers not currently buckling up. The employees at this facility have been informed many times about the value of safety belts, and they know how to buckle up. In fact, given that a safety-belt use law has been in effect in Virginia since 1989, vehicle occupants are willfully taking two calculated risks when they don't buckle up. They risk a $25 fine and the likelihood of being more seriously injured in a vehicle crash.

To increase safety-belt use among those who know what to do but don't, a behavioral intervention needs to be motivational. And the motivational contingencies need to be more powerful (soon, certain, and significant) than any other intervention currently in place to increase the safe behavior. Thus, it can be argued that our various instructional interventions were irrelevant, and for most non-users of safety belts, the consequences of our motivational intervention were not significant enough. The incentive/reward program was no more intrusive than the current BUL in Virginia, and thus did not involve a higher level of the MIL hierarchy (Geller, 1998a).

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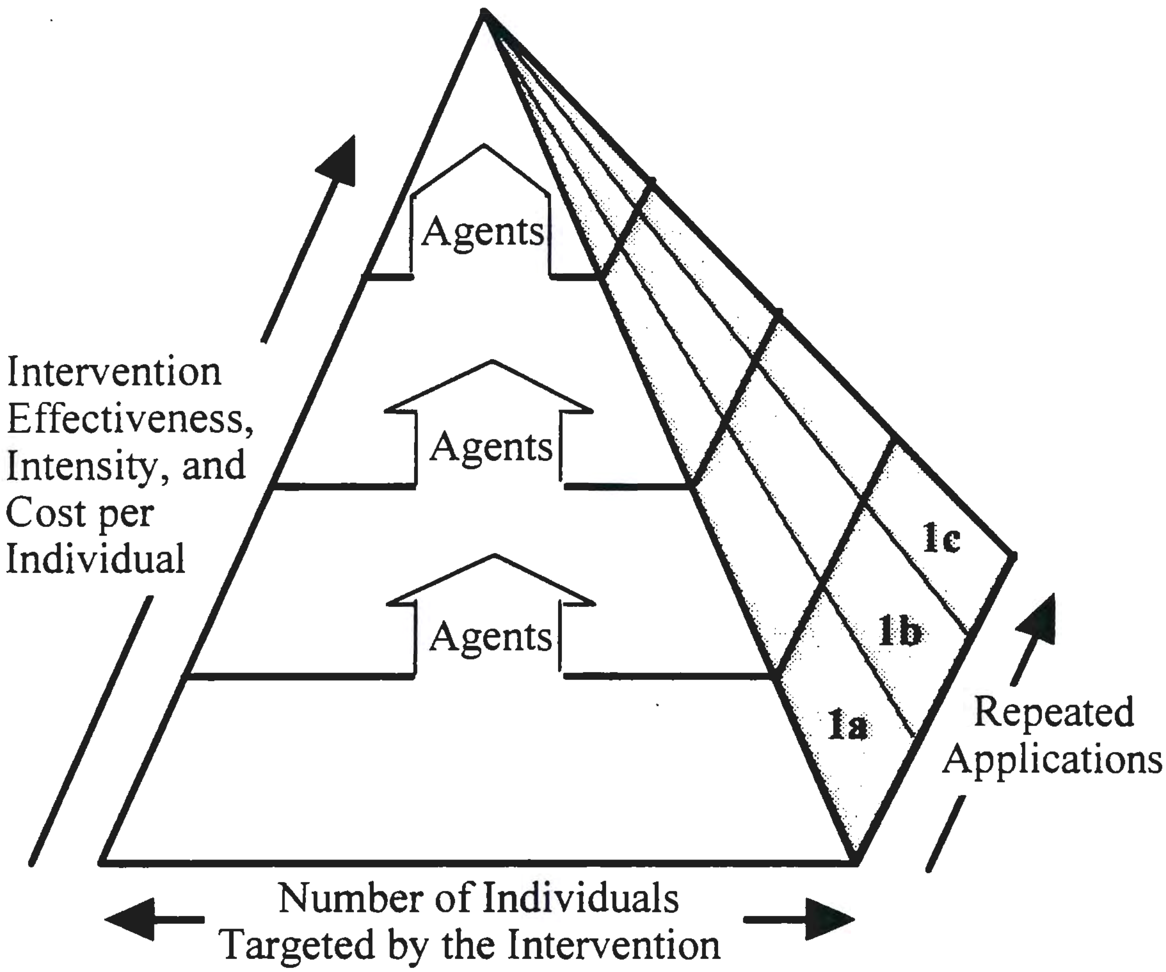
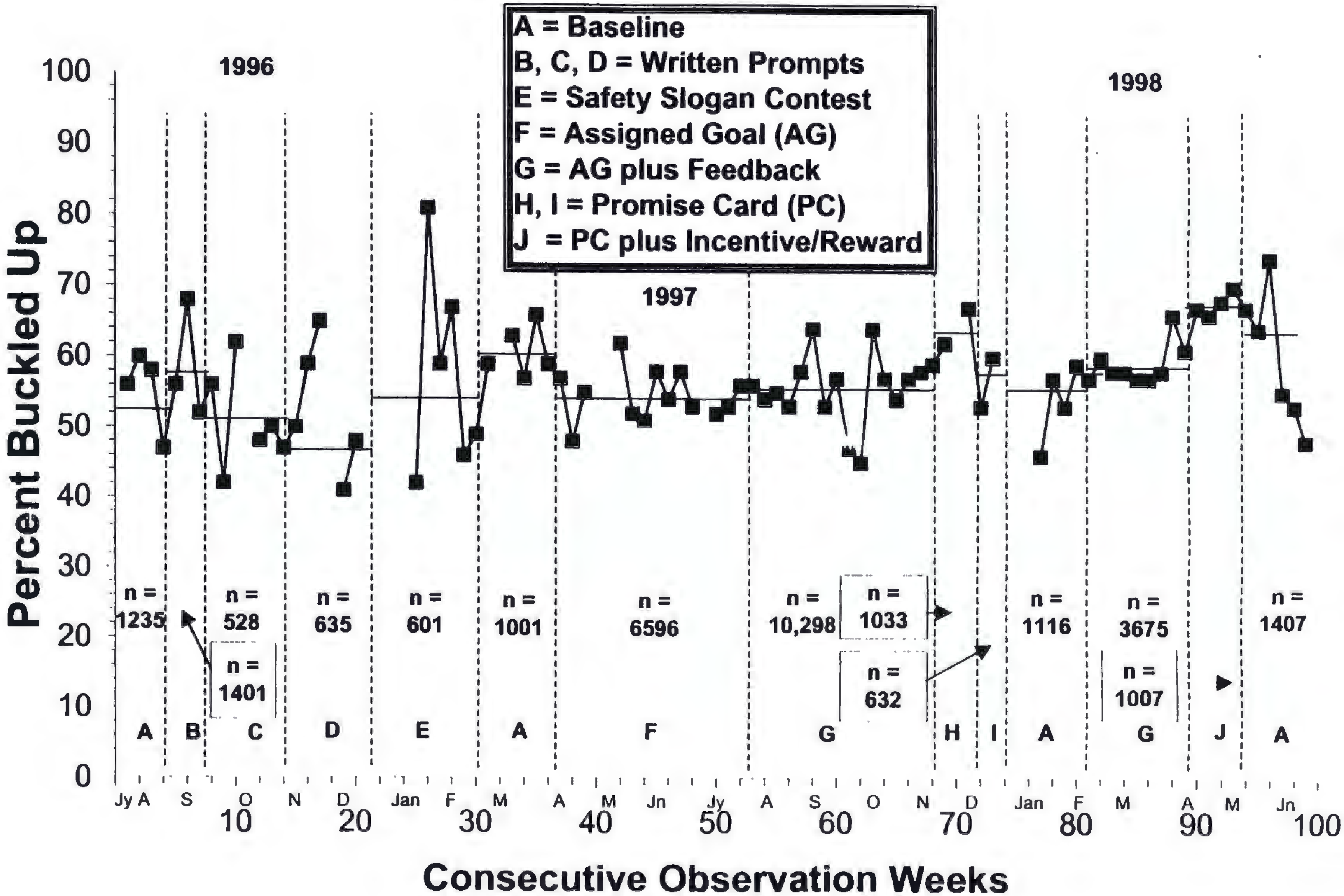
Figure Captions

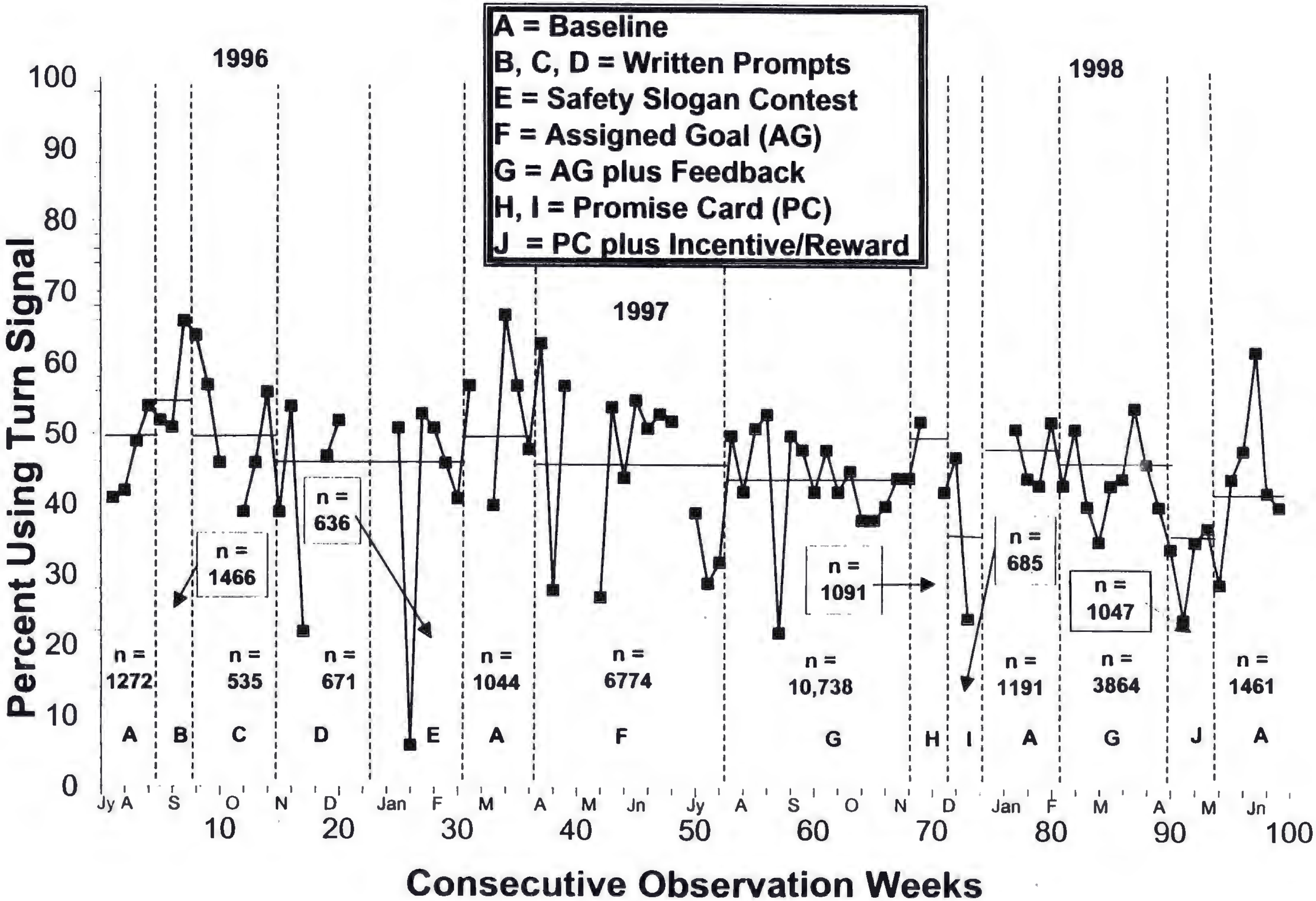
Figure 1. The multiple intervention level hierarchy, differentiating repeated prevention interventions at the same effectiveness level and higher level interventions that are more influential at changing behavior (adapted from Geller et al., 1990).

Figure 2. Plantwide safety-belt use across all phases of the current research. The "n" in each phase represents the total number of vehicles observed.

Figure 3. Plantwide turn-signal use across all phases of the current research. The "n" in each phase represents the total number of vehicles observed.


Agents
Agents
Agents
Intervention Effectiveness, Intensity, and Cost per Individual
1a
1b
1c
Repeated Applications
Number of Individuals Targeted by the Intervention


A = Baseline
B, C, D = Written Prompts
E = Safety Slogan Contest
F = Assigned Goal (AG)
G = AG plus Feedback
H, I = Promise Card (PC)
J = PC plus Incentive/Reward
1996
1997
1998
Percent Buckled Up
Consecutive Observation Weeks
n = 1235
n = 528
n = 1401
n = 635
n = 601
n = 1001
n = 6596
n = 10,298
n = 1033
n = 632
n = 1116
n = 3675
n = 1007
n = 1407
A B C D E A F G H I A G J A
Jy A S O N D Jan F M A M Jn Jy A S O N D Jan F M A M Jn
0 10 20 30 40 50 60 70 80 90 100



A = Baseline
B, C, D = Written Prompts
E = Safety Slogan Contest
F = Assigned Goal (AG)
G = AG plus Feedback
H, I = Promise Card (PC)
J = PC plus Incentive/Reward
1996
1997
1998
Percent Using Turn Signal
Consecutive Observation Weeks
n = 1272
n = 1466
n = 535
n = 636
n = 671
n = 1044
n = 6774
n = 10,738
n = 1091
n = 685
n = 1191
n = 1047
n = 3864
n = 1461
A
B
C
D
E
A
F
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APPENDIX E:

INVESTIGATING THE IMPACT OF SPECIFIC, GLOBAL, AND SOCIAL COMPARISON FEEDBACK ON TARGETED AND NON-TARGETED SAFETY BEHAVIORS

Accepted Ph.D. dissertation proposal
based on grant research

Investigating the Impact of Specific, Global, and Social Comparison Feedback on Targeted and Non-Targeted Safety Behaviors

Dissertation proposal submitted to the faculty of Virginia Tech

in partial fulfillment of the degree

Doctor of Philosophy

Joshua Holbrook Williams

Department of Psychology

Virginia Polytechnic Institute and State University

Dissertation Examination Committee Signatures

____

Dr. E. Scott Geller
Committee Chairperson

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Dr. Neil M. A. Hauenstein

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Dr. Roseanne Foti

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Dr. John Donovan

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Dr. Jack Finney

ABSTRACT

Behavior-based safety feedback is increasingly used by organizations to reduce the frequency and severity of work-related injuries. Improvements in safety performance have been demonstrated in numerous settings following behavior-based (BB) safety feedback. The relative impact of global, specific, and social comparison BB feedback on target and non-target behaviors will be assessed in the current study. A 3 phase (baseline, training, intervention) X 2 feedback level (global versus specific feedback) X 2 feedback type (social comparison versus no social comparison feedback) ANOVA will be used to test the hypothesis that specific, social comparison feedback will lead to the strongest improvement in safety performance with target safety behaviors. Also, the impact of global, specific, and social comparison BB feedback on non-target safety behaviors will be assessed. This represents an investigation of response generalization. It is predicted that global feedback will lead to more response generalization than specific feedback. In other words, global, social comparison feedback should lead to the strongest improvements in safety performance with non-target safety behaviors. Participants will be 300 employees from Shifts 1 and 2 of a foundry in the Southeastern U.S. The results of a pilot study investigating global versus specific feedback is presented. Results and implications of the current study will be discussed.

INTRODUCTION

The Problem

Injuries and deaths occurring on the job due to at-risk work behaviors are a significant problem in the U.S. (Baker, Conroy, Johnston et al., 1992). Each year approximately 11.3 million employees are seriously injured and nearly 11,000 workers are killed on the job. Today it is estimated that employers pay $155 billion in direct costs (e.g., workers' compensation, insurance premiums) associated with workplace injuries, amounting to over $1,400 per work-related injury (Baker et al., 1992; Miller, 1997; The National Committee for Injury Prevention and Control, 1989).

Injury Prevention

The Surgeon General identified people and their *behavior* as the primary contributor to work-related injuries (Califano, 1979). This theme of improved health and reduced injuries through behavior change efforts has been emphasized in journal articles (e.g., Roberts, 1987), government reports (e.g., Harris, 1980, 1981), conference proceedings (e.g., Geller, 1988; Tolsma, 1987), and throughout entire journal issues (e.g., Geller, 1991; Lawson, Sleet, & Amoni, 1984; Roberts & Brooks, 1987). As Roberts, Fanurik, and Layfield (1987) point out, "What people *do* influences the quality of life, and people *doing* is the realm of psychology, the science of behavior" (p. 105). Clearly, research which addresses the identification, improvement, and maintenance of behaviors that prevent workplace injury is greatly needed (Institute of Medicine, 1988) and should be based on the success of previous behavior analytic research (e.g., Elder, Geller, Hovell, & Mayer, 1994; Geller, 1984,1988,1996; Geller, Rudd, Kalsher, Streff, & Lehman, 1987; Winett, King, & Altman, 1989).

Safety Triad

Moving from at-risk to safe work habits is key to injury avoidance on the job. Through the course of a workday, employees face hundreds of instances where they choose to work safely or at-risk. Unfortunately, workers are often reinforced for performing tasks in an at-risk manner because doing so is typically faster, easier, more comfortable, and more efficient or convenient than following the safe procedures (Geller, 1998a). Examples of at-risk choices include: not wearing protective gear, failing to follow standard energy-controlled lock-out procedures, lifting a heavy object without a hoist, standing on a machine instead of a ladder, etc. In addition to the natural consequences like ease and comfort, *external factors* often further reinforce at-risk behavior. For instance, workers may feel management pressure to take safety short-cuts for production.

The Safety Triad proposed by Geller (1996) emphasizes the importance of environment, person, and behavior-based factors to explain and ultimately improve organizational safety. Environmental factors include equipment and cultural factors (e.g., management support) which impact safety. Person factors include individual states (e.g., self-esteem, personal control) which influence one's willingness to look out for personal safety and the safety of others. Behavior-based factors include observable activities (e.g., behavioral observations and feedback) which impact organizational safety.

Critical Observation Checklist (CBC)

The CBC is a safety-improvement tool, providing objective information about workers' safety performance (cf. Geller, 1996; Krause, Hidley, & Hodson, 1996). To develop a CBC, front-line employees work together to select a number of critically important safety behaviors to target as a group. Then they operationalize these behaviors. For instance, safe lifting behavior may be defined according to certain steps, such as: a) hold load close to body; b) bend knees not back; c) move feet and turn instead of twisting; and d) use a hoist with loads over a designated weight. These behaviors, with corresponding definitions, are then listed on the checklist with corresponding columns for safe and at-risk behaviors (see Figure 1 for a sample CBC).

Employees use this checklist to make observations of fellow employees and offer constructive behavioral feedback. Specifically, an observer categorizes specific behaviors as either safe or at-risk while observing an individual work. While data from the CBC can be analyzed in many ways, the percentage of safe behavior occurrences, termed *percent safe scores*, is typically calculated over time (e.g., 74% safe for Week 1, 79% safe for Week 2, etc.). Overall, the information yielded from observation checklists may include individual and/or group performance and may be assessed for each behavior, or given as an overall percentage across behaviors.

The number and nature of behaviors selected for the CBC vary as a function of the type of industry, the unique injury statistics for a given organization or work area, the scope of the observation process, and the collective experience of the individuals constructing the CBC (e.g., safety leaders, consultants, safety committee members, plant managers). Also, the observation schedules vary according to the individual characteristics and available time/resources of the organization.

The information from CBCs are used to develop proactive strategies to reduce the probability of injury occurrence. This corrective action process has been referred to as "DO IT" (Geller, 1996; 1997; 1998a). Simply, DO IT involves: a) Define critical behaviors to increase or decrease, b) Observe target behaviors during a baseline phase to set specific goals for achievement and to understand outside conditions influencing the target behavior, c) Intervene to change the target behaviors in the desired direction, and d) Test the impact of the intervention by continuing to observe the target behaviors. If desired results are not achieved, target behaviors are re-defined or other interventions are implemented. When improvement goals are met, other target behaviors can be selected.

Behavior-Based Safety

The antecedent-behavior-consequence model of applied behavior analysis has been frequently and successfully used to prevent occupational injuries (e.g., Alavosius & Sulzer-Azaroff, 1986; Komaki, Collins, & Penn, 1978; Streff, Kalsher, & Geller, 1993). Antecedents, or activators, *direct* one's focus and attention on relevant safety behaviors required for a given task. For instance, a safety sign may be placed above a particularly dangerous machine reminding workers to always use safety guards in the correct manner. Effective activators are simple, memorable, and tied closely to consequences (Geller, 1996).

Consequences follow behavior and *motivate* the future occurrence of either safe or at-risk behaviors. For instance, incentives (e.g., pizza party for reaching 80% safe) may be used as a consequence to promote safe behavior occurrences. The most effective consequences are extremely likely to occur, follow the desired behavior closely, and are meaningful for the individual. This level of functioning represents *fluency* and is the mission of all behavior change efforts to improve organizational safety (Geller, 1997). Broadly, behavior analysis offers a great deal to the field of injury control by enhancing the understanding of the determinants of at-risk behavior and guiding the development of effective behavior change interventions (e.g., Elder et al., 1994; Geller, 1988, 1996; Krause et al., 1996; Petersen, 1989).

Overall, behavior-based approaches to injury control have a number of advantages over other safety approaches, including: a) they can be administered by people with minimal professional training (Daniels, 1989); b) they can reach people in the natural setting where a problem occurs such as a particular work area (Geller, 1996); c) the leaders in these settings can be taught the behavior-change techniques most likely to work under specific circumstances (Baer, Wolf, & Risley, 1968, 1987; Daniels, 1989; Geller, 1997); and d) they are cost-effective (Daniels, 1989; Sulzer-Azaroff & de Santamaria, 1980).

Behavior-Based Feedback and Safety Performance

The beneficial impact of behavior-based (BB) feedback on organizational safety performance is well established. Improvement in safety-related behaviors following BB feedback have been demonstrated in a number of organizational settings including: a plastics manufacturing plant (Sulzer-Azaroff & de Santamaria, 1980), a metal fabrications plant (Zohar, Cohen & Azar, 1980), a bakery (Komaki, Barwick & Scott, 1978), a public work's department (Komaki, Heinzmann, & Lawson, 1980), a university chemical laboratory (Sulzer-Azaroff, 1978), and a university cafeteria (Geller, Eason, Phillips, & Pierson, 1980). As researchers point out, "Informational feedback on performance has been shown to be a simple, effective, and durable method for promoting safety" (Fellner & Sulzer-Azaroff, 1984, p. 7).

While research demonstrates that BB feedback improves organizational safety performance, less is known about specific characteristics of BB feedback driving these results. This represents a serious problem when one considers the devastating impact work-related injuries have across the country. To maximize the effectiveness of BB safety feedback, empirical tests of various types of feedback are needed. To this end, the present research will evaluate the relative strength of global versus specific BB feedback.

Global versus Specific BB Feedback

Two common forms of BB feedback are present in the safety literature: global and specific feedback. Briefly, global BB feedback is defined as an 'overall safety score based on the percentage of safe behavior occurrences for a given time period across *all* targeted behaviors (e.g., 76% safe for Week 1) and has been evaluated in numerous occupational safety studies (Austin et al., 1996; Chhokar & Wallin, 1984; Cooper & Newbold, 1994; Cooper et al., 1994; Komaki et al., 1978; Komaki et al., 1980; Komaki et al., 1982; Reber & Wallin, 1984; Reber, Wallin, & Chhokar, 1990). In contrast, specific BB feedback is defined as the 'percentage of safe behavior occurrences for a given time period for *each* targeted behavior' (e.g., Bending knees when lifting is 45% safe for Week 1) and has been studies in various safety feedback articles (Cohen & Jensen, 1984; Fellner & Sulzer-Azaroff, 1984; Fellner & Sulzer-Azaroff, 1986; Geller et al., 1980; Hopkins et al., 1986; Ludwig & Geller, 1997; Sulzer-Azaroff & de Santamaria, 1980; Sulzer-Azaroff et al., 1990). A comprehensive list of global and specific BB feedback studies is provided in Appendix A.

Broadly, the percentage of safe behavior occurrences (i.e., percent safe scores) is a proactive, effective measure of safety performance commonly used by organizations and assessed by safety researchers (Daniels, 1989). Typically, as the percentage of safe behavior occurrences increases, the frequency and severity of corresponding injuries drops. For instance, an increase from 30% to 90% in safe lifting behaviors would likely lead to a significant decrease in the severity and frequency of back injuries reported.

Although there is ample evidence that both global and specific BB feedback lead to beneficial behavior change, no published research has systematically compared these two feedback approaches. As Boyce and Geller (1998) state, "A systematic evaluation of providing specific versus global performance feedback when targeting multiple behaviors to produce maintenance is also needed" (p. 28). While theories of generalized responding lead one to expect greater improvement in safety performance from global feedback, behavioral theory predicts specific feedback to be superior to global feedback in influencing safety performance.

Specific Feedback

While theoretical and empirical support for the use of global feedback is available, specific BB feedback may be most effective in influencing organizational safety performance. In fact, safety interventions based on the principles of applied behavior analysis often take the form of operationalizing specific, objective behaviors to target, and later posting percent safe data based on each specific behavior (Geller, 1996; Krause et al., 1996). Interventions to improve safety performance typically involve modifying or changing the salience of the antecedents and/or consequences of the *specific* safety behaviors targeted (Daniels, 1989). This has led some leading-edge safety researchers to strongly maintain that specific, not global, BB feedback will have the most profound impact on percent safe scores and should replace global BB feedback in actual organizational settings (Sulzer-Azaroff, 1997).

Interestingly, some organizational performance literature suggests that the only behaviors affected by feedback are those *specifically* targeted for feedback. For instance, when assessing the impact of specific feedback on two of four behaviors within a common response set, researchers demonstrated that improvement in two targeted areas ('proper form documentation' and 'proper document filing') based on specific feedback had no impact on the remaining behaviors ('proper chart placement' and 'proper signature acquisition'). In a second trial, the latter two behaviors improved with specific feedback, with no changes in the prior two behaviors targeted. The authors showed that feedback is a powerful tool to improve behavior when it is applied in a *specific* manner to a *particular* target behavior, and they concluded that generalization to other behaviors may be limited (Fredericksen et al., 1982).

Support for the benefits of specific feedback on safety performance was demonstrated with lift truck operators over a twelve week period. In two studies, the use of specific feedback and goal-setting with 14 behaviors led to a 44% and 61% decrease in percent at-risk scores over a three month period (Cohen & Jensen, 1984). Also, when workers in a paper mill received weekly, specific BB feedback they showed significant and successive improvements in percent safe scores over a three-month time span. This improvement was accompanied by a 50% reduction in injuries during this time (Fellner & Sulzer-Azaroff, 1984). In a follow-up study, improvements in percent safe scores were demonstrated with specific BB feedback, and the addition of goal-setting had no impact on percent safe scores (Fellner & Sulzer-Azaroff, 1986).

Further, specific BB feedback combined with a safety awareness program led to percent safe increases from 65% to 82% and 46% to 76% for transport training center employees over a six week period (Grant, 1990). Similar results were found with university kitchen workers receiving daily, specific feedback for seven target behaviors (Geller et al., 1990) and with plastics workers receiving daily, specific feedback for nine target behaviors leading to a 36% reduction in chemical exposures (Hopkins et al., 1986). Also, percent safe scores for 'complete vehicular stops at intersections' improved with specific BB feedback (plus goal-setting) over a 15-week period (Ludwig & Geller, 1997). Finally, specific BB feedback and goal-setting led to a significant improvement in percent safe scores with manufacturing plant workers over a six month time span, leading to a substantial decrease in injuries and a $55,000 return on investment (Sulzer-Azaroff et al., 1990).

Global Feedback

Global BB feedback has been recommended over specific feedback as a strategy for enhancing and maintaining performance (Bandura, 1986, 1997). Global feedback is typically defined as percent safe scores across behaviors (i.e., global, overall in Appendix A). Global feedback may also be defined in terms of broad, behavioral categories (i.e., global, response class in Appendix A) such as lifting, which is reflected in specific behaviors such as bending knees, holding load close, etc. Theoretical support for global feedback is driven by theories of generalized responding. Specifically, for a given set of behaviors, overall feedback without information regarding the specific behaviors driving the results should lead to more vigilant attention to *all* behaviors, resulting in longer-term and generalized improvement (Baer et al., 1968, 1987; Boyce & Geller, 1998; Stokes & Baer, 1977). As Boyce and Geller point out, "Providing general feedback as opposed to specific feedback and targeting multiple behaviors decreases the likelihood that any one behavior will become associated with the consequences provided for performance improvement" (p. 21).

Empirical support for this assertion has been demonstrated in industrial settings. For instance, global feedback (both overall and by response class) was provided to social workers helping handicapped patients regarding their lifting and transport behaviors. Global feedback led to an improvement or maintenance of percent safe scores for 34 of 36 behaviors and "these improvements tended to maintain as feedback was faded" (Alavosius & Sulzer-Azaroff, 1986, p. 261). Similarly, global feedback (overall and by response class) led to a percent safe increase from 8% to 78% with light assembly workers across 16 behaviors over an 11-week period (Cooper & Newbold, 1994). Interestingly, Cooper and Newbold (1994) note, "Improvements in the data were met with cheers, applause, and whistles as the three targeted and overall plant performance data was presented" (p. 39).

Also, global BB feedback and incentives improved the safety behaviors of roofers from 51% to 90% on the ground and 55% to 95% on roofs across 25 behaviors over a four-week period (Austin et al., 1996). When global feedback was combined with training and goal-setting, percent safe scores (percent of workers performing 100% safe) increased with metal fabrication workers from 65% to 95% across 35 behaviors. Improvements from feedback were significant beyond training and goal-setting alone over a 42-week period (Chhokar & Wallin, 1984).

Similar results were found with British cellophane workers who experienced significant improvements in percent safe scores following goal-setting and global BB feedback. The improvements in percent safe scores corresponded with nearly a 50% reduction in injuries over a six month period (Cooper et al., 1994). Improvements in percent safe scores from 70% to 96% and 78% to 99% were demonstrated with manufacturing workers following global feedback BB used with training and goal-setting, leading to a significant drop in injury rates (Komaki et al., 1978). Global feedback also led to significant improvements (11% increase) in percent safe scores over baseline and training conditions with poultry processing employees over a 46-week period (Komaki et al., 1982).

The benefits of global feedback were also demonstrated with four sections of a city's vehicle maintenance division across the following behavioral categories: proper use of tools, use of safety equipment, housekeeping, and general safety procedures. For all targeted areas, percent safe scores increased significantly following the introduction of global feedback. Not surprisingly, the average number of lost time incidents declined from 3 to 1.8 (per 100,000 hours) following the presentation of global BB feedback (Komaki et al., 1980). Finally, the benefits of overall global BB feedback with training and goal-setting led to significant improvements in percent safe scores (percentage of employees performing 100% safe) and significant reductions in injury rates with farm machinery workers (Reber & Wallin, 1984; Reber et al., 1990).

Overall, theoretical and empirical support has been demonstrated for both global and specific BB feedback on safety performance. However, published research assessing the *relative* strength of each approach has not been provided.

Social Comparison Feedback

Social comparison feedback has rarely been studied in the safety literature, particularly with respect to behavior-based safety. Social comparison feedback (SCF) is defined as 'information demonstrating an individual's performance in comparison to a relevant comparison group.' The importance of social comparison feedback is grounded in Festinger's (1955) seminal article, "A Theory of Social Comparison Processes." Festinger (1955) argues that in Western cultures individuals are driven to continually improve performance and that we seek out 'similar others' with whom to gauge our own performance. Thus, attributions of our own performance are determined by our relative standing in comparison to others.

While Festinger (1955) discusses social comparison information in terms of an objective, self-evaluative motive, his concept of the 'unidirectional drive upward' suggests that individuals are motivated to improve their own performance as well as outperform the comparison group. In clarifying this issue, Wood (1989) maintains, "...people not only wish to evaluate their abilities, they also feel pressure to continually improve them. When combined with the desire to compare with similar others, this drive upward leads the individual to strive toward a point slightly better than that of comparison others" (p. 232).

This desire to outperform similar others is reflected in the uniqueness bias, or constructive social comparison, in which individuals manufacture self-serving consensus estimates to match their highly positive self-opinions (Goethals, Messick, & Allison, 1996). Simply put, individuals "...want social comparison information to confirm the correctness of their opinions and the high level of their abilities" (Goethals et al., 1996, p. 151). This is consistent with findings from social psychology which demonstrate that average self-rated job performance lies at the 78th percentile (Meyer, 1980), and that individuals have unrealistically positive views of themselves (Taylor & Brown, 1988). Overall, self-rated performance is typically inflated beyond actual performance levels and the ratings yielded from co-workers (Farh, Werbel, & Bedeian, 1988; Harris & Schaubroeck, 1988; Mabe & West, 1982).

The combination of overly optimistic self-views and the unidirectional drive upward suggests social comparison feedback can serve a motivational purpose in influencing organizational performance, including percent safe scores with safety. Simply put, the use of BB feedback should serve as a motivational referent by which individuals gauge their percent safe scores compared to others. If expectations of one's performance are higher than actual performance , which is likely given the inflated nature of self-appraisals, individuals should be motivated to improve their own performance. This is especially true when one considers the unidirectional drive upward. The collective desire to outperform others should lead to organizational safety performance improvement over time.

Empirical evidence suggests that social comparison feedback does, in fact, lead to improved task performance. For example, participants performing a word completion task demonstrated significant improvements in performance following the presentation of social comparison feedback (Mathieu & Button, 1992). Also, the introduction of social comparison feedback in a work-related simulation led to significant improvements in subsequent task performance over a no SCF condition (Mitchell, Rothman, & Liden, 1985).

In terms of percent safe scores with product handling in a microelectronics plant, SCF led to a significant improvement in percent safe scores over a no SCF feedback condition (Goltz et al., 1989). Also, the introduction of social comparison feedback led to significant improvement over a pre-feedback condition on a mental rotations task (Tindale, Kulik, & Scott, 1991). Finally, the use of SCF has been shown to influence other factors, including self-efficacy (Bandura, 1982; Early & Erez, 1991), performance goals (Meyer & Gellatly, 1988; Rakestraw & Weiss, 1981), and internal motivation (Harackiewicz, Sansone, & Manderlink, 1985; Sansone, 1989).

Evidence Against Social Comparison Feedback

While theoretical and empirical support for SCF has been demonstrated, some researchers maintain that SCF either has no impact, or a negative impact, on subsequent task performance. For instance, Kluger and DeNisi (1996) argue that SCF brings additional, unneeded attention to one's self, thus taxing cognitive resources and diminishing performance. They conclude that SCF presentations are likely to, "...shift attention away from the task toward other goals of the self and consequently may debilitate performance" (p. 267).

Also, one aspect of Festinger's (1955) research suggests that individuals are motivated to reduce discrepancies in abilities between themselves and the referent group. In other words, poor performers will be motivated to improve but exceptional performers may be motivated to perform less effectively. This pressure to conform to the mean is heightened when there is a strong sense of group cohesion (Corollary VIIA of Derivation E in Festinger, 1955). While the majority of Festinger's (1955) theory supports the positive influence of SCF on performance, some aspects of his theory suggest that mean group performance would not be changed with SCF.

Other theories suggest negative performance information will *not* motivate individuals to improve their performance. Taylor and Brown (1988) maintain that individuals process information through rose-colored filters such that negative information about the self is simply ignored. Otherwise, this information is relegated to 'pockets of incompetence' and dismissed as unimportant. As Ilgen, Fisher, and Taylor (1979) suggest, "Negative feedback, on the other hand, may be denied by the recipient because of an unwillingness to accept such knowledge about himself or herself" (p. 354). The implication for safety performance is that negative SCF regarding percent safe scores may simply be ignored or considered irrelevant.

There is empirical support for the theoretical assertion that SCF will *not* lead to improved performance. For example, in completing a word search task, SCF lead to slightly diminished performance on subsequent trials. However, performance feedback without SCF resulted in significant improvements in task performance on later trials (Johnson et al., 1996). Similarly, SCF had no significant impact on actual job performance, although subjective measures of satisfaction with the feedback process were improved. Specifically, organizational leaders who received SCF were more willing to discuss the feedback and were more satisfied with the feedback process than their no SCF counterparts. However, when asked about modifying future behavior to improve job performance, non-significant differences were found between participants in the SCF and no SCF conditions. In other words, SCF had no impact on leader's intentions to improve their future job performance (Smither, Wohlers, & London, 1995).

In sum, there is contradictory evidence regarding the influence of SCF on task performance. While some research demonstrates that SCF has a beneficial impact on task performance, other research suggests SCF has no impact, or even a negative impact, on subsequent task performance.

Social Comparison Feedback at the Group Level

Leading-edge organizations (including the organization in the current study) are moving toward 'team-oriented' work groups, where performance is assessed at the team, not individual, level (Geller, 1998b). This movement toward work-teams has dramatic implications for SCF research. Simply, social comparison research may have more practical value when couched in terms of work team performance instead of individual performance. While Festinger (1955) does not make explicit predictions regarding social comparison processes at the team level, he maintains that people "tend to move into groups" which leads to group identification in which the groups' abilities and beliefs are compared to the opinions and abilities of other groups or the society at large (p. 136). To this end, leading BB safety researchers have assessed percent safe scores at the team level in comparison to the overall organization (Goltz et al., 1990). However, the relative impact of SCF versus no SCF has not been addressed at the work team level with regard to percent safe improvements.

Response Generalization

The majority of behavior-based safety studies involve interventions on a single target response, failing to consider that a variety of responses may covary as a function of similar reinforcement histories (consequences they produce). Therefore, safety behaviors can be conceived of not as individual responses, but as groups of functionally related behaviors (as in safe driving practices). If safety practices covary in a consistent fashion, intervening to increase one desired behavior may have indirect effects on other desired safety behaviors within the same response class. This behavioral covariation has been termed 'response generalization' (Baer et al., 1968, 1987; Bandura, 1969; Carr, 1988; Stokes & Baer, 1977). Basically, response generalization occurs when multiple behaviors clustered in a functional response class (as in safe driving) increase as a result of intervening on one of the specific behaviors within that response class (Russo, Cataldo, & Cushing, 1981).

Recent applied studies of injury control interventions have shown evidence of response generalization. More specifically, field studies have demonstrated: a) an intervention used to increase safety-belt use facilitated a concomitant increase in turn-signal use (Ludwig & Geller, 1991), b) an intervention to increase complete intersection stops facilitated a concomitant increase in safety-belt use and complete intersection stops (Ludwig & Geller, 1997), and c) an intervention to increase personal protective equipment use on the job (i.e., use of gloves, ear plugs, and safety glasses) resulted in a significant increase in safety-belt use when driving to and from work (Streff et al., 1993).

Obviously, developing a checklist to target *all* possible behaviors for *all* workers in an organization is unrealistic. Fortunately, research demonstrates that safety improvements from response generalization do occur in certain contexts. So, improvements on checklist behaviors lead to improvements on other, non-targeted, behaviors. While this is very encouraging on a practical level, there is little available information regarding the specific conditions under which response generalization occurs. To this end, the current study will explore the impact (if any) of global, specific, and social comparison feedback on non-targeted safety behaviors. As discussed earlier, there is theoretical rationale to predict more response generalization with global versus specific feedback.

Overview of Current Study

There is a plethora of research suggesting BB feedback leads to improved organizational safety performance. However, less is known about the specific *types* of feedback which lead to the greatest improvement in safety performance. More specifically, the existing body of literature does not address the relative impact of specific *versus* global feedback and SCF *versus* no SCF on percent safe scores.

It is expected that specific, social comparison feedback will be most effective in influencing organizational safety performance for targeted behaviors. This prediction is based on theories of behavior analytic and social comparison processes. Also, global, social comparison feedback is expected to be most effective in influencing organizational safety performance for non-targeted safety behaviors. This prediction is based on theories of generalized responding and social comparison processes.

Hypotheses

Hypothesis 1: Specific BB feedback will be more effective than global BB feedback in increasing percent safe scores for targeted behaviors.

Hypothesis 2: Social comparison feedback will lead to an increase in percent safe scores with targeted behaviors over a no social comparison feedback condition.

Hypothesis 3: Specific, social comparison feedback will be most effective in increasing percent safe scores with targeted behaviors.

Hypothesis 4: Global BB feedback will be more effective than specific BB feedback in increasing percent safe scores for non-targeted behaviors.

Hypothesis 5: Social comparison feedback will lead to an increase in percent safe scores with non-targeted behaviors over a no social comparison feedback condition.

Hypothesis 6: Global, social comparison feedback will be most effective in increasing percent safe scores with non-targeted behaviors.

Pilot Study

Participants and Setting

Participants were 40 front-line workers at a soft-drink bottling plant in Southeastern Virginia. The plant contained a number of assembly lines where cans and bottles were filled, labeled, sorted, and packaged. A large amount of water was required to keep the lines running, resulting in a number of areas where standing water existed. Many of the lines were 5 feet in the air, requiring workers to bend under the lines to get to different locations in the plant. Also, several of the automated machines (i.e., pallatizers) were extremely dangerous and power had to be locked out to work on the machines.

Critical Observation Checklist (CBC)

A CBC with corresponding behavioral definitions was designed by the safety committee of the organization with help from research assistants at a large southeastern University (see Figure 2). The observed behaviors included: personal protective gear (glasses, ear plugs), lifting (use legs, back straight, twist, hold close), fork truck driving (visual scan, backwards with load, honk at intersections, slow at intersections), and general safety (stacking, handrail use, conveyer avoidance). Trained observers marked either "safe" or "at risk" for the safety-related behaviors. At the end of each week, the total percentage of safe behaviors was calculated for each behavioral category. An overall "percent safe" score for the week was also tallied. Reliability estimates for inter-rater agreement between observers was calculated each week and were above 85% for all behaviors observed.

Procedure

The employees were observed by trained behavioral observers from Virginia Polytechnic Institute and State University once a day for two work shifts. The observers used the CBC and walked through the plant several times during hour-long observation sessions. For 15 weeks, a baseline period was established to determine percent safe scores for the targeted behaviors. This baseline period was followed by an intervention period in which participants were made aware of the specific behaviors that were being observed with the CBC. They were observed for 10 weeks following this 'awareness intervention.'

After this period, the first 'feedback intervention' was introduced. Shift 1 participants received global feedback, whereas Shift 2 participants received specific BB feedback for each behavioral *category* (with no global feedback). This BB feedback was provided in weekly meetings and took the form of graphs that showed weekly changes in percent safe scores.

For the global feedback condition, a single graph was provided each week. For the specific feedback condition, four graphs (one for each behavior category) were provided each week. Behavioral observations with the first feedback intervention lasted 6 weeks. Following this, the second feedback intervention was introduced.

With the second feedback intervention, Shift 1 participants received specific BB feedback and Shift 2 participants received global behavioral feedback. In other words, the feedback conditions for the two shifts were reversed for the second feedback intervention. The second feedback intervention lasted 6 weeks. Finally, the Withdrawal phase of the experiment consisted of 17 weeks in which observations were made following the removal of BB safety performance feedback with both shifts.

The percent safe occurrences of behaviors served as the dependent variable. The formula for calculating this percentage was:

$$\% \text{ Safe Observation} = \frac{\text{Total Safe Observation}}{\text{Total Safe Observation} + \text{Unsafe Observation}} \times 100\%$$

Results

Behavioral observations were recorded over 54 weeks. A 2 Group (Shift 1: Global – Specific vs. Shift 2: Specific – Global Feedback) x 5 Phase (Baseline vs. Awareness Intervention vs. Feedback Intervention 1 vs. Feedback Intervention 2 vs. Withdrawal) repeated measures ANOVA was calculated on the overall percent safe scores for each week.

Results indicated a significant Group x Phase interaction, $F(4, 76) = 2.98$, $p < .05$. Follow-up analyses using simple effects analyses by Group indicated a significant Phase main effect for both Shift 1 (Global-Specific Feedback), $F(4, 38) = 2.54$, $p < .05$, and Shift 2 (Specific-Global Feedback), $F(4, 38) = 8.28$, $p < .001$. Percent safe scores were calculated for each safety behavior by shift for each week and an overall percent safe score was calculated across all behaviors for each shift and week. Post-hoc analyses were conducted using Student Newman-Keuls multiple range tests.

Results for Shift 1 (Global-Specific Feedback) indicated that overall percent safe during the Global Feedback Intervention ($M = 88.4$, $SD = 3.49$) was significantly greater than all other Phases (Baseline: $M = 77.1$, $SD = 12.91$; Awareness: $M = 78.9$, $SD = 4.68$; Specific Feedback: $M = 77.2$, $SD = 9.85$; Withdrawal: $M = 69.7$, $SD = 14.9$), $p < .05$. Results for Shift 2 (Specific-Global Feedback) indicated that overall percent safe during Baseline ($M = 60.4$, $SD = 7.9$) was significantly lower than all other Phases (Awareness: $M = 81.3$, $SD = 4.7$; Specific Feedback: $M = 81.9$, $SD = 8.4$; Global Feedback: $M = 75.8$, $SD = 1.6$; Withdrawal: $M = 73.2$, $SD = 11.2$), $p < .05$. No other significant differences with overall percent safe scores were found.

Response Generalization. The non-targeted behaviors in the current study were hearing protection, twisting, and fork-truck honking at intersections. So, participants were unaware we were observing these behaviors. For both twisting and hearing protection, non-significant differences were found between pre and post-feedback conditions. However, significant differences were found with 'honking at intersections.' When global feedback preceded specific feedback (i.e., Shift 1), the percent safe for honking increased from 23% at baseline to 34%. When specific feedback preceded global feedback (i.e., Shift 2), the percent safe for honking fell from 12% at baseline to 5.5%.

Discussion

These results indicate that global feedback significantly improved safety performance beyond baseline measures with Shift 1, while specific feedback did not. With Shift 2 however, specific feedback lead to higher percent safe scores than global feedback, although differences were not statistically significant. Also, response generalization was demonstrated with forktruck honking at intersections, but not hearing protection and twisting. Significant improvements in honking behavior were shown when global feedback preceded specific feedback over a non-feedback baseline period. However, the percent safe for this behavior only increased from 23% to 34%. Overall, little evidence for response generalization was shown and differences between global and specific feedback were minimal. Regardless, the overall frequency of recordable injuries at this facility fell by more than 50% following the implementation of BB observation and feedback.

Lessons Learned

The 'specific' BB feedback should have been presented at the specific behavioral level (e.g., bend knees when lifting), instead of the response class level (e.g., lifting), to get a cleaner test of global versus specific feedback. Also, the feedback graphs were presented without *any* formal BB safety education/training. So, employee 'buy in' to the observation/feedback process was likely weakened. Further, irregular safety meetings resulted in inconsistent feedback presentations. In addition, a second baseline period was needed between the two feedback interventions to reduce order effects. Finally, the influence of global and specific feedback on safety performance should be considered within the context of social comparison feedback.

METHOD

Participants and Setting

Participants will be 300 employees from Shifts 1 and 2 of a foundry located in the Southeastern United States. The foundry produces cam shafts and other steel parts for the automotive industry. Iron and other chemicals are heated to 2200 degrees and poured into molds, then cooled into parts, sanded to eliminate sharp edges, and then shipped out to automotive plants. The most common injuries are strains/sprains, hand abrasions, and eye injuries. A similar number of workers are on Shifts 1 and 2, and injury reports are similar for these shifts.

Procedure

Baseline. For two weeks prior to BB safety education/training, employees on Shifts 1 and 2 will be observed. Percent safe scores for each shift will be established each day for all targeted and non-targeted behaviors, as well as daily, overall percent safe scores for each shift. Participants will not be informed about the purpose of the observations.

BB Safety Education/Training. Participants will then receive 2 hours of BB safety education/training, with approximately 30 participants per session. Immediately after completing (or 2 hours before starting) a shift, Shift 1 employees will receive the BB safety education/training. It will take approximately five days to train an entire shift. During these sessions, participants will learn about the principles and practical applications of BB safety, including observation and feedback processes (see Training Materials in Appendix B). Participants will also be informed that a number of trained observers will be making behavioral observations following BB education/training.

So, participants will have a comprehensive understanding of the rationale behind, and manner in which, CBCs are used. Also, participants will be informed that observation data will not be shared with the foundry personnel. The author and another graduate student with two years of industry experience delivering BB safety education/training will conduct all education/training sessions. Percent safe information will be collected for two weeks in the same fashion as the baseline condition. Shift 2 participants will receive identical BB education/training two weeks after the Shift 1 participants to allow for a multiple baseline design. Timelines reflecting expected results with targeted and non-targeted behaviors are provided in Figures 3 and 4.

Feedback Conditions. Following two weeks of baseline and two weeks of observations following BB safety education/training, Shift 1 participants will begin receiving BB feedback each Monday for four weeks. Participants in Shift 1 will receive global BB feedback (overall percent safe score across all behaviors). Two weeks later, Shift 2 participants will begin receiving BB feedback each Monday for four weeks. Shift 2 participants will receive specific BB feedback (for every specific behavior) without the presentation of an overall percent safe score.

The feedback will be presented in sealed envelopes and will take the form of percent safe scores presented on a critical observation checklist (CBC). So, global feedback participants will receive a CBC with only a single percent safe score (see Figure 5). Specific feedback participants will receive a CBC with percent safe scores adjacent each behavior without a global, percent safe score (see Figure 6). The BB feedback represents percent safe scores from the prior week.

Social Comparison Feedback. Participants in the filler and maintenance departments will receive social comparison feedback. Specifically, they will receive their team's percent safe score(s) for the week, as well as the mean percent safe score for the entire organization. An example of (global) SCF is provided in Figure 7. Participants in the cooling and distributing departments will *not* receive social comparison feedback. They will *only* receive their group's percent safe score. A similar number of employees work in the four foundry departments.

Behavioral observations. Research personnel will make all observations. Observations will be made for eight consecutive weeks. The observers will mark individual behaviors as either safe or at-risk, based on the operational definitions given on the back of the CBC. These definitions will be developed by the author and safety manager based largely on past injury records. Feedback information will be provided to employees on this checklist. These behaviors represent the targeted behaviors for the experiment.

Also, a second CBC will be developed by the experimenter. The second CBC will be used by the research assistants to make all behavioral observations. This checklist will have all of the behaviors and corresponding definitions from the original checklist, but will also include several other behaviors which all foundry employees will be unaware of. These additional behaviors will serve as the non-targeted behaviors for the study of response generalization.

Reliability of observations. For 30% of the behavioral observations, two research personnel (excluding the experimenter) will independently observe the participants and will be blind to the purpose of the study. The research personnel will communicate with each other during the observation procedures only to identify the person being observed. A percent agreement score will be calculated per each behavioral category for safe observations. Reliability estimates with the pilot study were strong, and procedures for the current study are similar.

Observation Schedule. The observers will perform daily observations, Monday through Friday, for eight weeks following BB education/training. Observations will be made on both shifts and an observation session will last 1-2 hours.

Dependent Variables

The percent safe scores will serve as the dependent variables. The formula for calculating this percentage is:

$$\%\ Safe\ Score = \frac{Total\ Safe\ Observation}{Total\ Safe\ Observation + Unsafe\ Observation} \times 100\%$$

Each day, percent safe scores will be calculated for all targeted behaviors and the resulting overall percent safe score. This will be calculated for both shifts and SCF (or no SCF) conditions. Also, percent safe scores will be calculated each day for all non-targeted behaviors and the resulting overall percent safe score. This will be calculated for both shifts and SCF (or no SCF) conditions.

Analyses

A 3 phase (baseline, training, feedback intervention) X 2 feedback level (global versus specific feedback) X 2 feedback type (social comparison feedback versus no social comparison feedback) ANOVA will be used to test all hypotheses. A multiple baseline design will also be used to analyze the data.

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Appendix A:
Review of BB Safety Feedback Articles

Article	*Population/ Duration of study*	*Level of feedback specificity*	*Number of behaviors*	*Individual versus group*	*Public versus private*	*Mode of delivery*	*Frequency of delivery*	*Additional independent variables*	*Feedback specificity during training*	*Safety performance metric*	*Findings*
Alavosius & Sulzer-Azaroff (1986)	6 social workers, 7 months 7 mo.	Global, response class; global, overall; specific (verbal)	36	Individual	Private	Written, verbal	Weekly (written), Daily (verbal)	None	N/A	Percent safe	Percent safe improved/ maintained (i.e., 100% safe pre and post) with 34 of 36 behaviors
Article	*Population/ Duration of study*	*Level of feedback specificity*	*Number of behaviors*	*Individual versus group*	*Public versus private*	*Mode of delivery*	*Frequency of delivery*	*Additional independent variables*	*Feedback specificity during training*	*Safety performance metric*	*Findings*
Austin et al. (1996)	7 roofers; 28 days 1 mo.	Global, overall	25	Group	Public	Graphs	Weekly	Time off for reaching 80% safe	None	Global percent safe; Actual labor cost savings	Percent safe increased from 51 to 90% safe (ground) and 55 to 95% safe (roofs)
Article	*Population/ Duration of study*	*Level of feedback specificity*	*Number of behaviors*	*Individual versus group*	*Public versus private*	*Mode of delivery*	*Frequency of delivery*	*Additional independent variables*	*Feedback specificity during training*	*Safety performance metric*	*Findings*
Chhokar & Wallin (1984)	58 metal fabrication workers, 42 weeks 11 mo.	Global, overall	35	Group	Public	Graphs	Weekly then Bi-monthly	Training, goal-setting (95% safe)	Specific	Percentage of workers performing 100% safe	Percent safe increased from 65% to 95%. No differences by feedback frequency

Article	*Population/ Duration of study*	*Level of feedback specificity*	*Number of behaviors*	*Individual versus group*	*Public versus private*	*Mode of delivery*	*Frequency of delivery*	*Additional independent variables*	*Feedback specificity during training*	*Safety performance metric*	*Findings*
Cohen & Jensen (1984)	96 lift truck operators, 3 months 3 mo.	Specific	14	Group	Both	Graphs, verbal	Daily	Goal-setting of 80% safe	Specific	Percent at-risk	Percent at-risk dropped by 44% in Study 1 and 61% in Study 2.
Article	***Population/ Duration of study***	***Level of feedback specificity***	***Number of behaviors***	***Individual versus group***	***Public versus private***	***Mode of delivery***	***Frequency of delivery***	***Additional independent variables***	***Feedback specificity during training***	***Safety performance metric***	***Findings***
Cooper & Newbold (1994)	28 light assembly workers, 11 weeks 3 mo.	Global, response class and overall	16	Group	Public	Graphs	Weekly	None	Specific	Percent safe	Overall percent safe increased from 8 to 78% safe. Lifting: 14 to 100%, Body positioning 7 to 83%, Tool use: 5 to 50%.
Article	***Population/ Duration of study***	***Level of feedback specificity***	***Number of behaviors***	***Individual versus group***	***Public versus private***	***Mode of delivery***	***Frequency of delivery***	***Additional independent variables***	***Feedback specificity during training***	***Safety performance metric***	***Findings***
Cooper et al. (1994)	540 British construction workers, 11 weeks 3 mo.	Global, overall	Not provided	Group	Public	Graphs	Weekly	Goal setting with percent safe varied by department, ranging from 70-100% safe	Specific	Percent safe	Percent safe increased from 53% to 62%, 71%, 76%, and 70% for the next 4 months. Injury rates dropped 50%.

Article	***Population/ Duration of study***	***Level of feedback specificity***	***Number of behaviors***	***Individual versus group***	***Public versus private***	***Mode of delivery***	***Frequency of delivery***	***Additional independent variables***	***Feedback specificity during training***	***Safety performance metric***	***Findings***
Fellner & Sulzer-Azaroff (1984)	500 paper mill workers, 6 months 6 mo.	Specific	24	Group	Public	Charts	Weekly	None	Specific	Percent safe	Significant improve-ments found in percent safe scores following feedback, leading to a 50% drop in injuries and significant cost/benefit savings.
Article	***Population/ Duration of study***	***Level of feedback specificity***	***Number of behaviors***	***Individual versus group***	***Public versus private***	***Mode of delivery***	***Frequency of delivery***	***Additional independent variables***	***Feedback specificity during training***	***Safety performance metric***	***Findings***
Fellner & Sulzer-Azaroff (1986)	150 paper mill employees, 50 weeks 12 mo.	Specific	24	Group	Public	Charts	Weekly	Goal-setting	Specific	Percent safe	In following up the 1984 study, percent safe increases from feedback did not further increase with goal-setting.
Article	***Population/ Duration of study***	***Level of feedback specificity***	***Number of behaviors***	***Individual versus group***	***Public versus private***	***Mode of delivery***	***Frequency of delivery***	***Additional independent variables***	***Feedback specificity during training***	***Safety performance metric***	***Findings***
Geller et al. (1980)	9 university kitchen workers, 30 days 1 mo.	Specific	7	Group	Private	Charts	Daily	None	Specific	Frequency of safe behaviors performed	Safe behavior occurrences increased significantly for one of two dependent safety measures

Article	*Population/ Duration of study*	*Level of feedback specificity*	*Number of behaviors*	*Individual versus group*	*Public versus private*	*Mode of delivery*	*Frequency of delivery*	*Additional independent variables*	*Feedback specificity during training*	*Safety performance metric*	*Findings*
Goltz et al. (1990)	20 micro-electronic workers, 76 days 2 mo.	Specific, Global, overall	Not provided	Group versus group plus individual	Private	Charts	Daily and weekly	None	Specific	Percent safe for a given behavior, when all workers perform the behavior safely (i.e., one at-risk observation is 100% at risk for that behavior)	Percent safe increased from 84% (baseline) to 91% (group feedback) to 96% (group plus individual feedback)
Article	*Population/ Duration of study*	*Level of feedback specificity*	*Number of behaviors*	*Individual versus group*	*Public versus private*	*Mode of delivery*	*Frequency of delivery*	*Additional independent variables*	*Feedback specificity during training*	*Safety performance metric*	*Findings*
Grant (1990)	370 transport training center workers, 6 weeks 2 mo.	Specific	1, safety belt use	Group	Public	Sign	Daily	Awareness campaign	Specific	Percent safe	Percent safe increased 65 to 82% for driver and 46 to 76% for passenger following feedback
Article	*Population/ Duration of study*	*Level of feedback specificity*	*Number of behaviors*	*Individual versus group*	*Public versus private*	*Mode of delivery*	*Frequency of delivery*	*Additional independent variables*	*Feedback specificity during training*	*Safety performance metric*	*Findings*
Hopkins et al. (1986)	Four plastics workers, 17 days ½ mo.	Specific, but not presented in terms of percent safe	9	Individual	Private	Verbal	Daily	None	Specific	Percent safe behaviors, exposure to chemicals	Percent safe increased for most behaviors, 36% drop in exposures

Article	*Population/ Duration of study*	*Level of feedback specificity*	*Number of behaviors*	*Individual versus group*	*Public versus private*	*Mode of delivery*	*Frequency of delivery*	*Additional independent variables*	*Feedback specificity during training*	*Safety performance metric*	*Findings*
Komaki, Barwick, & Scott (1978)	162 food manufacturing workers, 25 weeks 6 mo.	Global, overall	Not provided	Group	Public	Chart	Bi-weekly (approximately)	Training, Goal-setting (90%)	Specific	Percent safe for a given behavior, when all workers perform the behavior safely	Percent safe increased from 70 to 96% and from 78 to 99% for 2 areas, with significant drops in injury rates.

Article	*Population/ Duration of study*	*Level of feedback specificity*	*Number of behaviors*	*Individual versus group*	*Public versus private*	*Mode of delivery*	*Frequency of delivery*	*Additional independent variables*	*Feedback specificity during training*	*Safety performance metric*	*Findings*
Komaki, Collins, & Penn (1982)	200 poultry processing workers, 46 weeks 11 mo.	Global, overall	Not provided	Group	Public	Chart	3 times a week	Meeting emphasizing safety rules	Specific	Percent safe	Feedback led to an 11% increase in percent safe over baseline.

Article	*Population/ Duration of study*	*Level of feedback specificity*	*Number of behaviors*	*Individual versus group*	*Public versus private*	*Mode of delivery*	*Frequency of delivery*	*Additional independent variables*	*Feedback specificity during training*	*Safety performance metric*	*Findings*
Komaki, Heinzmann, and Lawson (1980)	City vehicle maintenance workers, 45 weeks 11 mo.	Global, response class	4 behavioral categories	Group	Public	Graphs	Weekly, then 3 times a week	Training, goal-setting (75% and 90%)	Global, response class	Percent safe	Percent safe improved with feedback (but not training by itself), but only maintained when feedback was provided 3 times/week

Article	***Population/ Duration of study***	***Level of feedback specificity***	***Number of behaviors***	***Individual versus group***	***Public versus private***	***Mode of delivery***	***Frequency of delivery***	***Additional independent variables***	***Feedback specificity during training***	***Safety performance metric***	***Findings***
Ludwig & Geller (1997)	Pizza delivery drivers, 15 weeks 3 mo.	Specific	1, complete stops	Group	Public	Graph	Approx-imately bi-weekly	Goal-setting	Specific	Percent safe	Percent safe increased significantly Non-targeted behaviors improved with participative goal-setting.
Article	***Population/ Duration of study***	***Level of feedback specificity***	***Number of behaviors***	***Individual versus group***	***Public versus private***	***Mode of delivery***	***Frequency of delivery***	***Additional independent variables***	***Feedback specificity during training***	***Safety performance metric***	***Findings***
Reber & Wallin (1984)	105 farm machinery workers, 56 weeks 12 mo.	Global, overall (by department not organiz-ation)	Not provided	Group	Public	Graphs	Weekly	Training, Goal-setting	Specific	Percentage of employees performing 100% safe	Percent safe increased from 56 to 93%,59 to 96%, and 69 to 98% for groups 1-3.. Injury rates dropped over 50%.
Article	***Population/ Duration of study***	***Level of feedback specificity***	***Number of behaviors***	***Individual versus group***	***Public versus private***	***Mode of delivery***	***Frequency of delivery***	***Additional independent variables***	***Feedback specificity during training***	***Safety performance metric***	***Findings***
Reber, Wallin, & Chhokar (1990)	44 farm machinery workers, 55 weeks 12 mo.	Global, overall (by department not organiz-ation)	Not provided	Group	Public	Graphs	Weekly	Training, Goal-setting	Specific	Percentage of employees performing 100% safe	Percent safe increased from 55 to 93%, 58 to 97%, 81 to 97% for areas 1-3. Injury rates dropped for 2 of 3 areas.

Article	*Population/ Duration of study*	*Level of feedback specificity*	*Number of behaviors*	*Individual versus group*	*Public versus private*	*Mode of delivery*	*Frequency of delivery*	*Additional independent variables*	*Feedback specificity during training*	*Safety performance metric*	*Findings*
Sulzer-Azaroff & de Santamaria (1980)	235 manufacturing plant workers, 7 months 7mo.	Specific	18 hazards, with corresponding behaviors	Group	Individual	Charts and oral feedback	Approximately bi-monthly	None	Specific	Frequency of hazards, similar to percent at-risk	Hazard frequency decreased following feedback from 30 to 13% for one area and 29 to 6% for a second area.
Article	*Population/ Duration of study*	*Level of feedback specificity*	*Number of behaviors*	*Individual versus group*	*Public versus private*	*Mode of delivery*	*Frequency of delivery*	*Additional independent variables*	*Feedback specificity during training*	*Safety performance metric*	*Findings*
Sulzer-Azaroff, Loafman, Merante, & Hlavacek (1990)	225 manufacturing plant workers, 6 months 6mo.	Specific	Not provided	Group	Public	Charts	Weekly	Goal-setting, incentives for 100% safe	Specific	Percent safe	Significant improvements in percent safe corresponded with a drop in LTAs from 14 to 1 following the intervention and a $55,000 return on investment.

APPENDIX F:

RESEARCHING BEHAVIOR-BASED SAFETY: A MULTI-METHOD ASSESSMENT AND EVALUATION

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Researching Behavior-Based Safety

A multi-method assessment and evaluation

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1998 PROFESSIONAL DEVELOPMENT CONFERENCE

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BEHAVIOR-BASED SAFETY

Behavior-based (BB) approaches to injury prevention have a number of advantages, including: a) they can be administered by individuals with minimal professional training; b) they can reach people in the setting where a problem occurs (e.g., community, school, workplace); and c) the leaders in these settings can be taught the BB techniques most likely to work under specific circumstances (Baer, Wolf, & Risley, 1968, 1987; Daniels, 1989; Geller, 1997). Research has also shown this approach to be cost effective, primarily because BB techniques are straightforward and relatively easy to administer, and because intervention progress can be readily assessed by indigenous personnel monitoring target behaviors (e.g., Daniels, 1989; Geller, 1996; Geller, Winett, & Everett, 1982; Rudd & Geller, 1985; Sulzer-Azaroff & De Santamaria, 1980).

Behavior-based approaches to safety focus on systematically studying the effects of various interventions on target behaviors, first by defining the target behavior in a directly observable and recordable way, and second by observing and recording it in its natural setting. When a stable baseline measure of the frequency, rate, or duration of behavior is obtained, an intervention is implemented to change the behavior in beneficial directions. Interventions typically involve modifying or changing the antecedents and/or consequences of specified target behavior(s). To determine intervention effectiveness, the frequency, duration, or rate of the target behavior is recorded during and/or after the intervention and compared to baseline measures of behavior (Daniels, 1989; Geller, 1996,1997).

Intervention Effectiveness Theory

A multiple intervention level (MIL) hierarchy. Over two decades of behavior change research at corporate and community sites has led to our development of the *multiple intervention level* (MIL) hierarchy depicted in **Figure 1**. We use this model to categorize behavior change approaches and evaluate the cost-effectiveness of successive intervention strategies to alter the behavioral patterns of large numbers of individuals (Geller, Berry, Ludwig, et al., 1990; Ludwig & Geller, 1991). The MIL hierarchy is characterized by dividing intervention strategies into multiple tiers or levels, each defined by certain dimensions of intervention effectiveness. At the first (bottom) level the interventions are least intrusive and target the maximum number of people. At this level, the intervention is designed to have maximum large-scale appeal and minimum individual-to-individual contact. Those individuals affected at a particular intervention level may benefit from repeated exposure to similar interventions (as booster sessions), but we assume most individuals uninfluenced by the first exposure to a particular intervention will be uninfluenced by repeated exposure to interventions at the same level of intrusiveness. Thus, these individuals require a higher-level (more involving) intervention. Successively higher intervention levels are more costly and intrusive, but they are needed for the "hard core" problem individuals. These problem persons are likely at greater risk for injury. Thus, a MIL

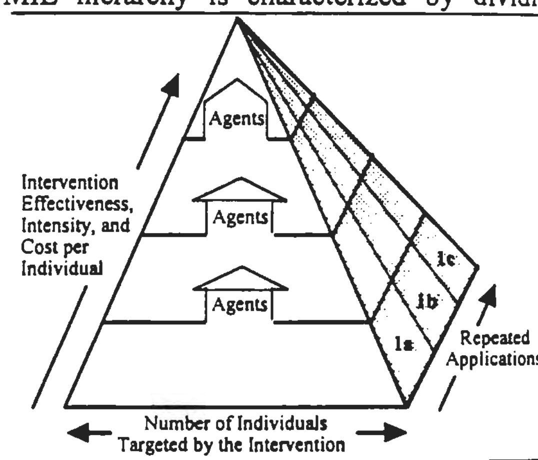


Figure 1. The MIL hierarchy, differentiating repeated prevention interventions at the same effectiveness level and higher level prevention interventions that are progressively more influential at changing behavior.

approach to public health has critical implications for evaluating the cost-effectiveness of a BB safety program. The MIL model also suggests that individuals influenced at a particular level of the intervention hierarchy become potential intervention agents for the next level of intervention (cf. Katz & Lazarfeld, 1955).

The current research explored ways to involve indigenous personnel in the implementation of successful intervention strategies. We also studied personality, lifestyle, and attitudinal characteristics of those individuals who volunteer to help implement a program to promote safety at work. Additionally, evaluation of the MIL model was the catalyst for the research targeting driving behaviors.

STUDY 1: NATIONWIDE SURVEY ON BEHAVIOR-BASED SAFETY

Safety professionals were solicited for input through a nationwide survey published in *Industrial Safety and Hygiene News (ISHN)*, a monthly magazine for safety professionals with 62,000 company subscribers. The survey was designed to assess readers' knowledge and interest in BB safety, and to explore ideas for improving the communication and implementation of BB principles and procedures for reducing industrial injuries. The survey also allowed us to begin constructing a database of organizations currently active in BB safety efforts.

A total of 162 completed surveys were returned to us by mail or fax. An appreciation of the BB approach was shown by 80% (n=129) of the respondents answering "yes" to the question "Do you believe behavior-based safety is a viable approach for reducing at-risk work behaviors and activities?" (Only 3% responded "no" to this question; the rest said they didn't know). In addition, more participants responded "no" (48%) than "yes" (34%) to the question, "Do you think a safety program should put more direct focus on attitudes than on behaviors?" This is interesting because it not only shows preference for a BB approach, it reflects a shift from the traditional educational approach to injury prevention.

The astute reader will note, however, that the sample of surveys we analyzed was not random and was likely biased toward the BB approach. The survey was presented within the context of research aimed at discovering how to make the BB approach more effective. Thus, it's likely most people who took the time to complete and return the survey were at least interested in this particular approach to industrial safety. In fact, several respondents asked specifically to be included in our sample of organizations to visit for an on-site evaluation of factors contributing to the impact of a BB safety process. Thus, compared to the average reader of *ISHN*, those who answered the questions and returned our survey were probably more informed about BB safety and had higher confidence in the effectiveness of BB safety. Even with this positive bias, however, the survey revealed some misperceptions about BB safety which can limit its application for safety improvement.

What is behavior-based safety? The first part of the survey asked respondents to give their impression of BB safety by checking all of the items they believe are true from a list of 16 possible characteristics. In general, the respondents' selections indicated accurate knowledge of BB safety, but there were a few notable exceptions.

The three items selected most often as representing BB safety were: 1) an intervention approach for increasing safe behavior (selected by 143 respondents); 2) an observation and feedback process (n=130); and 3) a tool for managing safety (n=114).

Relatively fewer respondents considered other characteristics of BB safety to be relevant. Specifically, only 42 of the 162 respondents considered BB safety an approach useful for investigating injuries. Only 88 respondents (54%) felt BB safety is useful for evaluating safety achievement, and 99 respondents (61%) considered BB safety an intervention approach for decreasing at-risk behavior.

It is likely that people have a rather narrow viewpoint regarding BB safety. This limited perspective is also reflected in numerous safety articles, sales pitches from safety consultants, and presentations at safety conferences. In fact, BB safety is much more than a tool for doing observation and feedback. It is actually "a general philosophy that can be applied to many aspects of safety management." This general definition was actually the most accurate item on our survey checklist, and was checked by 71% of the respondents.

Principle versus application. Most survey respondents were aware that BB safety focuses on positive consequences to influence behavior change, since only four individuals indicated that BB safety was "an approach focusing on the use of punishment to decrease unsafe behavior." However, a different story emerged when the survey asked respondents to check which techniques were actually used in their plant "to influence safety-related behaviors in the workplace."

Activators (or antecedent strategies) were most popular, with policies (n=149), posted safety signs (n=124), demonstrations (n=108), and lectures (n=102) leading the list. Goal-setting, feedback, and incentive/reward programs were used frequently, but more companies focused on outcome ("accidents or injuries") rather than process ("safety-related behaviors or activities") when setting goals (n=95 vs. 48), when giving group feedback (n=83 vs. 60), when giving individual feedback in coaching sessions (n=96 vs. 74), and when rewarding people for safety improvement (n=72 vs. 56).

The absence of checks for many techniques was quite revealing, and inconsistent with an appreciation for BB safety principles. For example, the most cost-effective BB approaches to improve safety are BB goal-setting and feedback for individuals and groups, yet these intervention approaches were being used at less than half of the sites represented by the survey respondents. It was encouraging, however, that almost two-thirds of the sample (n=102) use safety steering committees to manage their safety programs.

Only 15% (n=24) of the respondents indicated they monitor "percent safe behavior" to assess the success of their safety programs. The traditional outcome measures were most popular, with 77% (n=125) using OSHA recordables, 75% (n=122) using lost-time accidents, 42% (n=68) using total recordable injury rate, and 44% (n=66) using total recordable rate, including illness. Interestingly, slightly more respondents reported they use attitude or perception surveys (17%) than percent safe behaviors (15%).

Implications. The responses of those who completed and returned our BB safety survey published in *ISHN* reflected appreciation for a BB approach to injury prevention, but they also demonstrated substantial misunderstanding and misapplication. A majority of respondents, for example, perceived BB safety as an observation and feedback tool rather than a general approach to improving the human dynamics of safety, relevant for ergonomics, injury analysis, and the design of incentive/reward programs.

Even with substantial appreciation for BB observation and feedback as a way to increase safe behavior, relatively few respondents indicated use of a relevant metric for monitoring the success of a behavior-improvement process. Thus, while safety leaders are increasing their belief in the power of observation and feedback to improve behavior, companies are apparently slow to apply appropriate feedback measures to evaluate and improve their safety programs. This is likely not due to inconsistencies between people's beliefs and behaviors, but rather to management system variables that prevent a paradigm shift from an outcome-based and reactive evaluation process to one focused on up-stream process activities that contribute to the prevention of workplace illnesses and injuries.

STUDY 2: WHAT FACTORS DISTINGUISH SUCCESSFUL FROM UNSUCCESSFUL BEHAVIOR-BASED SAFETY PROGRAMS?

It was originally proposed that ten companies reporting exemplary success implementing a BB safety process and ten companies reporting unsuccessful implementation of a BB safety process be selected for site visits. We quickly found that distinguishing between an effective BB safety process and an ineffective BB safety process was not simple. The majority of organizations returning surveys reported a decrease in incident and injury rate. And companies with a poor safety record were not apt to volunteer for a safety visit. As an alternative approach, we decided to approach site visits with the perspective of identifying themes or patterns of factors related to success vs. failure.

To date, we have conducted 14 of the 20 proposed site visits. During the site visits, the teams conduct one-on-one interviews and hold focus-group meetings to discuss reasons for program successes/failures, and to explore strategies for improving the long-term implementation of a BB safety process. A separate group meeting is held with members of the plant safety steering committee and with a random sample of hourly employees. The survey team also tours the facilities and records any visible signs of support for BB safety (such as slogans, posters, billboards, feedback charts, team meeting announcements, etc.). In sum, 26 focus groups have been conducted with a total of 245 employees (221 males, 24 females).

Table 1. *Sub-Scales of the Safety Culture Survey*

Assertiveness	Reactance	Personal Responsibility for Safety	Frequency of Positive Feedback Given
Belonging	Self-Esteem	Trust in Management	Frequency of Negative Feedback Given
Impulsivity	Self-Efficacy	Trust in Peers	Frequency of Positive Feedback Received
Optimism	Management Support for Safety	Perceptions of Safety Training Received	Frequency of Negative Feedback Received
Personal Control	Peer Support for Safety	Frequency of Observations	Propensity to Actively Care

The Safety Culture Survey with 171 items was also administered to all employees in participating organizations. The 20 different variables assessed by the Safety Culture Survey are depicted in **Table 1** above. Prior research has shown that all of the variables in **Table 1** influence industrial safety. Results obtained in the current research will uncover relations among these variables as they relate to aspects of the BB safety process. Survey data are currently being completed and returned, and are not yet analyzed. Results discussed here rely on information gathered during structured interviews and focus-group sessions conducted at 14 sites.

Results from structured interview and focus groups. Site-visit interviews and focus groups have provided a wealth of relevant information. Qualitative data collected so far have enabled us to begin identifying patterns and trends within organizations visited. Specifically, responses from employees have helped to uncover factors that appear to act as obstacles across organizations, as well as factors that facilitate a BB safety process.

Employee perceptions of observation and feedback. One of the primary techniques used to change behavior in a BB safety process is observation and feedback. If an organization is new to BB safety, the observation and feedback process can be perceived as threatening to many of the employees. Indeed, one of the most frequently voiced concerns by employees is that such a procedure is implemented for identifying and punishing those individuals who do not wish to perform their jobs safely.

In an attempt to alleviate some of these suspicions, many organizations make participation in their observation and feedback process voluntary. The assumption is that a voluntary process will be less threatening to employees. As the resistors see their fellow coworkers taking part without negative consequences, their own trust in the process grows and eventually they also volunteer.

It is a common perception that those employees with the opportunity to choose whether or not to participate in the observation and feedback process would be more accepting and positive in their regard for the process in comparison to those employees without such a choice. A content analyses of the data collected during focus groups suggest this may not be the case.

Specifically, during focus group sessions, one of the questions asked employees was how they felt about the observation and feedback processes. A total of 51 comments (31 positive and 20 negative) were recorded. Results indicate no more positive regard for observation and feedback in those organizations using a voluntary process (n=8) than those organizations using a mandatory process (n=5). Although not significant, the correlation between using voluntary observation processes and positive regard was -.28. (Positive regard was determined by subtracting the number of negative verbal responses from the number of positive verbal responses).

Further analyses of specific responses gives additional insight into what employees like and dislike about using observation and feedback. The most frequent positive comments indicated a perception that observation and feedback is beneficial because it increases one's awareness of safe and at-risk behaviors (n=10).

In contrast, the most frequent negative comments dealt with employee perceptions that inappropriate or negative feedback is given too often (n=4). For observation and feedback methods to be successful, the feedback must focus on the positive. When questioned about the observation and feedback process, those employees who were most vocal against the process pointed to the frequency with which negative feedback was occurring (reflected in statements like "Inappropriate feedback is often given;" "I give permission to be observed, then I'm made to look bad;" "The observers are looking for negatives."). Consequently, if employees use the observations as opportunities to criticize a fellow employee, the process will likely meet with substantial resistance.

Management involvement. An additional issue encountered by organizations in the BB safety journey involves deciding the role management should play in the process. Is it beneficial for management to play a controlling role in the BB process, or should the process be more bottom-up (employee driven)? Does management need to be involved in the training? Should management be allowed to perform behavioral observations of line workers? Should managers' behaviors be observed?

There were 25 responses obtained for the question regarding management involvement (12 positive, 10 negative, 3 other). A content analyses of the responses revealed that most employees from the organizations (n=8) visited had more positive than negative comments regarding management involvement in the BB process.

It should be noted however, that these organizations stressed the importance of management's role as *supportive* rather than *directive*. In other words, management involvement was perceived as positive as long as it did not become overbearing. The overwhelming consensus was that the driving force behind the BB efforts should be found at the level of the hourly employees.

With regard to direct management involvement in the process, reactions were mixed. Some employee groups suggested the more management was involved the better (as evidenced by the quote "They should to be involved because a team means everyone."). Other employee groups felt direct management involvement was a bad idea (as reflected in the consensus comment "Less management involvement is better, support is good if direct involvement is minimal."). Those groups that discussed management involvement as a factor that would inhibit BB safety pointed to issues of trust as crucial in determining their perceptions. Management involvement should follow successful efforts to build interpersonal trust.

In sum, while all those interviewed agreed management support is a necessity, perceptions regarding degree of direct management involvement in the process were mixed. In deciding the role management will play in the process, an organization would do well to heed employee perceptions on this issue. If safety has traditionally been top-down (management driven) in a particular culture (as reflected in the slogan, "safety is a condition of employment"), then it may be most advantageous for that organization to initially keep management involvement to a minimum, at least initially.

Safety steering committees. Several factor concerning the safety steering team were found to have influences on BB safety efforts. Effective safety efforts require careful selection and grooming of safety champions. Approaches used to determine committee membership vary greatly, from allowing anyone to volunteer to an extensive selection and interview process. The individuals who compose the BB safety steering committee play a critical role in the success or failure of the process. Because of the importance of this team, it is critical an organization be selective in determining committee membership.

A committee which does not have the respect of its coworkers (reflected by comments like "People just want overtime;" "I don't even know who is on it;" "They're brown-nosers;" "Some of those committee members are the most unsafe workers we got. Does that make any sense?") may experience more difficulties in getting employee participation as compared to a committee that does command such respect (reflected by comments like "They are dedicated and try hard;" "The facilitators really help get things done."). Due to the significance of the behavior-based steering committee, organizations would benefit from selecting employees who are viewed as leaders and are respected by the workers in their area.

A total of 48 responses (13 positive, 25 negative, 10 other) have been recorded for the item asking employees about perceptions of the BB safety steering committee. A content analysis of these items revealed the positive comments mentioned most often indicate employees feel members on the committees' are well-intentioned and serious about safety (n=5). The most common negative responses centered on perceptions that employees on the committees' tend to be "out of touch" and spend too much time in meetings (n=6).

Key ingredients to BB safety success. In addition to issues discussed above, participants in all focus groups were asked to indicate factors they perceived necessary for an organization to achieve success with BB safety. To date, 126 responses have been recorded. A content analysis of these responses has uncovered useful information for understanding what employees are looking for in a BB safety program.

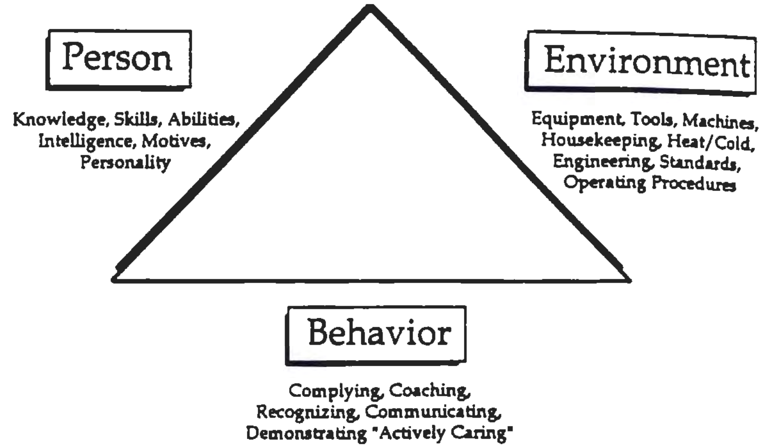


Figure 2. *The Safety Triad (Geller, 1996)*

Responses were categorized using a systems perspective of industrial safety. Specifically, it is argued that in order for one to fully understand levels of safety within an organization, one must be aware of behavior-based factors, person-based factors, and environment-based factors. These three factors are dynamic and interrelated, so as one changes so do the others (Bandura 1977, 1997). A graphical representation of a systems perspective to injury prevention, commonly referred to as the Safety Triad (Geller, 1996), is given in **Figure 2.**

Using a systems perspective, all responses recorded during focus groups were categorized as either a behavior-based, person-based, or an environment-based key ingredient for BB safety. The classification of each response was performed by two subject-matter experts who reached consensus on each item.

Table 2. *Most Frequent Responses to Key Ingredients Question*

Category	Most Frequent Items	Frequency
Person-Based (n=49)	1. Trust	10
	2. Proper Attitude	4
	3. Knowledge of Process	3
Environment-Based (n=40)	1. Management Support	16
	2. Accountability	2
	3. Training	2
Behavior-Based (n=37)	1. Involvement	9
	2. Communication	5
	3. Looking out for self/others	5

Results of the analysis revealed a majority of BB key ingredients focused on person-based factors (49). The next highest number of responses were classified as environment based factors (40). And the fewest number of responses were classified as behavior-based (37). Individual responses were examined within each of the factors to determine which were most common. The most common responses for each of the system factors are displayed in **Table 2.**

Biggest obstacles to BB safety success. The analyses performed for key ingredients to BB safety success were repeated for obstacles experienced. The same person-behavior-environment classification scheme was used. At present, 101 responses have been recorded.

Results of the analysis revealed the majority of BB obstacles manifested in the environment-based factors (55). The next highest number of responses were classified as person-based factors (33). And the fewest number of responses were classified as behavior-based responses (13). The most common responses for each of the system factors are displayed in **Table 3.**

Table 3. *Most Frequent Responses to Biggest Obstacles Question*

Category	Most Frequent Items	Frequency
Environment-Based (n=55)	1. Lack of Resources	14
	2. Previous Failed Programs	7
	3. Paperwork	5
Person-Based (n=33)	1. Lack of Trust	7
	2. Poor Attitudes	4
	3. Lack of Buy-In	4
Behavior-Based (n=13)	1. Lack of Communication	2
	2. Lack of Participation	2

STUDY 3: APPLICATIONS OF STRATEGIES TO INCREASE SAFE DRIVING: A SYSTEMATIC EVALUATION OF INTERVENTION EFFECTIVENESS AFTER A DECADE OF CULTURE CHANGE

Despite mandatory belt-use laws (BULs) and engineering strategies designed to protect vehicle occupants, many motorists still refuse to use the devices provided to safeguard them. This study had three primary objectives: a) to investigate the use of safety belts among industry workers after a decade of culture change, influenced in part by a mandatory BUL, b) to test the impact of several common behavior change techniques on the safe driving behaviors of industry employees, and c) to study generalization between changes in safety-belt use and the use of turn signals.

Our recent observations of employees revealed remarkable increases in baseline safety-belt use from 1982, and a significant difference in mean belt use among wage (46%, n= 2,897 observations) and salary (65%, n= 1,744 observations) workers. More than a decade earlier, Geller, Davis, and Spicer (1983) found that during baseline, mean use of safety-belts among industry workers at the same plant was only 3.4% for wage workers and 17.4% for salary employees. At that time, an incentive program increased mean belt use more effectively among salary (50.6%) than wage (5.5%) employees.

Since the 1982 research, Virginia has instituted a mandatory BUL. The state average of safety-belt use remains near 70% which approximates the national average of 67% (Novack, 1995). The current study describes a systematic effort to increase safety-belt use among workers not influenced by Virginia's BUL.

Subjects and Setting. Subjects consisted of 556 hourly and salary employees at an engine bearing manufacturing plant in southwest Virginia. The population of employees ranged in age from 19 to 63 years, and employee tenure at the facility ranged from six months to more than 25 years. The proportion of hourly to salary workers was approximately five to one.

Procedure. Trained research assistants sat in two distinct parking lots of the facility during the first shift arrival, second shift arrival/first shift departure times for hourly workers, and at the arrival and departure time for salary employees during the regular work week. A minimum of three data collection times was scheduled at each lot every weekday.

Observers collected data on driver gender, safety-belt use, turn-signal use, complete stops at a parking-lot stop sign, the presence or absence of traffic, and whether the targeted vehicle was entering or leaving the parking lot. Information on weather conditions (e.g., clear or rain, etc.) and road conditions (e.g., dry or wet, etc.) and the time of day were indicated on the data sheet.

To assess inter-observer reliability, a second independent observer collected data with the primary observer on 30 percent of all observation sessions. As it was impossible to record data on every vehicle entering or leaving the parking lots, the primary observer identified vehicles to observe by calling out their make and color (e.g. the red pick-up) as they passed an obvious stationary landmark. Interobserver reliability exceeded 90% for all measures collected.

Design and intervention techniques. Over the course of two years and after four weeks of baseline observations, a series of progressively more invasive interventions was implemented at the facility to test the validity of the MIL model. Interventions in sequential order consisted of written prompts for the hourly workers, written prompts for the salary workers, plant-wide written prompts, an employee safety-slogan contest and celebration, assigned goals, assigned goals with performance feedback, and a pledge-card commitment. Detailed descriptions of each respective intervention appear below.

1. ***Written prompt:*** This intervention consisted of a flyer displaying the logo of the industry and a message selected by a safety steering committee of wage workers which read: "*We Buckle-Up Because Safety is Not Only for the Workplace.*" These flyers were first attached to the paychecks of all wage employees and two weeks later all salary employees. After the initial attempts to prompt salary and wage employees separately, the same prompt was displayed plant-wide on table tents in the workers' cafeteria, in bathrooms above hand dryers, and on doors located in strategic places throughout the plant. (Interventions B, C, and D respectively in **Figures 3** and **4**)
2. ***Plant-wide safety slogan and safety celebrations:*** A celebration announcing the winner of a plantwide safety slogan contest was scheduled near the Christmas Holidays during the first year of the research. This celebration consisted of rewarding the winner with a $50 gift certificate to a store of their choice. When the research team learned of this event, Vince and Larry (the famous Crash Test Dummies) made an appearance at the plant during the scheduled celebration to distribute posters featuring two prominent Virginia Tech football players encouraging safety-belt use. The event occurred between workshifts one and two to increase involvement, and included refreshments and photograph sessions with the dummies. (Intervention E in **Figures 3** and **4**)
3. ***Assigned goal-setting:*** This intervention involved setting a specific, difficult, but attainable goal for plant-wide safety-belt use. Feedback about the current amount of safety-belt use among employees was not provided. Flyers displaying the plant logo, winning safety slogan ("Bearings in Mind, Safety First!"), and set goal were posted on table tents in the workers' cafeteria, in bathrooms above hand dryers, and on doors located in strategic places throughout the plant. These flyers were inspected weekly by research assistants and the plant safety manager for damage, and loss. Damaged and missing flyers were replaced throughout the goal-setting intervention. The goal was set at 80%, approximately 25% above their current rate of belt use. It met the criteria for effective assigned goals in that it was specific and difficult, but achievable. (Intervention F in **Figures 3** and **4**)
4. ***Goal-setting plus feedback:*** This intervention was identical to the goal-setting intervention described above with one noteworthy exception --feedback in written and graphical form on

the plant-wide safety-belt use from the previous week was included on the flyer. This feedback was updated weekly, and new flyers were posted during first shift each Monday. As a result of an employee suggestion, after an initial period of feedback, the flyers were done in bright colors which were changed weekly to attract attention. (Intervention G in **Figures 3** and **4**)

5. ***Pledge-card commitment:*** This intervention consisted of written pledge-cards distributed to all employees with their paychecks. The voluntary pledge encouraged safety-belt use for a two week period. The pledge cards contained the company logo, the winning safety slogan and a formal statement promising the use of safety-belts throughout the pledge period. The pledge also contained a location for the employees to sign, and a box they could check if they would allow their pledge to be posted in the plant. Pledges indicating posting (n = 200, 82% of the signed pledges) were laminated on a 4 foot by 4 foot poster-board and posted on the plant safety bulletin board after the second week of the pledge period. Blank pledge-cards were distributed next to the signed pledges and labeled "Second-Chance Pledges." This was done to encourage workers who had not initially pledged to do so. The initial pledge period was extended an additional two weeks. New pledges (n = 31) were posted (with approval) at the time they were signed. The flyers displaying the safety-belt use goal and performance feedback were posted as described above throughout the pledge period. (Interventions H and I respectively in **Figures 3** and **4**)

6. ***Return to baseline:*** Each return to baseline was marked by removal of all intervention materials. Trained research assistants continued their observations as usual during baseline periods. (Represented by A in **Figures 3** and 4)

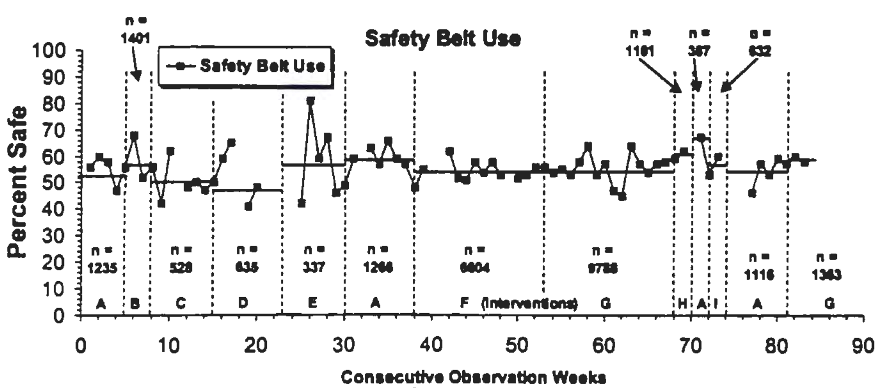


Figure 3. *Percent safety-belt use over duration of study.*

Safety-belt use. **Figures 3** and 4 display the weekly percent of safety-belt and turn-signal use respectively for all employees throughout the research. Vertical lines indicate the introduction of a new intervention or return to baseline as described above. Horizontal lines represent the mean percent safe for each specific phase of the research. The number of observations per phase are indicated above each intervention condition.

A visual inspection of the data indicate some surprising results. Most noteworthy are the lack of significant increases in safety-belt use, the target behavior, as interventions became more intrusive. Of particular interest is the lack of impact resulting from the addition of performance feedback to the initial goal-setting intervention. Previous research (e.g. Sulzer-Azaroff, Loafman, Merante, & Hlavacek, 1990) suggest that timely feedback would have an additive effect with goal-setting done alone. The absence of this effect may have resulted from the failure of the initial goal-setting strategy to influence safety-belt use (54% n = 6604 observations) significantly above the baseline mean (52%, n = 1235).

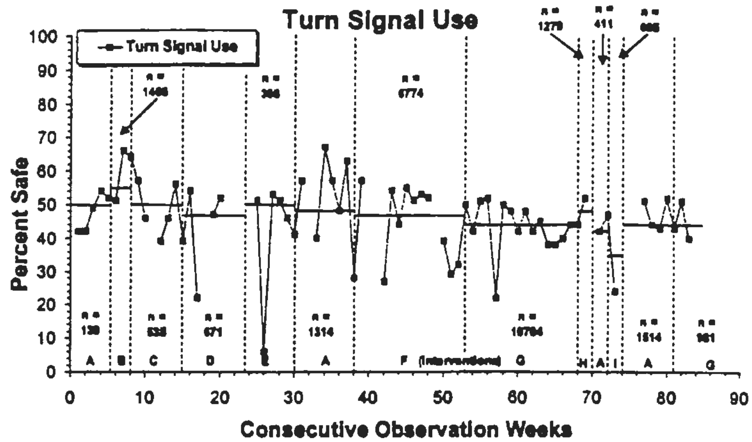


Figure 4. *Percent turn-signal use over duration of study.*

A closer look at the data indicate that the most powerful intervention to date was the employee selected safety slogan contest and celebration. This intervention resulted in an immediate increase in safety-belt use for six weeks to 57% (n = 337) and a longer-term maintenance of 58% (n =1266) during a subsequent six-week return to baseline. These increases resulted after three attempts to prompt the use of safety belts resulted in a decrease of safety-belt use to 47% (n = 637) during the plant-wide prompt condition.

Intrinsic motivation theory would suggest that the beneficial impact of the safety-slogan contest resulted because it was developed "in-house" as opposed to the other efforts which were imposed by "outside" researchers. Similarly, Boyce and Geller (1998) describe the powerful effects of using indigenous personnel on maintenance of safety-related behaviors in their conceptual review of the industrial safety literature. This intervention was also the only one associated with a monetary consequence for participation. Although not contingent on safety-belt use, employees participating in the contest may have felt the need to match their behavior to their thoughts about safety as a result of submitting a slogan. This result is consistent with the literature on cognitive dissonance (Festinger, 1957). It is particularly noteworthy that approximately 59% of the workers submitted a legitimate safety slogan. This level of participation matches the proportion of employees using their safety belts during this phase of the research. The modest increase in safety-belt use above baseline suggests that the contest may have influenced some safety-belt nonusers, but it is likely that the majority of the slogans were submitted by workers who already used their safety belts.

The only intervention to date that has had similar effects was the pledge-card commitment campaign. Two-hundred and seventy-five (49%) of the workers signed the buckle-up pledge. This strategy increased safety-belt use to 61% (n = 1161) during the two week pledge period. An increase to 67% (n =387) was observed during a return to baseline, but upon posting the pledges publicly, use of safety-belts dropped to 57% (n = 632), the level obtained during the safety slogan contest.

Like the voluntary slogan contest, the voluntary pledge technique provided employees with choice, and thus may have enhanced internal control as predicted by intrinsic motivation theory. It is noteworthy that safety-belt use decreased when pledge-cards were posted. It could be speculated that upon public posting (done by research personnel) some of the feelings of personal control and ownership established by the initial voluntary pledge was diminished, resulting in observed decreases of the target behavior. As of this writing, safety-belt use in a goal-setting plus feedback phase remains near 60% (n = 1363 observations), 10 percentage points higher than the initial baseline taken nearly two years ago.

Turn-signal use. Although not targeted, turn-signal use was observed in general to decrease throughout the course of the research. During the initial phases of the study, turn-signal use covaried positively with safety-belt use, suggesting support for response generalization (RG) theory (Bandura, 1969; Carr, 1988). This theory proposes that some behaviors (e.g., safe-driving behaviors) are organized in a class of functionally-related responses. As a result, RG theory predicts an increase in one safe behavior will be accompanied by increases in other related safe behaviors. Firm conclusions cannot be drawn, however, because of the failure of the interventions to impact the target behavior, safety-belt use.

A systematic relationship between turn-signal use and the use of safety-belts was lost after the first return to baseline. Visual inspection of the data indicates that turn-signal use did not differ markedly throughout the course of research from the baseline mean of 50% (n = 1190), but trended downward to its current level of 46% (n = 1301). Thus from the big picture, the trend upward in safety-belt use (10% over initial baseline) coupled with the trend downward in turn-signal use (4% below baseline) would support risk compensation (RC) theory (Peltzman, 1975). That is, as people perceive themselves to be less at-risk in some situations, they will compensate by taking more risks in others.

Conclusions. Overall, these data support the MIL model. That is, one could argue that the antecedent strategies used to motivate safety-belt use in the current research are all first level interventions, less powerful than Virginia's BUL. As such it follows that the hard-core resistors, not influenced by the BUL, would not be impacted by repeated applications of lower level interventions. As suggested by the MIL, the modest improvements seen in the use of safety belts may have been in part due to the involvement of belt users as intervention agents to get some non-users to buckle-up. Modeling appropriate behavior has been shown to increase the likelihood of others emitting the desired response by: a) demonstrating the ease at which it can be done; b) making more salient the costs versus benefits of the target behavior; and c) changing cultural norms regarding the behavior.

STUDY 4: THE EFFECTS OF EMPLOYEE INVOLVEMENT ON BEHAVIOR-BASED SAFETY

This research evaluated intervention procedures commonly taught by industrial safety trainers and consultants as part of a BB safety process. More specifically, this research studied the effects of involving employees in the development and implementation of BB safety interventions as opposed to the typical top-down approach to occupational safety.

Training BB safety. The BB safety process at a large manufacturing plant in southwest Virginia began by training volunteer safety facilitators from representative areas and then conducting facility-wide training sessions for the remaining employees (n=550). The format of the training sessions was manipulated in order to investigate the impact of employee participation during BB safety training. The materials for all sessions were held constant. However, the safety trainers in the *Choice* condition (n=230 on Shift 1) were instructed to ask questions and facilitate group discussion and involvement with workers. This included group exercises in which workers presented their suggestions for safety enhancement. In contrast, the same trainers in the *Assigned* conditions (n=246 on Shifts 2 and 3) presented the safety material in a lecture format without asking questions or facilitating workers' input. Further, group exercises in this condition were "yoked" from the responses of the groups in the *Choice* condition (i.e., Shift 1).

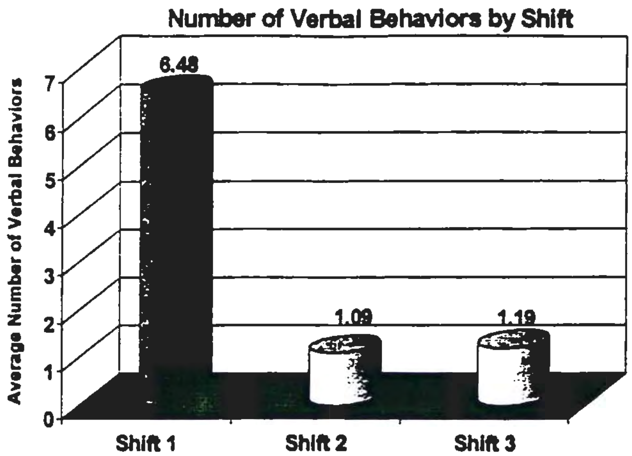


Figure 5. *Shift 1 received participative training and Shifts 2 and 3 received nonparticipative training.*

Four-hour training sessions, presented by two trainers, were held for 12 *Choice* groups and 14 *Assigned* groups, ranging in size from 7 to 30 individuals. To assess the impact of the two training approaches, three variables were measured – – the amount of verbal participation directed at the trainers, participants' reported satisfaction with the training, and the participants' retention of safety training information.

All verbal behaviors from the participants, including questions asked, questions answered, and reactive statements, were evaluated for each training session. As shown in **Figure 5**, a one-way analysis of variance (ANOVA) of verbal behavior for training format (*Choice* vs. *Assigned*) indicated that participants in the *Choice* condition emitted significantly more verbal behaviors ($M = 6.48$) than participants in the *Assigned* conditions (Shift 2: $M = 1.09$, Shift 3: $M = 1.19$, $p < .05$).

Further analyses were conducted on each type of verbal response: questions answered, reactive statements, and questions asked. As shown in **Figure 6**, a one-way ANOVA of questions answered per Shift indicated that participants in the *Choice* condition answered significantly more questions ($M = 4.02$) than participants in the *Assigned* condition (Shift 2: $M = .35$, Shift 3: $M = .38$, $p < .05$). As illustrated in **Figure 7**, a one-way ANOVA of reactive statements per Shift indicated that participants in the *Choice* condition made significantly more reactive statements ($M = 2.32$) than participants in the *Assigned* conditions (Shift 2: $M = .67$, Shift 3: $M = .73$, $p < .05$).

Additionally, a one-way ANOVA of questions asked per Shift indicated no significant difference in the average number of questions asked by participants in the *Choice* ($M = .14$) and *Assigned* conditions (Shift 2: $M = .08$, Shift 3: $M = .08$, $p > .05$). Overall, these findings suggest participants in the *Choice* condition were significantly more involved in the training process than employees in the *Assigned* condition, although there were no differences in number of questions from participants.

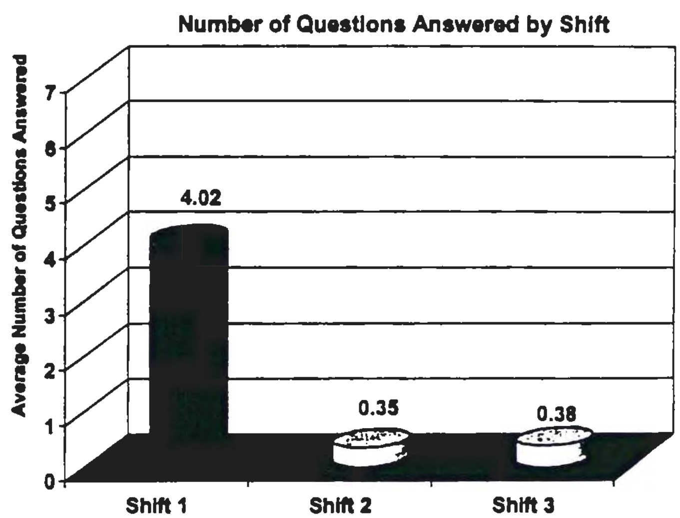


Figure 6. *Shift 1 received participative training and shifts 2 and 3 received nonparticipative training.*

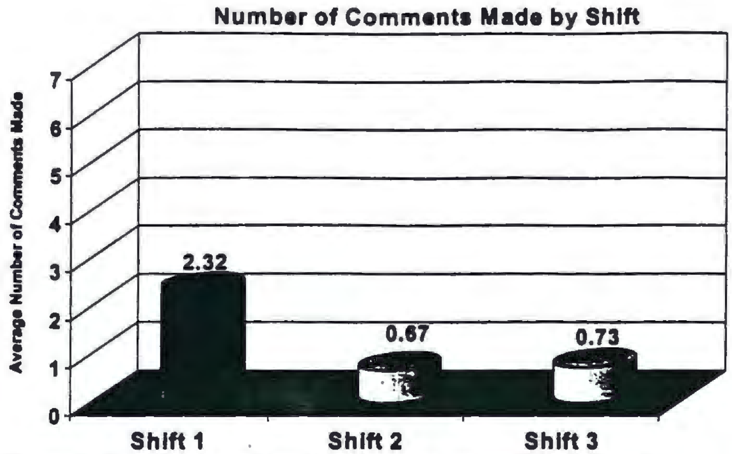


Figure 7. *Shift 1 received participative training and Shifts 2 and 3 received nonparticipative training.*

Participants' responses to the following post-training questionnaires were also evaluated: a) an 18-item knowledge test, b) a 5-item measure of involvement, and c) a 1-item measure of satisfaction with the training. As illustrated in **Figure 8,** a one-way ANOVA by Shift indicated no significant differences between the knowledge scores of participants in the *Choice* ($\underline{M}$ = 66.6) and *Assigned* conditions (Shift 2: $\underline{M}$ = 68.9, Shift 3: $\underline{M}$ = 66.5, $\underline{p} > .05$).

Analyses of participants' perceptions of involvement using a one-way ANOVA by Shift indicated no significant difference between the perceived involvement of participants in the *Choice* ($\underline{M}$ = 3.44) and *Assigned* conditions (Shift 2: $\underline{M}$ = 3.58, Shift 3: $\underline{M}$ = 3.70, $\underline{p} > .05$). Finally, analysis of participants' self-reports of satisfaction with the training process using a one-way ANOVA by Shift indicated that participants in the *Choice* condition (Shift 1) were more satisfied with the training process ($\underline{M}$ = 2.56; 1 = *strongly liked,* 7 = *strongly disliked*) than Shift 3 participants in the *Assigned* condition ($\underline{M}$ = 3.05, $p > .05$). The satisfaction of Shift 2 participants in the *Assigned* condition ($\underline{M}$ = 2.80) was not significantly different from the satisfaction of participants in the *Choice* condition.

These results were counter to our hypothesis that participative training would be more effective and appreciated than nonparticipative training. The lack of significant differences between conditions regarding information retention, satisfaction, and involvement suggest that: a) group participation may not be directly measurable by verbal behavior alone, b) the nature of the training material itself may have involved workers cognitively, or c) *Choice* training simply may not be more effective than *Assigned* training in terms of information retention and personal satisfaction.

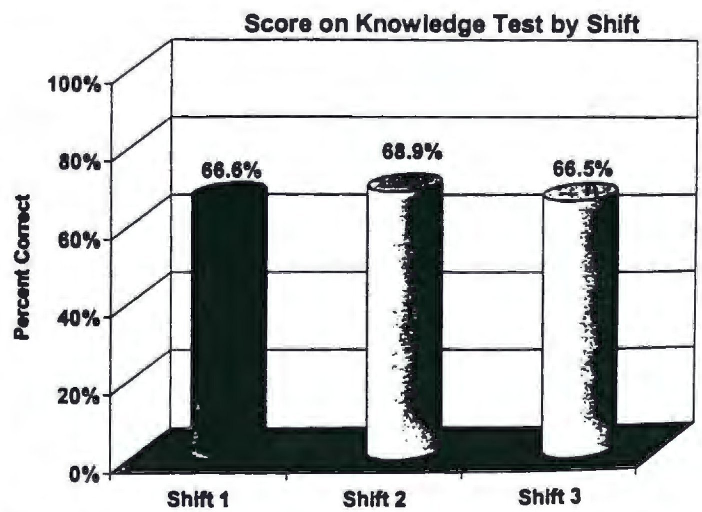


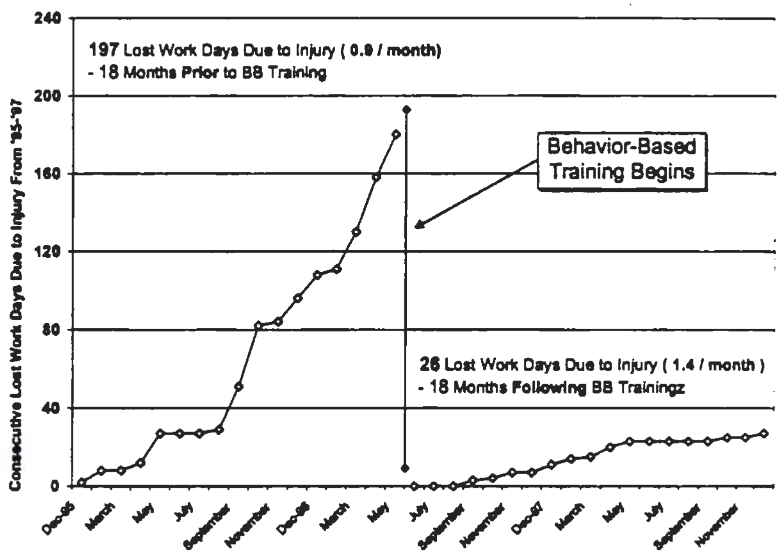
Figure 8. *Shift 1 received participative training, and Shifts 2 and 3 received nonparticipative training.*

Implementing BB safety. Many involvement manipulations were made to give the Shift 1 facilitators (n=8) as many opportunities to make key decisions in the BB safety process as possible. For example, the Shift 1 safety facilitators selected: a) the initial safety-related behavior to observe plant-wide (hearing protection was chosen), b) the design and location of group feedback prompts, c) the initial plant-wide safety intervention, d) the design of a safety slogan contest, and e) the safety-related behaviors to observe in individual work areas. The choices made by the Shift 1 safety facilitators were assigned (or yoked) to the Shift 2 safety facilitators (n=6), thus limiting Shift 2 input into the BB safety process. This extended the *Choice* vs. *Assigned* manipulations implemented during training.

For nine weeks, the safety facilitators of Shift 1 (n=230) and Shift 2 (n=210) made behavioral observations on hearing protection. The data were graphed and posted on a safety bulletin board located at the entrance to the production areas of the plant. The dependent measure used to assess facilitator involvement was number of observations taken.

Results and discussion. Over the nine-week period, the Shift 1 facilitators ($\underline{n}$ = 8) made significantly more observations per facilitator per week ($\underline{M}$ = 10.57, $\underline{SD}$ = 3.39) than the Shift 2 facilitators [($\underline{n}$ = 6, $\underline{M}$ = 6.13, $\underline{SD}$ = 3.76, $\underline{t}$ (16) = 3.1, $\underline{p}$ < .05]. Also, the Shift 1 facilitators observed a significantly greater [$\underline{t}$ (8) = 2.6, $\underline{p}$ < .05] percentage of their shift than did the Shift 2 facilitators (37% vs. 23%, respectively). Shift 1 facilitators also took significantly more observations per person each week than the Shift 2 facilitators [$\underline{t}$ (16) = 3.05, $\underline{p}$ < .05].

These findings show promise regarding the effects of giving employees choice regarding the implementation of a BB safety process. In addition, a time series tabulation of this plant's injury statistics shows the bottom-line beneficial impact of the BB safety process across all three shifts (see **Figure 9**). Lost days due to injuries decreased markedly after the BB safety training and observation/feedback programs were put in place (10.9 lost days per month prior to BB safety versus 1.5 lost days per month after the initiation of BB safety).



STUDY 5: EFFECTS OF SELF-OBSERVATON ON SAFE DRIVING PRACTICES

Self-management (Mahoney, 1971, 1972) is an improvement process whereby individuals change their own behavior in a goal-directed fashion by: a) manipulating behavioral antecedents, b) observing and recording specific target behaviors, and c) self-administering rewards for personal achievements (Kazdin, 1994; Watson & Tharp, 1997). The practical benefits of self-management processes have been demonstrated in numerous clinical settings, including the reduction of alcohol consumption (Sobell & Sobell, 1995), weight control (Baker & Kirschenbaum, 1993), and smoking cessation (Curry, Marlatt, & Gordon, 1987; Shiffman, 1984).

Social cognitive theory (Bandura, 1991) suggests that self-observation is one of the primary components of the self-regulation of behavior change. According to Bandura (1991), critical elements in the application of self-observation include specific self-set goals, and a belief in the "value" of behavior change. Research also indicates that perceptions of choice and increased self-awareness of specific behaviors can focus individuals' attention on behavior improvement (Binswanger, 1991). In addition, the impact and maintenance of a self-management effort is determined by an individual's ability to sustain focus on the consequences motivating behavior change (such as avoiding injury).

Need for Self-Management in Safety

While a variety of procedures have been developed to improve safety performance (i.e., reward systems, feedback), most rely on the interpersonal observation of behavior by supervisors or coworkers. While these techniques have been effective in increasing safety, there is a need for effective behavior-change techniques among solitary workers and for infrequent safety-related behaviors (such as lockout-tagout), which are not likely to be observed in most behavior-based coaching systems.

Self-management strategies. Research indicates that five self-management procedures can facilitate behavior change: a) activator management, b) social support, c) goal-setting, d) self-observation and self-recording, and e) self-rewards.

Activator management involves identifying environment, behavior, and person factors that precede the occurrence of safe and at-risk behaviors. Strategies are then employed to eliminate activators that precede at-risk behaviors and add activators to increase the probability of safe behaviors (i.e., reminder messages to direct target safe behaviors).

Creating a supportive environment can also improve self-management success (Stuart, 1967). Sources of social support can include supervisors, coworkers, friends, and family who can encourage the targeted behaviors (Heinzelman & Bagley, 1970; Lawson & Rhodes, 1981; Moss & Arend, 1977). For example, social support can include positive feedback and encouragement for personal successes (Perri & Richards, 1977), particularly when self-observation data is displayed so others can see accomplishments (Taylor, Neter, & Wayment, 1995). Additionally, specific behavioral goals should be: a) set high, yet b) be achievable, c) specify expectations for improvement, and d) include the tracking of progress (Geller, 1996, 1997).

Regularly engaging in the self-observation and self-recording of specific behaviors is also a key component of self-management (Bagozzi, 1992; Kazdin, 1994). Self-observation involves observing one's own target behavior soon after it occurs, as well as noting related environmental events that precede and follow the target behavior (Watson & Tharp, 1997). Recording the occurrence of safe and at-risk behaviors provides an objective record of current safety performance; and charting progress toward reaching specific behavior-based safety goals provides feedback on achievements, and identifies areas for improvement.

Finally, using self-rewards to recognize personal achievement motivates continued self-management. While self-management techniques are new to the field of occupational safety, studies in clinical settings indicate that individuals who use self-rewards are more likely to: a) sustain attempts to change their behavior, and b) maintain behavior change (Watson & Tharp, 1997). However, the efficacy and "social validity" of using self-rewards to improve personal safety in the workplace needs to be established.

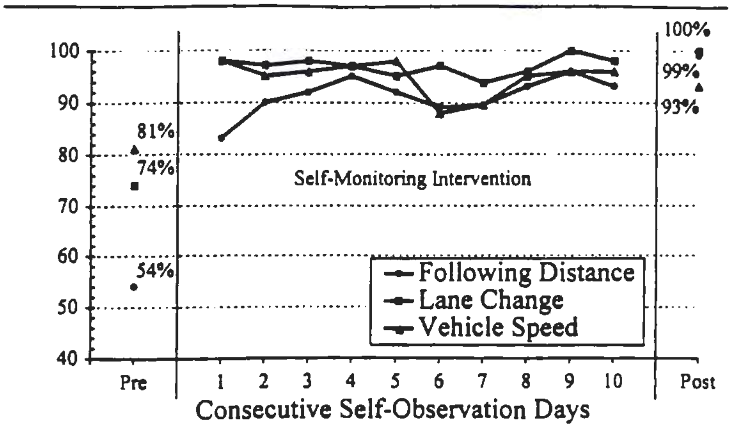


Figure 10. *Percent safe before (Pre) and after (Post) the self-monitoring intervention and as reported by the drivers on their self- monitoring forms (1 - 10).*

Implementing safety self-management. Self-management is typically a six-step process, including: a) establishment of a behavioral baseline using self-observation, including the identification of antecedents and consequences associated with the occurrence and non-occurrence of the target behaviors (Cormier & Cormier, 1991); b) identification of target behaviors (Cervone & Scott, 1995); c) selection of a self-management strategy to promote desired behavior change and chart progress; d) selection of a goal which is specific, motivational, attainable, recordable, and trackable (Geller, 1996); e) self-observing and self-recording of target behaviors to measure progress toward the goal (Kirschenbaum et al., 1982), and f) administration of self-rewards that are accessible, individualized, valued, varied, and follow the targeted behavior as immediately as possible (Cormier & Cormier, 1991).

Identification of target behaviors can be accomplished by: a) reviewing injury and crash data, b) analyzing "near misses," and c) most importantly, evaluating previous behavioral observations to identify individual problem areas. Since self-management is a self-directed process, the most beneficial approach to identifying target behaviors is for individuals to survey their own work practices to determine personal at-risk behaviors.

Self-observation of behavior has been shown to be effective at identifying and changing behavior within clinical psychology. To date their has been little research on the use of self-observation to improve individual safety-related performance in work settings, and more specifically, driving behavior. This study investigated the viability of using self-observation technology to increase the safe driving of short-haul truck drivers.

Method. A sub-sample of 12 male drivers from Site A (self-observation) and 11 male drivers from Site B (control) were randomly selected to evaluate the self-observation intervention. During the week prior to implementing the self-observation intervention, trained research assistants observed the driving behaviors of participants while riding in the passenger seat of their delivery truck. All employees at Site A (n = 30) were then asked to complete a self-observation checklist each work day for a two-week period.

While on their sales routes, participants recorded the following behaviors when arriving at each of their accounts: a) use of running/head lights, b) safety-belt use, and c) walking around the vehicle before leaving account. At the end of the day, participants estimated their percent safe on the following behaviors: a) following distance, b) lane change, c) traffic lights, d) complete stops at stop signs, and e) vehicle speed.

Self-observation forms were collected and graphed on a daily basis. These graphs were posted in a break room where employees gathered before and after their routes each day. The self-observation data which were graphed each day are presented in **Figure 10**.

Self-observation occurred on ten consecutive work days. During the week following the intervention, research assistants again observed the driving behaviors of the drivers during a ride-along. Since only one observer was permitted to ride with each participant, it was necessary to assess reliability (inter-observer agreement) of the driving measures in an alternative setting using the same observers. The inter-observation reliabilities for all behaviors were above .88.

Results. A percent safe score was calculated for each participant's driving behaviors by dividing the number of safe behaviors by the number of safe and at-risk behaviors. A total percent safe score was also calculated based on the total number of safe behaviors (collapsed across all driving behaviors). An ARCSIN transformation was calculated on all percent safe scores. A 2 Time (pre- vs. post-intervention) x 2 Group (self-observation vs. control) mixed model ANOVA was calculated for each dependent variable. Results indicated a significant Time x Group interaction for overall percent safe, $p < .05$. Follow-up analyses indicated that overall safety did not improve in the control group (from 71.5% to 75.4%), $p > .05$. In contrast, there was a significant increase in the overall safety of the self-observation group (from 66.8% to 87.8%), $p < .05$.

Based on this finding, each driving behavior was examined separately. Sample sizes varied for each analysis because there was no opportunity to observe some behaviors for some drivers on neither the first nor second ride-along. Thus, n-sizes are reported for each analysis. As shown in **Figure 10**, results indicated a significant Time x Group interaction for lane changes, $p < .01$ and following distance, $p < .01$. Follow-up analyses indicated that safe lane changes and following distances *did not* improve in the control group (from 94.3% to 81.9% for lane changes, $n = 5$; from 64.4% to 75.0% for following distance, $n = 5$), $ps > .05$. In contrast there was a significant increase for both lane changes and following distance in the Self-Observation group (from 0.0% to 100.0% for lane changes, $n = 5$; from 48.1 to 96.9% for following distance, $n = 7$), $ps < .05$. No other effects were significant for the remaining driving behaviors, but they were in the expected and desired direction.

Discussion. Self-observation may be one of the most effective behavior change techniques in situations where social support is not available. In fact, it is the only technique that can be applied by solitary workers without extensive support from supervisors and coworkers. Self-management is non-invasive, simple, and practical. If self-management activities can be integrated with other job activities, safety practitioners will have an effective tool for improving safety-related behaviors that occur when there is little or no opportunity for interpersonal BB observation and feedback (as with low base-rate behaviors like lockout-tagout, and with workers who work alone). The successful integration of self-management behaviors into daily work tasks is invaluable for the maintenance of safe work practices.

EXECUTIVE SUMMARY

Our comprehensive review of the research literature turned up convincing evidence that a BB approach to occupational safety can be extremely effective at reducing at-risk behavior and workplace injuries. A key ingredient of every effective BB intervention was observation and feedback. In other words, participants need a mechanism for learning what to do differently in order to prevent the possibility of personal injury. Little is known, however, about the best way to implement a BB observation and feedback process, nor has there been any systematic study of the organizational factors needed to institutionalize a BB process for improving safety-related work practices. This defines the mission of our research reviewed here.

Our two-year project is still underway, and most of the survey data are not yet analyzed. However, the preliminary research and five experiments described here enable the following conclusions:

- Although appreciation for BB safety is on the rise, BB safety principles are rarely applied in the development of a company-wide accountability system. In other words, outcome numbers (such as total recordable injury rate) rather than process numbers (such as quality and quantity of participation) are used most often to evaluate safety performance, even on the shop floor.
- Involving employees in a BB safety training program did not facilitate knowledge gained nor personal satisfaction in the process. However, involving employees in the development of an intervention tool and protocol had prominent beneficial effects on actual implementation of an observation and feedback process.
- Marked reductions in workplace injuries occurred at two study sites immediately after a BB observation and feedback process was put in place.
- Interviews and focus groups at sites with varying success implementing BB safety indicated key roles of an employee steering committee, visible management support, one or more champions to drive the process, and personal perceptions of program ownership and interpersonal trust. The most successful organizations "do it their own way," and the procedures and support systems vary dramatically across cultures.
- A systematic evaluation of successive interventions to improve safety-belt use supported a key assumption of a mulitple intervention level (MIL) model, namely that people who are uninfluenced by a BB intervention presented at one level of intrusiveness will not be influenced by subsequent interventions with the same degree of intrusiveness. In other words, repeating the same kind of intervention process will not influence the critical resistors unless a more intense and intrusive procedure is added.
- Self-management techniques developed in clinical settings seem to be a viable behavior change tool for workers in a solitary work environment.
- And finally, we realize we have only cracked the surface in determining the critical success factors of BB safety. We will obtain much more information before our grant ends, but then we will have only begun an important discovery process. Much more research is needed in this human factors domain of industrial health and safety.

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APPENDIX G:

CRITICAL SUCCESS FACTORS FOR BEHAVIOR-BASED SAFETY: A STUDY OF TWENTY INDUSTRY-WIDE APPLICATIONS

Compete report as currently under review
for publication in the
Journal of Safety Research

EXPLORING PERSONAL RESPONSIBILITY FOR PARTICIPATION IN PROSOCIAL ORGANIZATIONAL PROCESSES: ANTECEDENTS AND CONSEQUENCES

Accepted Ph.D. dissertation proposal
based on grant research

Running Head: CRITICAL SUCCESS FACTORS

Critical Success Factors for Behavior-Based Safety:

A Study of Twenty Industry-wide Applications

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Abstract

During visits to 20 organizations currently using a behavior-based safety (BBS) process research teams conducted one-on-one interviews and held focus-group meetings to find reasons for program successes/failures, and to explore strategies for improving the long-term implementation of a BBS process. A total of 31 focus groups gave 629 answers to six different questions. A content analysis of these responses uncovered critical information for understanding what employees are looking for in a BBS program. An individual perception survey was also administered to employees in participating organizations. The survey measured a variety of variables identified in prior research to influence success in safety efforts. The survey data indicated five variables to be predictive of employee involvement in a BBS process: 1) perceptions that BBS training was effective, 2) trust in management abilities, 3) accountability for BBS through performance appraisals, 4) whether or not one had received education in BBS, and 5) tenure with the organization. Also, employees in organizations mandating employee participation in a BBS process reported significantly higher levels of a) involvement, b) trust in management, c) trust in coworkers, and d) satisfaction with BBS training. In addition, employees in mandatory processes reported significantly greater frequency of giving and receiving positive behavior-based feedback.

Critical Success Factors for Behavior-Based Safety: A Study of Twenty Industry-wide Applications

Occupational injuries due to at-risk work behavior remain a significant problem. Each year 7,000 to 11,000 U.S. workers are killed and 2.5 to 11.3 million employees suffer from non-fatal injuries. Most of these workers are in the prime of their lives (Baker, Conroy, & Johnston, 1992). In addition to these sobering statistics are those which estimate that every ten minutes in the U.S., two persons are killed and 170 people sustain a disabling injury (National Safety Council, 1988). On a daily basis, an estimated 16 workers are killed and 36,000 are injured (U.S. Department of Health and Human Services, 1998). In sum, approximately 250,000 potential productive years of life are lost annually in the U.S. because of premature death due to work-related injuries (Baker, et al., 1992).

Miller (1997) estimated that each year U.S. employers pay approximately $200 billion in direct costs associated with injuries occurring both on and off the job. Occupational injuries account for three-quarters of this total or nearly $155 billion annually. This amounts to over $1,400 per work-related injury. The majority of these costs are in the form of insurance premiums for workers and their families, as well as workers' compensation for days lost from work (Miller, 1997). And to make matters worse these estimates are likely gross under-estimations because of unreliable surveillance techniques and the fact that many injuries are not reported (Baker et al., 1992; The National Committee for Injury Prevention and Control, 1989).

In order to combat the ever-present threat of employee injury and associated losses, many organizations are implementing what is referred to as behavior-based safety (BBS). This approach to injury control has a number of advantages over more traditional approaches, including: a) it can be administered by individuals with minimal professional training; b) it can reach people in the setting where the problems occur (e.g., school, workplace, or community at large); and c) the leaders in these settings can be taught the behavior-change techniques most likely to work under specific circumstances (e.g., Baer, Wolf, & Risley, 1968; Daniels, 1989). Research has also shown BBS to be cost effective, primarily because behavior-change interventions are straightforward and relatively easy to administer, and their impact can be regularly monitored by indigenous personnel (Daniels, 1989; Geller, 1996; Geller, Lehman, & Kalsher, 1989; Sulzer-Azaroff & de Santa Maria, 1980).

Over the years, BBS has been applied frequently and successfully in various industrial settings (Petersen, 1989). For example, research has demonstrated the cost-effectiveness of: a) participative education to increase safety-belt use (Kello, Geller, Rice, & Bryant, 1988), b) incentives/rewards to increase safety-belt use (Geller, 1984; Geller & Hahn 1984), c) goal-setting and behavioral feedback to increase safety-belt use, turn-signal use, and complete intersection stopping (Ludwig & Geller, 1991; 1997) and reduce driving speed (Van Houten & Nau, 1983), and d) pledge-card commitment strategies to increase the use of personal protective equipment (Streff, Kalsher, & Geller, 1993).

Behavior-based safety starts by defining one or more critical behaviors to target. Then these behaviors are observed and recorded in particular work settings. When a relatively stable baseline measure of the frequency, duration, or rate of behavior is obtained, an intervention is implemented to change the behavior in beneficial directions. This intervention might involve removing environmental barriers, modifying a work-station, or adding antecedents or consequences to the situation to alter response probability. The frequency, duration, or rate of the target behavior is recorded during and after the intervention and compared to baseline measures of behavior to determine intervention impact (Daniels, 1989; Geller, 1996, 1998b).

Facilitating Employee Involvement in BBS

Although BBS methods are consistently effective at increasing the occurrence of safe behaviors, they can only work optimally if used throughout an organization. In other words, if employees do not "buy-in" to BBS principles, participate actively in observation and feedback sessions, and help to implement BBS intervention procedures, research describing the impact of this approach is academic (pun intended). Therefore, a primary objective of the current study was to identify organizational and interpersonal variables that inhibit or facilitate employee involvement in a BBS process. The research literature offered some guidance for our focus and for formulating hypotheses.

Providing adequate BBS training. Learning experiences can be a potent source of stimulation (Goldstien, 1993). Training programs are learning experiences designed to produce desired cognitive and/or behavior change among participants. An employee's first exposure to a BBS process often occurs during a training session. As such, employee perceptions regarding the quality and relevance of BBS training received may have great potential for determining the frequency and quality of involvement in a BBS process. However, our literature review found no empirical investigations of the relationship between perceptions of a training process and subsequent involvement in a safety program.

Mandatory versus voluntary participation. One obvious way to promote employee participation in a BBS process is to make such a process mandatory. In other words, some minimal level of participation in a BBS process could be a job requirement. A potential drawback of such a mandatory approach, however, is that employees may feel a diminished sense of personal control and engage in resistance behaviors (Geller, 1996). For example, monitoring systems which produced constant vigilance of production behaviors (Grant, Higgins, & Irving, 1988) or management-set standards employees perceived as unreasonably high led to the occurrence of false reporting behaviors to beat the system (Dose & Klimoski, 1995). Research by Kelman (1958) suggests organizations limiting personal control increase the occurrence of defensive strategies, including the motivation to do only what's required and no more (cf. Geller, 1998a).

Other research has found beneficial effects of elevated levels of personal control. For example, organizational structures which provide employees greater discretion were shown to correlate positively with employee satisfaction, perceived quality of work life, and actual job performance (Hackman & Lawler, 1971; Sashkin, 1984). In contrast, a lack of control over organizational outcomes can lead to a state of learned helplessness (Seligman, 1975) and lowered effectivenenss on the job. In this state, employees are said to possess "trained incapacity" (Dose & Klimoski, 1995).

The role of interpersonal trust. Little research has examined the direct impact of interpersonal trust on performance outcomes (McAllister, 1995). This seems strange given that researchers have long recognized trust as a hallmark of favorable relationships (Hart, 1988; Zand, 1972) and organizational performance (Granovetter, 1985; Shapiro, 1987). In fact, trust between individuals and groups within an organization is considered a critical ingredient in the long-term stability of the organization and the well-being of its members (Cook & Wall, 1984). In other words, it is generally agreed that high levels of interpersonal trust are beneficial for most organizational functioning.

Yamagishi and Cook (1993) investigated the impact of interpersonal trust on individual participation in exchange relationships. They found strong support for the notion that interpersonal trust increases an individual's level of participation in a group situation. In fact, several other studies have shown a beneficial impact of interpersonal trust on the frequency and quality of group member interaction as well as participation in decision-making situations (e.g., Samuelson, Messick, Rutte, & Henk, 1984; Sato, 1988)

The role of interpersonal trust may be particularly critical for successful BBS. An important BBS method involves employees in the observation of other employees' work behaviors. These observations are recorded systematically on a behavioral checklist and turned in for tracking and group feedback. If employees do not trust both the intentions and abilities of the behavioral observers, an observation and feedback process cannot work. In other words, if employees perceive the BBS process to be another method for management to monitor their behavior, or for coworkers to "rat" on each other, participation in the process will likely be minimal. As concluded by Geller (1998c), " Lack of interpersonal trust causes resistance to an observation and feedback process, and interpersonal trust is what's missing in a culture deemed unready for behavior-based safety (p. 14).

Hypotheses. Based on our review of the literature related to the present research, we derived the following hypotheses.

Hypothesis 1. The quantity and quality of BBS training will influence the amount of employee involvement in a BBS process.

Hypothesis 2. Mandated participation in a BBS process will decrease personal involvement and satisfaction with a BBS process.

Hypothesis 3. Trust in management abilities and intentions will facilitate employee involvement in a BBS process.

Hypothesis 4. Trust in coworkers abilities and intentions will facilitate employee involvement in a BBS process.

Method

Subjects and Setting

Participation was solicited through survey research conducted in a professional safety journal, as well as through presentations and interactions at professional safety conferences and workshops. The participants were employees working at 20 different industrial sites. From these 20 organizations, 245 employees (221 male, 24 female) made up 31 different focus groups. About 80% of these participants were male, a male-to-female ratio that paralleled the workforce. All 20 of the sites visited were involved in an employee-driven BBS process that was in place for at least one year. Each BBS process included interpersonal observation and feedback with a checklist of specific safe and at-risk behaviors.

Procedures

During scheduled site visits to all 20 participating organizations, data were collected by two researchers via two distinct methods: focus group discussions and perception surveys. Focus groups were performed with each site visited. One focus group involved only members of the safety steering committee, and the other involved a random selection of hourly employees. While this should have resulted in 40 focus-group sessions, nine of the sites visited did not have an intact safety committee. Therefore, a total of 31 focus groups were performed (20 with hourly employees and 11 with safety-committee members). Focus groups ranged in size from four to 22.

The focus group sessions lasted approximately 90 minutes, during which time employees were asked a series of questions designed to solicit their opinions regarding the necessary ingredients for an effective employee-driven BBS process. All reactions to these questions were recorded simultaneously and independently on data collection sheets by both researchers. The questions asked of all groups are listed in the Results Section along with a summary of the responses.

After completing both focus groups, researchers left a perception survey with each organization. The dimensions measured by this survey are displayed in Table 1. The contact person at each organization was instructed to get as many employees as possible to complete these surveys. If it was not possible to survey all employees, the contact person was asked to obtain a representative sample of every work area. When completed, the surveys were mailed to the researchers for analysis.

Insert Table 1 about here

Results

Focus Groups

Two steps were used to analyze information gathered during focus groups. First, researchers looked at the employee responses for all questions as recorded by both focus-group facilitators. Only those responses that appeared on both of the data sheets were retained for analysis. Second, for the first five questions, each response was classified as a positive, negative, or neutral statement by two researchers. Neither researcher was aware of how the other was classifying any of the responses. Only if a statement was classified as positive, negative, or neutral by both researchers was it retained. Agreement was very high, only 12 responses were eliminated as a result of this process.

For Questions 6-8, the responses were categorized as a behavior-based factor, a person-based factor, or an environment-based factor. This classification was performed by two subject-matter experts, and consensus was reached on each item. The results obtained from focus groups are reported separately for each question.

Question 1. How do you feel about the observation and feedback process used in your behavior-based safety process? A total of 104 comments (56 positive, 37 negative, 11 neutral) were recorded. The most frequent positive comments indicated a perception that observation and feedback is beneficial because it increases one's awareness of safe and at-risk behaviors (17 comments, 15 focus groups, 14 organizations). The second most frequent response implied the observation and feedback process facilitated positive attitudes among employees (8 comments, 6 focus groups, 5 organizations). Specifically, employees indicated it has resulted in increases in trust, comfort with coworkers, and even pride. A smaller number of responses indicated that such a process increased individual accountability (3 comments, 3 focus groups, 2 organizations).

The most frequent negative comment revealed a perception that ulterior motives are behind the observation and feedback process (15 comments, 9 focus groups, 8 organizations). For example, some of these comments indicated employees only participate in the process to "rat" on other employees (7 comments, 5 focus groups, 5 organizations) or as an excuse to give negative feedback to someone they did not like (4 comments, 4 focus groups, 4 organizations). This was reflected in statements like "Inappropriate feedback is often given;" "I give permission to be observed, then I'm made to look bad;" "The observers are looking for negatives."

A few other negative comments implied employees participating in the process are simply looking for overtime (2 comments, 2 focus groups, 2 organizations), trips to conferences (1 comment), or just trying to make themselves look good (1 comment). Other negative comments suggested the observation and feedback process was inconvenient (9 comments, 8 focus groups, 6 organizations). In other words, the observation and feedback process was perceived as just one more thing to do on top of all the other responsibilities.

Question 2. Is participation in the observation and feedback process mandatory or voluntary? The workers interviewed at 12 organizations indicated their process was voluntary, whereas those at 8 organizations indicated participation was either "expected" or mandatory. For each organization, a "positive regard score" was calculated for the observation and feedback process. This was accomplished by subtracting the total number of negative comments made about observation and feedback from the number of positive comments given about this BBS process. The positive regard scores per organization were then correlated with type of process (mandatory vs. voluntary). The correlation between using voluntary observation processes and positive regard was -.304. Suggesting a trend toward more positive regard for an observation and feedback process that is mandated.

Question 3. What role should management play in your BBS process? There were 50 total responses obtained (23 positive, 15 negative, 12 neutral) for this question. The content analysis of focus-group responses revealed only a few organizations (15%) with more negative than positive comments regarding management involvement in the BBS process. In other words, only three organizations expressed a negative reaction toward any amount of management involvement.

With regard to direct management involvement in the interpersonal observation and feedback process, reactions were mixed. Six employee groups from 6 organizations suggested the more management is involved the better (as evidenced by the quote "They should to be involved because a team means everyone."). Nine employee groups from 8 organizations felt direct management involvement was a bad idea, as reflected in a common statement "Less management involvement is better, support is good if direct involvement is minimal." These groups pointed to issues of trust as crucial in determining their perceptions. Management involvement should follow successful efforts to build interpersonal trust. It should be noted these organizations stressed the importance of management's role as supportive rather than directive.

Question 4. How do supervisors influence your BBS process? This question was added after the first four site visits had already been completed. As such, focus groups from 16 of the 20 organizations had a chance to respond. From those 16 organizations, only 12 had a position analogous to a front-line supervisor. From these, the employees participating in the focus groups for 11 organizations stressed the importance of the front-line supervisors. At each site it was stated specifically if front-line supervisors do not support the process it will not be effective.

Question 5. What are your perceptions of the BBS steering committee? A content analysis of the 87 responses (33 positive, 36 negative, 18 neutral) revealed employees at the majority of the participating organizations had overall positive regard for their safety steering committee (16 comments, 15 focus groups, 12 organizations). While some of these comments were general commendations such as "I think there doing a good job (9 comments, 9 focus groups, 8 organizations)." Other remarks in this category revealed employees on the steering committees were viewed as well intentioned and serious about safety (7 comments, 7 focus groups, 7 organizations).

The most common negative responses centered on perceptions that employees on the steering committees are "out of touch" and spend too much time in meetings (8 comments, 7 focus groups, 6 organizations). Another complaint with the safety steering committees was that they were composed of safety "spies" or safety "rats" (4 comments, 4 focus groups, 3 organizations). Finally, it was also commented that employee participation in steering committee meetings was responsible for morale and production problems (4 comments, 3 focus groups, 3 organizations).

Question 6. How would you improve your BBS process? Of the 103 responses to this question most were categorized as environment-based (n = 72). The second greatest number of responses were classified as behavior-based (n = 23), and the fewest were person-based (n = 8).

The most common environment-based responses indicated that employees would improve the BBS process by using more and better incentives to motivate participation (11 comments, 11 focus groups, 10 organizations) and making sure everyone had adequate training (11 comments, 9 focus groups, 6 organizations). Additional remarks indicated a need to improve the quality of machinery being used (9 comments, 7 focus groups, 6 organizations). Also, a need to simplify the behavioral checklist was mentioned several times (6 comments, 6 focus groups, 6 organizations).

The most common behavior-based suggestion was a need to increase employee participation (8 comments, 8 focus groups, 7 organizations). Other recommendations included increasing the occurrence of positive feedback (2 comments, 2 focus groups, 2 organizations), and firing any at-risk worker (2 comments, 2 focus groups, 2 organizations). All 8 responses categorized as person-based focused on ensuring proper employee attitudes. Beyond more effective training, however, employees did not suggest ways to improve attitudes.

Question 7. What are the biggest obstacles your BBS process has faced? Of 133 responses recorded, the majority of BBS obstacles were environment-based (n=67). The next highest number of responses were classified as person-based factors (n=47), and the fewest number of responses were behavior-based (n=19).

The most common environment-based barrier was lack of management support (22 comments, 20 focus groups, 18 organizations). For some, lack of support meant employees were not given the time to perform behavioral observations (8 comments, 8 focus groups, 7 organizations), or there was not enough money to give BBS requisite resources (8 comments, 8 focus groups, 7 organizations), or even that management did not show they believed in BBS process (4 comments, 4 focus groups, 2 organizations). Additional remarks indicated that previous unsuccessful initiatives had made many employees cynical regarding the success of BBS (10 comments, 10 focus groups, 10 organizations). Also, there was fairly consistent distaste for the extra paperwork involved (6 comments, 6 focus groups, 6 organizations), especially if the behavioral checklists were complex.

Among the person-based factors, the most frequently mentioned obstacle was a lack of trust (12 comments, 12 focus groups, 12 organizations). According to focus groups at more than 50 percent of the organizations, lack of trust between coworkers and between line workers and supervisors was perceived as crucial for many of the setbacks experienced relevant to the BBS process. Another frequent person-based obstacle was discomfort associated with having another individual observe one's work practices (8 comments, 8 focus groups, 8 organizations). A number of comments also indicated that getting employees to buy-in to BBS was a challenge (5 comments, 5 focus groups, 5 organizations). It seems many employees had trouble seeing what was in it for them.

The fewest obstacles were classified as behavior-based. The most common behavior-based barrier was a lack of participation (5 comments, 4 focus groups, 4 organizations). Other responses in this category targeted poor communication (3 comments, 3 focus groups, 3 organizations), and a tendency to focus on negative as opposed to positive feedback (3 comments, 2 focus groups, 2 organizations).

Question 8. What are the key ingredients for success in a BBS process? Categorization of 152 responses revealed a majority of BBS key ingredients were person-based (n=57), followed by environment-based factors (n=53), and then behavior-based factors (n=42). Individual responses were examined within each of these domains to determine which were most common.

For person-based factors, the most popular key ingredient was interpersonal trust (13 comments, 13 focus groups, 13 organizations). Other responses to this question indicated a BBS process would more likely succeed if employees had a positive attitude (5 comments, 5 focus groups, 5 organizations), and if BBS procedures were approached with an open mind (4 comments, 4 focus groups, 4 organizations).

For behavior-based factors, getting more employee participation was the number one response (11 comments, 11 focus groups, 11 organizations), followed by the notion that teamwork was needed for success (6 comments, 6 focus groups, 6 organizations), and then open communication (5 comments, 5 focus groups, 4 organizations).

The most common environment-based factor mentioned for success was management support (18 comments, 18 focus groups, 18 organizations). Whether time, money, or just a supportive climate, employees indicated that without management support a BBS process will fail. Other responses which were repeated included a need for everyone to be trained properly (5 comments, 5 focus groups, 5 organizations), and that participation in the observation and feedback process had to be voluntary (4 comments, 4 focus groups, 4 organizations). Three of the latter comments came from organizations with a voluntary process, and one came from an organization with a mandatory process.

Perception Survey Results

A total of 701 perception surveys were returned that were acceptable for analysis. These surveys were returned from 15 of the 20 participating organizations. The employees at four organizations failed to complete and return the surveys, and the surveys returned from another organization were completed incorrectly. Table 2 displays the inter-correlations for all variables measured by the perception survey.

Insert Table 2 about here

Predicting involvement in the behavior-based process. A forward entry regression analysis was performed to determine variables most predictive of involvement in the safety process. Employee involvement was determined for each employee by summing their responses, using a seven-point likert scale, to the three involvement related items constructed specifically for this study. The three questions were as follows: 1) Up to this point I have been very active in this organizations behavior-based safety program. 2) I willingly attend and participate in most of the behavior-based safety related activities and meetings that occur in this organization. 3) It is my intention to remain very active in this organization's behavior-based safety program.

As shown in Table 3, five variables contributed significantly to predicting self-reported levels of involvement, namely a) adequacy of the BBS training, b) trust in management abilities, c) extent that safety is used in performance appraisals, d) whether or not the employee was educated in the BBS process, and e) tenure with the organization. These variables accounted for 41% of the variance in amount of self-reported involvement in the BBS process.

Insert Table 3 about here

Voluntary vs. mandatory BBS. Table 4 depicts the results of planned comparison t-tests for the perception survey variables between employees in a mandatory (n = 273) and employees in a voluntary (n = 427) BBS process. As shown in this table, employees in a mandatory BBS process showed higher scores on several questions related to BBS success than did employees in a voluntary BBS process. More specifically, employees in a mandatory process reported significantly higher rates for giving and receiving positive behavior-based feedback and significantly lower rates for receiving negative behavior-based feedback. In addition, employees in a mandatory BBS process demonstrated significantly greater levels of trust in management (both abilities and intentions), trust in coworkers (both abilities and intentions), and overall satisfaction with the BBS training received. Obviously, our hypothesis that voluntary participation in BBS would be superior to mandatory participation was not supported.

Insert Table 4 about here

Discussion

The tremendous improvements in safety and performance of companies who have implemented BBS processes has given this approach to safety management credibility and status (Geller, in press). Unfortunately, little objective research has been performed to elucidate the organizational factors that can facilitate successful implementation of a BBS approach. Instead, many organizations are left to muddle through the unending case studies provided by safety consultants. Although such literature may be enlightening and informative to some degree, it does not adequately inform readers of the underlying organizational processes that lead to successful BBS implementation. The current empirical investigation is a first step in understanding what factors are critical for successful implementation of BBS.

A primary method used in virtually every organization that has reduced injuries with BBS is observation and feedback. One of the first problems encountered by an organization is deciding if employee participation in the observation and feedback process should be mandatory or voluntary. The obvious concerns associated with making such a process mandatory is that it will lead to negative reactions from the employees due to reduced levels of choice or perceived control (Geller,1998a). On the other hand, a voluntary observation and feedback process could lead to minimal employee participation.

The current research enabled us to compare organizations incorporating a voluntary observation and feedback process with organizations opting for a mandatory observation and feedback process. Contrary to our research hypothesis, voluntary observation and feedback processes were not viewed any more favorably than were mandatory observation and feedback processes. In fact, the results for positive regard toward an observation and feedback process seemed to favor the mandatory approach. In addition, findings summarized in Table 4 indicate organizations taking the mandatory approach may experience benefits in a number of areas over organizations following an entirely voluntary approach.

At first these results seem to defy logic of common sense. However, upon closer examination of the mandatory approaches such findings are not too surprising. First, although employees in a mandatory process had no choice in whether or not they participated, they usually had a good deal of choice regarding when and how they conducted observation and feedback sessions. For example, all of the organizations using a mandatory approach gave employees choice regarding how many times a month they would perform an observation. And observations occurred with permission from the person being observed. Some organizations using a mandatory process (37%) rotated observers on a monthly basis. Thus it seems these organizations were able to circumvent reductions in employee perceptions of personal control by building employee choice into the BBS process.

Besides reporting higher levels of employee involvement, mandatory processes also demonstrated significantly higher levels of trust in management and trust in coworkers, a key ingredient for BBS success (as reported in most focus groups). Plus, the use of positive BBS feedback was reported more frequently for mandatory than voluntary programs. It's likely such results are due to the fact that mandatory programs led to more overall involvement. And as involvement in the observation and feedback process increased, more employees increased their trust in the process and realized it was designed to benefit them. Moreover, they probably found out that participation did not lead to negative consequences such as being "ratted-out" by a coworker or receiving a reprimand from a supervisor.

More experience with interpersonal observation and feedback results in more trust in the intentions and ability of coworkers, and then to more involvement. While these results should not be interpreted as a blanket endorsement for making BBS mandatory in all organizations, it does indicate that mandatory processes are not necessarily detrimental to employee satisfaction, trust, or perceptions of personal control. If instituted properly, mandatory processes can actually facilitate employee perceptions of personal control as well as increase a number of relationship-based variables beneficial to BBS success. Thus, it seems beneficial for management to set an expectation that everyone participate in the observation and feedback process they've been trained to implement. But management should then give plenty of leeway regarding how the process occurs, and offer ongoing support for the procedures customized by the line workers.

Beyond the observation and feedback process, the current investigation offers insight regarding a number of additional issues relevant to BBS. These results are particularly important because they come from the perspective of line workers or operators. For instance, our data support the notion that employees generally understand management and supervisors are key determinants of the success or failure of a BBS process. While there was disagreement regarding the extent to which management and supervisors should be involved, everyone acknowledged that these individuals needed to demonstrate visible support of an interpersonal observation and feedback process.

When negative reactions about BBS were given, significant attention was given to perceptions of the BBS steering committee. In such cases, the steering committee was viewed as being out of touch with what is really needed to improve safety in the organization. It was also common to find that a large number of employees perceived safety committee members as simply ingratiating individuals looking to get ahead. This emphasizes the need to select the right people to serve on the BBS steering committee, and to rotate membership at regular intervals.

The steering committee is responsible for driving an observation and feedback process, and negative perceptions of its members cannot be beneficial. Further research should investigate the type of involvement required by BBS steering committees from the beginning stages of BBS implementation to eventual institutionalization. For example, active and frequent involvement of a BBS steering committee is clearly needed to get a BBS process started, but it might be advantageous to fade out certain kinds of committee activity as BBS principles and procedures take hold throughout an organization. In other words, the role of the BBS steering committee needs to change as BBS processes mature. It's not clear, however, what roles should remain and how others should change.

Three of the questions asked of employees during focus groups were particularly informative regarding ways to implement and maintain a successful BBS process. Specifically, by asking employees a) how they would improve their BBS process, b) what were the biggest obstacles to BBS success, and c) what are the key ingredients to a BBS process, we learned useful perspectives from line workers - - the employees most responsible for BBS and the organization's safety record. Specifically, our content analysis of employees' answers to these questions revealed the following noteworthy issues.

First, although it may be impressive to collect a lot of behavioral data from behavioral observations, it is probably in an organization's best interest to start "small" with a simple behavioral checklist. Allow employees time to get used to an observation and feedback process before adding too much complexity. Second, it is imperative that trainers make clear BBS cannot be a vehicle for blaming individuals, or for delivering criticism of any kind. Third, interpersonal trust is essential, from the shop floor to the management boardroom. Trust was mentioned frequently not only as one of the critical factors for success, but also as one of the greatest barriers when it's not there.

As with interpersonal trust, employees expressed repeatedly the need for continued support from management. While monetary resources are essential, they are not sufficient. Visible recognition that management appreciates the BBS methods is critical. One way to do this is to provide necessary time for employees to perform behavioral observations and analyze results.

And if the outcome from a BBS process indicates a need for certain changes in environmental conditions or training procedures, management needs to follow through quickly and effectively.

Other critical success factors for BBS success were revealed through the multiple regression analysis. Most important in getting employee buy-in was BBS training. These sessions usually represent employees' first exposure to BBS, and if they are not made relevant to the employees' work setting and circumstances, employees could actually leave a training session discouraged, confused, and unlikely to get actively involved. Research is needed to define the parameters of a BBS training session which facilitate subsequent employee participation. Individual characteristics of the trainer are probably relevant, as well as the structure and format of the training itself.

Our regression analysis showed that a number of other variables can also help to facilitate employee involvement in a BBS process. As expected from the focus group results, trust in management added significant predictive power to our regression equation. However, we found trust in management abilities and not intentions to be the crucial factor. Perhaps employees believe management is well-intentioned when they start the safety process, but if management doesn't follow through with appropriate support, trust in ability is suspect. So trust in ability means management knows how to facilitate and support BBS. This explanation is consistent with the majority opinion from focus groups that management support is critical for a successful BBS process.

In conclusion, we would like to offer a framework for understanding why some BBS processes succeed and others fail. Analogous to the way in which we analyzed the focus group discussions, we propose the BBS Safety Success Triad illustrated in Figure 1. The three sides of this triangle are dynamic and interactive. When one changes the others are influenced.

Insert Figure 1 about here

The BBS Safety Success Triad summarizes the discussions from 31 focus groups, as well as the analysis of 701 perception surveys (from 15 different organizations). On the person side of the triangle is interpersonal trust; on the environment side of the triangle is management support; and on the behavior side of the triangle is employee participation/involvement. Training is in the middle of the triangle because of its critical role in facilitating all three sides of the triad. During training all employees receive the principles, procedures, and tools of a BBS process, and management receives the rationale and the method for supporting BBS. Proper training convinces participants that the process works and the people can implement it. This is necessary for self-efficacy (Bandura, 1997), a person state deemed necessary for any constructive change among people.

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Table 1
Variables measured by the perception survey

Measure	Number of items comprising scale	alpha
Position (management vs. front-line)	1	-
Impulsivity (Clift, Wilkins, & Davidson, 1986)	9	.78
Perception safety issues are included in performance appraisals	1	-
Trust in management intentions (Cook & Wall, 1980)	3	.64
Trust in peer intentions (Cook & Wall, 1980)	3	.80
Satisfaction with the BBS process	1	-
Amount of positive feedback given related to BBS process	1	-
Amount of positive feedback received related to BBS process	1	-
Amount of negative feedback given related to BBS process	1	-
Amount of negative feedback received related to BBS process	1	-
Whether or not trained to give feedback (Yes or No)	1	-
Tenure with the organization	1	-
Perceptions of BBS training	3	-
Trust in peer abilities (Cook & Wall, 1980)	3	.63
Trust in management abilities (Cook & Wall, 1980)	3	.75
Involvement in the BBS process	3	.78
Whether or not educated in BBS (Yes or No)	1	-

Table 2
Intercorrelations for all dependent variables

	Variable	1	2	3	4	5	6	7	8	9	10
1	position	1.00	-.07	.17*	.15*	-.07	-.16*	-.06	-.05	.24**	-.07
2	years with company		1.00	-.02	-.04	-.03	-.04	.06	.11	.09	.09
3	educated in b-b safety			1.00	.54**	.08	.04	.11	.06	.39**	.07
4	trained to observe				1.00	.09	.12	.09	.02	.46**	.07
5	observations performed					1.00	.69**	.22**	.09	-.08	.22**
6	frequency observed						1.00	.32**	.14	-.08	.35**
7	amount + feedback received							1.00	.65**	.14	.78**
8	amount - feedback received								1.00	.16*	.57**
9	trained to give feedback									1.00	.17*
10	amount + feedback given										1.00

	Variable	11	12	13	14	15	16	17	18	19	20
11	amount - feedback given	1.00	-.02	.04	.10	-.05	-.02	.10	.10	.09	-.11
12	safety in evaluations		1.00	-.01	.23**	.17*	.14*	.14*	.19**	.25**	.15
13	impulsivity			1.00	-.17*	-.20**	-.22**	-.32**	-.17*	-.17*	-.16*
14	perceptions of BBS training				1.00	.41**	.50**	.39**	.31**	.59**	.28**
15	trust in management intent					1.00	.67**	.39**	.37**	.42**	.18**
16	trust in management ability						1.00	.30**	.33**	.46**	.26**
17	trust in peer intent							1.00	.65**	.30**	.24**
18	trust in peer ability								1.00	.26**	.28**
19	involvement in process									1.00	.28**
20	process satisfaction										1.00

	Variable	1	2	3	4	5	6	7	8	9	10
11	amount - feedback given	.07	.02	-.08	-.04	.19**	.29**	.30**	.43**	.08	.60**
12	safety in evaluations	-.01	-.13	.02	-.01	.07	.03	-.06	-.02	-.03	-.04
13	impulsivity	-.08	-.15*	-.08	-.07	-.04	-.05	-.08	-.02	-.09	-.07
14	perceptions of BBS training	-.01	.10	.32**	.27**	.02	.09	.18*	.13	.25**	.20**
15	trust in management intent	.30**	-.16*	.28**	.32**	-.02	-.10	.08	.03	.38**	.09
16	trust in management ability	.15**	-.10	.31**	.31**	.00	-.03	.10	-.01	.37**	.11
17	trust in peer intent	.03	-.01	.06	.06	-.13	-.05	.09	.00	.05	.14*
18	trust in peer ability	.08	-.02	.09	.10	-.08	-.10	-.04	-.17*	-.04	-.07
19	Involvement in process	.06	.11	.40**	.33**	.09	.08	.17*	.14*	.31**	.22**
20	Process satisfaction	-.07	-.06	.16*	.08	-.03	-.02	.01	-.08	-.13	-.01

* p<.05, ** p<.01

Table 3
Predicting employee involvement in a BBS process

Variable(s) entered	R	R^2	Adjusted R^2	Std Error of the Estimate
1. Adequacy of BBS training	.54	.29	.29	.54
2. Trust in management abilities	.59	.35	.34	.51
3. Extent that BBS is used in performance appraisals	.61	.37	.36	.50
4. Whether or not educated in BBS	.63	.39	.38	.5
5. Tenure with organization	.64	.41	.4	.49

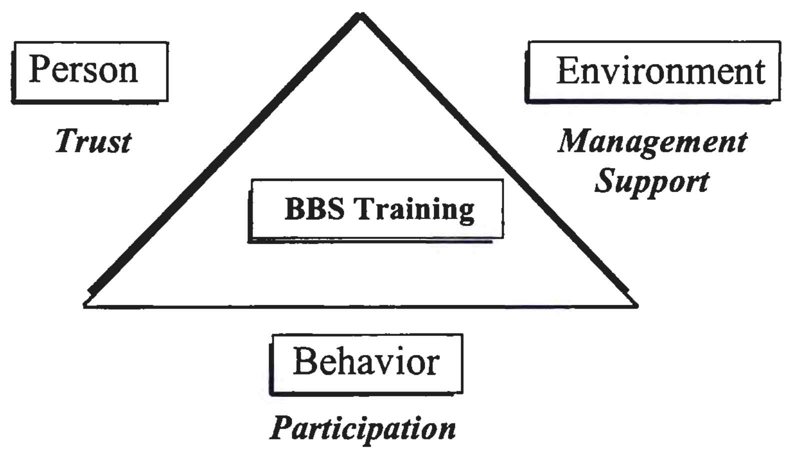
Table 4
Voluntary versus mandatory BBS processes

	Variable	Voluntary BBS Process	Mandatory BBS Process
1.	Average frequency of observation made per employee per month	6.5	7.6
2.	Average frequency of times observed per employee per month	4.0	6.6*
3.	Average frequency positive feedback received per employee per month	1.8	3.6**
4.	Average frequency negative feedback received per employee per month	0.6	0.6
5.	Average frequency positive feedback given per employee per month	3.1	5.3*
6.	Average frequency negative feedback given per employee per month	1.2	1.5
7.	Degree of Involvement	3.4	3.8*
8.	Amount of Satisfaction	3.1	3.3
9.	Trust in Management Abilities	3.8	4.2*
10.	Trust in Management Intentions	3.7	4.1*
11.	Trust in Peer Abilities	3.4	3.7*
12.	Trust in Peer Intentions	3.7	4.0*
13.	Impulsivity	2.5	2.5
14.	BBS is part of performance evaluations	3.3	3.4
15.	Satisfaction with BBS Training	3.5	3.8*

* significant at $p<.05$, ** significant at $p<.01$

Figure Captions

Figure 1. BBS Safety Success Triad


Person
Trust
Environment
Management Support
BBS Training
Behavior
Participation

Exploring Personal Responsibility for Participation In Prosocial Organizational Processes: Antecedents and Consequences

Dissertation proposal submitted to the faculty of Virginia Tech in partial fulfillment of the degree Doctor of Philosophy

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One of the earliest discussions of personal responsibility can be found in a paper by Hackman and Oldham (1976). In their paper on motivation and work design they introduce a model for work motivation that suggests certain job characteristics such as task identity and significance, and autonomy are likely to facilitate employees' perception of personal responsibility for their work processes. Since their introduction of the concept, researchers and practitioners alike have acknowledged the potential benefits an organization might enjoy should they employ individuals who manifest personal responsibility for participation in organizational processes.

Personal responsibility is defined as a state in which an individual feels an obligation to a situation or event (Cummings & Anton, 1990; Dose & Klimoski, 1995). Behaviors performed due to personal responsibility are performed for internal as opposed to external reasons. Such behaviors are considered self-directed in the behavior management literature (Watson & Tharp, 1993). As an example, lets look at two hypothetical employees, employee A and employee B. Both employee A and employee B have perfect attendance at their respective organizations. However, their reasons for perfect attendance are different. Employee A reports to work everyday because he knows perfect attendance is rewarded at the end of each year with a substantial monetary bonus. In contrast, while no such reward is available for employee B at his organization, employee B feels that consistent work attendance is simply the right thing to do. In the scenario just described, employee A is being influenced by the external contingencies put into place by management. In contrast, employee B is performing the attendance behavior due to feelings of personal responsibility.

Responsible behaviors are self-directed and not driven by external accountability systems. Such behavior is proposed to be more reliable (Cummings & Anton, 1990). In other words, it is expected employees who feel personal responsibility for organizational processes will perform behaviors to facilitate the process even in the absence of a supervisor. Additional research indicates employees who feel a personal responsibility for organizational processes are also more concerned about output quality (Hackman & Oldham, 1976). Given the definition of personal responsibility, and the positive consequences associated with it, it's understandable that researchers argue the identification of potential variables that can facilitate responsibility is a meaningful endeavor (Cummings & Anton, 1990; Dose & Klimoski, 1995).

Unfortunately, due to a dearth in empirical investigations, many questions remain regarding the determinants of personal responsibility. For example, research has not addressed the role of an individual's personality in the development of personal responsibility. It may be that some employees, due to person-based factors, are more likely to feel personal responsibility for work processes or become self-directed in their work assignments. If individual factors that promote personal responsibility can be identified, it would be beneficial to explore underlying psychological processes or mechanisms. Increased understanding of person and environment factors contributing to personal responsibility could suggest ways to develop, increase, or support this desirable state.

Acknowledging that some form of accountability or control system must be present in any complex organization, organizations appear unaware as to what steps can be taken to maximize employees' feelings of personal responsibility. Many accountability systems do not increase personal responsibility for completing a work process. Instead, they focus employee attention on external reasons for task performance. In these situations behaviors are performed essentially to gain a reward or avoid punishment, not because of internal feelings of personal obligation or responsibility.

Participation in Non-Prescribed Prosocial Organizational Processes

The need to facilitate feelings of personal responsibility for participating in organizational processes becomes even more critical when such processes involve non-prescribed prosocial behaviors. Non-prescribed prosocial behavior represents behaviors that go beyond specified role requirements and employees are not formally required to perform them, nor do they necessarily receive tangible rewards for doing them. Examples of this type of behavior could include volunteering to do extra work assignments, helping coworkers with personal problems, and suggesting procedural or administrative improvements. Performance of prosocial behaviors is often hypothesized to be an integral ingredient to effective organizational functioning (Brief & Motowidlo, 1986; Katz, 1964; Katz & Kahn, 1978).

As such, it is in the best interest of an organization to structure an environment that will facilitate employee personal responsibility for performing prosocial behavior or any *processes* that are based on performance of prosocial behaviors (referred to as *prosocial organizational processes*). It is intuitive if individual employees feel personal responsibility for prosocial organizational processes, they will actually participate in such processes with greater frequency (Pearce & Gregersen, 1991). Since this reasonable causal relation between personal responsibility and participation has not been tested empirically, it will be studied in the proposed research.

While it is presumably advantageous for an organization to promote employee feelings of personal responsibility for participating in prosocial processes, empirical research investigating factors contributing to employee personal responsibility is lacking. As such, the purpose of the present investigation is to identify factors, both individual and organizational, that can facilitate employee personal responsibility for participation in prosocial organizational processes. Also, the current study will investigate a number of proposed consequences, in addition to increased participation, associated with personal responsibility. Thus, an end product of the investigation will be a theoretical model to further our understanding of factors that increase the probability of personal responsibility for participating in organization-based prosocial processes.

Group Cohesion

Researchers have frequently considered cohesion to be an important component of group processes and performance (Baumeister & Leary, 1995; Gully, Devine, & Whitney, 1995). Although many variations in the definition of group cohesion exist, most definitions include members' desire to remain a part of the group. More specifically, theory suggests individuals who perceive themselves to be part of a cohesive group are more strongly motivated to contribute to the group's welfare, to advance its objectives, and to participate in its activities (Cartwright, 1968).

With regard to a relation between group cohesion and personal responsibility for participation in prosocial organizational processes, a number of researchers have concluded stronger group cohesion generally means a higher degree of interaction and personal responsibility among members of a group (Cartwright, 1968; Martin & O'Laughlin, 1984). Unfortunately, no research could be located that directly tests this assertion. The proposed research hypothesizes that group cohesion is critical if employees are to develop personal responsibility for participating in organizational processes, particularly if the processes are beneficial to group members or require increased employee interaction.

Spink (1995) performed two studies investigating the role of group cohesion on intentions to participate among both recreational and elite female athletes. In both studies, participants completed the Group Environment Questionnaire at the completion of the sport season. Findings from both studies indicated that an athlete's perception of cohesion with team members was significantly associated with intentions to continue playing with the team in future seasons.

In another relevant experiment, Cervin (1956) manipulated group solidarity of three person groups by having confederates agree or disagree with opinions expressed by the experimental participant. Findings indicated that both average degree of participation in discussion was greater in the high cohesion situations. Cartwright (1968) also discusses the impact of group cohesion on group activities. In particular, Cartwright states, "since cohesiveness contributes to a group's capacity to retain members and to exert influence over them, we might expect it also to result in a heightening of participation in group activities (p. 104)."

Moreover, in a study by Schoenrade, Batson, Brandt, and Loud (1986), 40 female undergraduates were given a choice between helping themselves or helping another undergraduate female with whom they either had or did not have a prior relationship. As predicted, in the absence of any prior relationship, an accountability manipulation was necessary to increase behaviors beneficial to the other woman. However, when a prior relationship existed, no accountability mechanisms were needed for the helping behaviors to occur. This research clearly supports the notion that the tendency to become involved with or help others in distress is related to personal feelings of responsibility to those individuals (Pearce & Gregersen, 1991).

In sum, the relation between group cohesion and prosocial behaviors in a group setting is well established (Brief & Motowidlo, 1986; Clark, 1981). However, the underlying processes responsible for these findings have not been empirically determined. In agreement with prior research (Cartwright, 1968; Martin & O'Laughlin, 1984), the theory proposed in the current study offers the construct of personal responsibility as a mediating variable between group cohesion and participation in organizational processes, and particularly those processes that involve performance of prosocial behaviors.

Interpersonal Trust

In addition to group cohesion, the current study proposes interpersonal trust will also play a critical role in determining personal responsibility for participation in prosocial organizational processes. The concept of trust refers to the extent to which one ascribes good intentions to others and has confidence in their competence (Cook & Wall, 1980).

Little research has examined the direct impact of interpersonal trust on performance outcomes (McAllister, 1995). This is strange given that researchers have long recognized trust as a hallmark of favorable or high-quality relationships (Hart, 1988; Zand, 1972), as well as the positive influence of trust on coordination and control at the institutional (Shapiro, 1987) and interpersonal (Granovetter, 1985) levels of an organization. Indeed, trust between individuals and groups within an organization is a critical ingredient in the long-term stability of an organization and the well-being of its members (Cook & Wall, 1980). In other words, it is generally agreed that high levels of interpersonal trust are beneficial for effective organizational functioning.

Similar to the relations between group cohesion and responsibility, the connection between interpersonal trust and personal responsibility has also not been directly researched. However, given what we know about these constructs, a causal relationship seems probable.

Dose and Klimoski (1995) assert that if a relationship does not include trust, or if an employee perceives management or a coworker acting only for personal gain, no accountability or control system will likely produce personal responsibility for participating in the process. In other words, it is more likely an individual will experience personal responsibility for participation in prosocial organizational processes if a favorable (i.e., trusting) relationship exists among the individuals involved (Dose & Klimoski, 1995).

Yamagishi and Cook (1993) performed two studies to investigate the impact of interpersonal trust on individual participation in exchange relationships. In both of their experiments support was found for the notion that interpersonal trust elevates an individual's level of participation in a group situation. In fact, several studies point to the beneficial impact of interpersonal trust on frequency and quality of group member interaction as well as participation in decision-making events (Samuelson, Messick, Rutte, & Henk, 1984; Sato, 1988)

In sum, both group cohesion and interpersonal trust are variables that have been linked positively to participation in prosocial group processes. The theory proposed in the current dissertation is that these two variables result in such increases because they increase an individual's feeling of personal responsibility participating in prosocial processes. More specifically, personal responsibility is hypothesized to be a mediator between cohesion and interpersonal trust, and subsequent participation in a prosocial work process.

Simply indicating that cohesive and trusting relations are conducive to personal responsibility, however, is not sufficient. It is also important to identify personality characteristics and organizational processes that will help to build group cohesion and interpersonal trust. By doing so, organizations will be better equipped to advance a culture propitious to employees feeling personal responsibility for participation in prosocial organizational processes.

Self-Construal

A particular individual difference variable that holds promise as a potential antecedent to feelings of both group cohesion and interpersonal trust is an individual's self-construal. Self-construal is conceptualized as a constellation of thoughts, feeling, and actions concerning one's relationship to others, and the self as distinct from others (Singelis, 1994). Researchers in cross-cultural psychology have long maintained that one's view of the self in relation to others is critical to understanding individual perceptions, evaluations, and behaviors (Markus & Kitayama, 1991; Singelis, 1994; Triandis, 1989). Specifically, how we perceive ourselves in relation to others can have a tremendous impact on how we interact with those in our environment (Markus & Kitayama, 1991). Plus, the extent that people value individual versus collective goals in human life has important consequences for their lifestyle, interpersonal relationships, and psychological well-being (Hui & Villareal, 1989).

Traditionally, cross-cultural research has focused efforts on examining differences between societies with an interdependent (e.g., Japan and other far-eastern countries) versus an independent (e.g., United States) culture. Recently however, evidence supports the assertion that there is a coexistence of independent and interdependent selves within a cultural group (Singeles & Brown, 1995; Trafimow et al., 1991).

An interdependent self-construal is defined as a self that emphasizes relationships, belonging and fitting in, as well as occupying one's proper place in a group. In other words, fitting in and connecting with others are primary motivating factors for people with an interdependent self-construal. Harmonious interpersonal relationships and the ability to adjust to various situations are sources of self-esteem (Singelis, 1994). Contrary to the independent self, the interdependent self depends on relations with others and contextual factors to regulate behavior (Singelis & Brown, 1995).

In contrast, individuals who possess a more independent self-construal place a greater emphasis on their own internal thoughts and abilities, promoting their individual goals, being unique and expressing themselves (Singelis & Brown, 1995). When thinking about the self, individuals with an independent self-construal are more likely to use their own skills, abilities, and goals as a referent than they are to take into account the thoughts feelings and actions of others (Singelis, 1994).

Research has documented that many aspects of social preferences and behaviors can be linked to the self-construal construct (Triandis et al., 1986). For example, individualists have been found to possess a higher need or preference for autonomy, whereas collectivists show greater belonging, nurturant, and succorant needs (Hui & Villareal, 1989). In addition, Triandis et al. (1985) found idiocentrism (i.e., an emphasis on personal goals and views) related to higher achievement motivation as well as to greater feelings of loneliness, alienation, and anomie.

Predictions of behavioral patterns from these constructs have also been successful (Triandis & Gelfand, 1998). Wheeler, Reis, and Bond (1989) used the Rochester Interaction Record (RIR) to investigate the effects of individualism-collectivism on everyday social interactions. To accomplish this, university students in the United States, an individualistic country, and Hong Kong, which is more collectivistic, maintained the RIR for a two-week period. As predicted, the Hong Kong students had longer but fewer interactions with fewer people. They communicated primarily with in-group members. Hong Kong students also indicated greater self- and other- disclosure during their interactions. It was concluded from this study that individualistic cultures are more likely to be composed of superficial relationships.

Interdependence and Group Cohesion

Although numerous researchers have documented a relation between task interdependence and group cohesion (Gully, Devine, & Whitney, 1995), few have investigated the impact of interdependence as an individual difference variable on actual experiences with group cohesion in a work setting. The current study proposes that an interdependent self-construal will lead to differences in perceived levels of cohesion in a group setting. In particular, it is suggested that individuals who are more interdependent in their self-construal will be more likely to establish cohesive relationships in their work group than individuals with an independent self-construal. To the extent such a relation is found between these variables, interdependent individuals will also manifest greater feelings of personal responsibility to participate in prosocial organizational processes.

Support for the proposed causal relationship is available in several sources. In particular, Triandis et al. (1988) offer some observations regarding this linkage. For instance, they assert that people living in more interdependent cultures are more likely to develop friendships that imply a life-long intimate relationship with many obligations. So the quality of the friendship is different. Further, research in the domain of self-psychology (Kohut, 1984) has demonstrated that individuals will tend to seek out relationships that confirm their world-view (Lee & Robbins, 1998; Miller, 1992). Interdependent individuals are more likely to view their world as a social system, and to possess a stronger need than their independent counter-parts to be a part of this system. Thus, to the extent an individual has an interdependent world-view they will be more likely to pursue relationships that satisfy their need to be part of a cohesive social network.

Lee and Robbins (1998) surveyed 185 students from a large, urban southeastern university. As a result of their analyses, the authors found that women who reported feeling more distant from the social world were less likely to make an attempt to satisfy their need for belonging. Similar findings are reported in research by Hui and Villareal (1989). Using participants from both the United States and Hong Kong, the authors demonstrated consistent differences between individuals with a collectivistic world-view versus individuals with an individualistic perspective. Specifically, individualism was positively correlated with a need for autonomy, and negatively correlated with needs for abasement, affiliation, nurturance, succorance, and desirability. Similar correlational patterns were found for participants in Hong Kong as well as the United States.

Interdependence and Interpersonal Trust

With regard to interpersonal trust, specific research investigating the nature of interpersonal trust and its antecedents has identified interdependence (Kumar, Scheer, & Steenkamp, 1995) as a potential causal variable. In other words, a number of researchers have hypothesized that all else being equal, as interdependence in a relationship increases so does trust. Unfortunately, as found in the group cohesion literature, the majority of the research investigating interdependence – trust relations have focused on task or work relationship characteristics as opposed to individual differences. For instance, using survey data from automobile dealers, Kumar, Scheer, and Steenkamp (1995) found that as perceived interdependence asymmetry increased, dealer trust and commitment declined. In addition, relationships with greater total interdependence exhibited higher trust, stronger commitment, and lower conflict than relationships with lower interdependence.

It is acknowledged that the Kumar et al. (1995) study examined interpersonal relationships from a contextual or structural perspective, and the characteristics of each individual involved were not assessed. A working premise for the proposed investigation, is that if an individual enters into a social situation with a pre-disposition for developing a more interdependent relationship (based on their self-construal), they will be more likely to manifest such a relationship than will individuals with an independent self-construal.

Given the differences found between people manifesting an interdependent self-construal versus an independent self-construal, a mediated relation is proposed between an individual's self-construal and subsequent feelings of personal responsibility in organizational processes. In particular, it is hypothesized that an interdependent self-construal sets the occasion for, or motivates an individual to establish cohesive and trusting relationships with coworkers. In turn, as discussed previously, elevated levels of cohesion and trust will help to facilitate perceptions of personal responsibility for participating in prosocial organizational processes.

Personal Control

Up to this point, the primary focus has been on how individual differences can facilitate the development of relationships more conducive to feelings of personal responsibility for participation in prosocial organizational processes. The proposal here is that some individuals bring with them a greater propensity for personal responsibility than others. In addition to individual differences, it is further proposed that organizations can facilitate feelings of personal responsibility for participation in any organizational processes by providing employees with greater levels of personal control over those processes.

All complex organizations incorporate some form of control system in order to provide guidelines for employee behavior as well as for managing performance (Dose & Klimoski, 1995; Katz & Kahn, 1978). Traditionally, views of organizational control have stressed mechanisms such as rules, hierarchies, and sanctions, making use of what has been called process control and output control strategies (Ouchi, 1977). Acknowledging such control mechanisms can be used to motivate employee behavior, shortcomings commonly attributed to traditional top-down methods of employee control should also be recognized.

One of the weaknesses associated with traditional bureaucratic control systems is that such mechanisms do not give organizations the flexibility to react in a timely manner to changes in a dynamic business environment. As Mitchell (1993) states "tall and formal chain of command organizations are proving to be unwieldy and unable to meet the customer dictated necessity of adroitness, flexibility, and adaptability (p.36)."

Second, rigid hierarchical control systems necessarily inhibit employee autonomy and personal control. To the extent employees desire some discretion in their work environment, a reduction in these factors can lead to employees engaging in resistance behaviors. For example, monitoring systems which produce constant vigilance for the purpose of control over production (Grant, Higgins, & Irving, 1988) or management standards that employees perceive as unreasonably high have demonstrated a significant association with false-reporting behaviors (Dose & Klimoski, 1995).

In addition, research by Kelman (1958) suggests that organizations relying solely on traditional management driven control policies will find their employees more likely to engage in compliance behaviors. But, compliance behavior tends to produce defensive strategies and a motivation to avoid punishment (Dose & Klimoski, 1995). Individuals perform the behavior only because they know they are being monitored and not because they agree with organizational policies. Such negatively reinforced behavior presumably decreases perceptions of individual freedom (Skinner, 1971).

Much research has demonstrated the benefits associated with elevated levels of personal control. For example, organizational structures which give employees greater discretion in job performance have been found to be positively related to employee perceptions of fairness, satisfaction, quality of work life, and organizational effectiveness (Hackman & Lawler, 1971; Hunton, Hall, & Price, 1998; Sashkin, 1984). In contrast, a lack of control over organizational outcomes may result in a state of learned helplessness (Seligman, 1975). In other words, employees are said to have "trained incapacity" in that all decisions are made for them rather than being encouraged to do so on their own (Dose & Klimoski, 1995).

Personal control in the context of self-management programs does not imply external control is irrelevant (Dose & Klimoski, 1995). Instead, the intent is to partially close the gap between the "doing" and the "controlling" aspects of the job. In this sense, increases in personal control are established by *vertically loading* a task or job (Hackman & Lawler, 1971). When a job is vertically loaded responsibilities and controls that formerly were reserved for management are given to employees as part of their job. Vertically loading a job inevitably increases autonomy. Subsequently, it is often found that employees in this situation will view task demands more favorably because they feel they are being treated with respect rather than simply being monitored (Cummings & Anton, 1990).

A number of researchers have provided evidence that increases in personal control leads to employee personal responsibility (Dose & Klimoski, 1995). For example, through surveying 658 employees from 62 different jobs in seven organizations, Hackman and Oldham (1976) found significant positive correlations not only between employee perceptions of autonomy and personal responsibility, but also between autonomy and job involvement. In another relevant investigation, Fisher (1978) directly manipulated subject personal control regarding effective task performance. In other words, individuals in a high personal control condition were assigned a puzzle task in which their effort could influence task outcome. Those relegated to the low personal control condition were assigned a puzzle task in which their efforts were meaningless in successful task performance, in fact successful performance was almost impossible in this condition. Their findings indicated that one's level of personal control was related to self-report and behavioral measures of internal motivation to perform the task.

In agreement with prior investigations, the current study proposes that elevated levels of employee personal control will increase personal responsibility for participation in organizational processes. In addition to the expected direct effect of personal control on personal responsibility, indirect effects are also predicted. Specifically, it is hypothesized that elevating levels of employee personal control over organizational processes will lead to increases in employee trust in management. In turn, increased feelings of trust in management will enhance employee personal responsibility for participation in organizational processes.

Personal Control and Interpersonal Trust

Often employees perceive management to be establishing a system whereby they monitor individual employee behavior for the sole purpose of keeping tabs on everyone. Due to these perceptions, employees do not develop personal responsibility for participating in organizational processes. Instead, employees participate only to avoid negative sanctions associated with nonparticipation. Any improvement program needs trust between management and worker ranks (Mitchell, 1993). To gain this trust, it is suggested that management allow employees control over the design and improvement of their work processes.

An atmosphere of trust between management and employees fosters the development of personal responsibility. However, promoting responsibility of this type requires less frequent monitoring on the part of management (Dose & Klimoski, 1995). In other words, management needs to allow employees to take more control over work processes if it is desirable for employees to develop trust in management intentions and subsequently personal responsibility. In other words, to cultivate personal responsibility companies are going to have to let their employees plan and control their own work to some extent (Mitchell, 1993).

To investigate the personal control/trust in management relationship Deci, Connell, and Ryan (1989) collected survey data from 23 managers and their subordinates in a major corporation. Their results showed that managers' orientations coordinated significantly with certain subordinate variables. In particular, subordinates of managers who provided a context for promoting a sense of self-determination, reported significantly higher levels of trust for their management. The results are consistent with proposals that discuss the importance of understanding and acknowledging individual needs, feelings, and attitudes with respect to situations at hand. When such needs are met, the target person will be more trusting of the context, and hence more likely to perform the desired behaviors (Deci et al., 1989).

Additional support for the influence of personal control on subsequent perceptions of trust is reported by Magner, Welker, and Johnson (1996). Questionnaire data from 220 academic accountants, showed supervisors who let employee give input into decision making processes were more likely to be trusted than supervisors who did not let employees give input into decision making processes.

Finally, Jenkins and Lawler (1981) investigated the impact of allowing employees in a small manufacturing firm more control in the development of a base pay plan. Attitudinal data (including a trust in management scale) and behavioral data were collected from 58 employees prior to, and immediately following the development and installation of the pay plan. The results showed a significant increase in employee trust in management. It was concluded that allowing employee input not only resulted in more effective pay plans, but also to a better overall relationship between employees and their organization.

Behavior-Based Safety

One domain that provides ample opportunity for empirical investigation of the issues discussed above is the domain of behavior-based (BB) safety (Geller, 1996, 1998b). In general, when organizations implement a BB safety process, participation is voluntary. As a result, any BB safety process behaviors performed are essentially at the employee's discretion. In other words, these behaviors are non-prescribed prosocial behaviors. Such behaviors could include performing BB safety observations, allowing a fellow employee to observe one's work practices, performing a self-observation as in safety self-management (Geller, 1998a), or even making suggestions to improve the organizations BB safety process.

In addition, behaviors performed related to the BB safety process are ideal for investigating personal responsibility, and should be of particular interest to organizations because safety related behaviors benefit the bottom line. Feelings of personal responsibility to participate in a BB safety process should be influenced by personality, interpersonal, and environmental variables discussed here: interdependent self-construal, personal control, group cohesion, and interpersonal trust.

Consequences of Voluntary Participation in the Behavior-Based Safety Process

With an increase in voluntary performance of BB safety process behaviors, a concomitant increase in safe working behaviors is expected. In addition, it is expected that increases in the performance of safe behaviors will extend beyond the working environment. In other words, it is proposed that individuals participating voluntarily in a BB safety process will also exhibit an increase in safe behaviors at home and on the road while driving their car.

Individuals who become actively involved in a BB safety process are necessarily endorsing a certain class of behaviors - - safety-related behaviors. Their public endorsement of safe behaviors leaves them susceptible to negative consequences when performing at-risk behaviors. Specifically, aversive consequences may be public (disapproval from others for inconsistency in behaviors), or private (anxiety, guilt, or perhaps cognitive dissonance). In other words, an individual who is active in a BB safety process, but consistently performs at-risk behaviors should experience an induced hypocrisy (Aronson, Fried, & Stone 1991).

A study by Aronson et al. (1991) took advantage of the induced hypocrisy concept to promote safer sex practices. In this experiment feelings of hypocrisy were induced in college students to increase condom use. Hypocrisy was created by making students mindful of their past failure to use condoms and then having them persuade others about the importance of condoms for AIDS prevention. The induction of hypocrisy decreased denial and led to a greater intent to improve condom use relative to control conditions. In addition to an increase in intent to use condoms, when contacted several months later, subjects in the induced hypocrisy condition reported having used condoms at a greater rate than subjects in the control condition.

Further support for hypocrisy induced behavior change was documented by Dickerson, Thibodeau, Aronson, and Miller (1992). Dickerson et al. tested the phenomenon in a field experiment on water conservation. Experimenters aroused hypocrisy in patrons of a campus recreation facility by making them feel hypocritical about their showering habits. They made participant's aware that they had sometimes wasted water while showering, and then varied whether or not participants made a public commitment urging other people to take shorter showers. In other words, individuals assigned to the hypocrisy condition were asked to make a public commitment urging others to take shorter showers, whereas individuals in the control condition were not. As expected, participants in the hypocrisy condition took significantly shorter showers then individuals in the control condition.

Finally, Ludwig and Geller (1998) investigated the behavioral impact of serving as an intervention agent on subsequent behaviors. Using pizza deliverers as intervention agents for a community safety-belt campaign it was found that participating deliverers increased their own safety belt use 32% over baseline levels. In contrast, deliverers at a control side did not demonstrate any concomitant increases in safety-belt use. Also noteworthy in the Ludwig and Geller (1998) results was that the deliverers acting as intervention agents also exhibited increases in turn-signal use, suggesting a spread of effect across other safety-related behaviors as a result of becoming an intervention agent.

Hypotheses

Based on the author's literature review summarized here, the following hypotheses are offered for testing in the proposed dissertation:

H1: Group cohesion will directly affect personal responsibility for participation in a BB safety process. That is, individual's who perceive more group cohesion will also report a greater feeling of personal responsibility to participate in the process.

H2: Trust in coworkers will directly affect personal responsibility to participate in a BB safety process. That is, individual's who report higher levels of trust in their coworkers will also report a greater feeling of personal responsibility to participate in the process.

H3: Trust in management will directly effect personal responsibility to participate in a BB safety process. That is, individuals who report higher levels of trust in management will also report greater feelings of personal responsibility to participate in the process.

H4: An interdependent self-construal will have indirect effects on personal responsibility to participate in the BB safety process. That is, individuals with an interdependent self-construal will report more cohesive and trusting relationships with their coworkers. In turn, as previously hypothesized, group cohesion and interpersonal trust will influence personal responsibility to participate in the BB process.

H5: Personal control will directly affect personal responsibility to participate in a BB safety process. That is, employees assigned to a personal control *condition will report higher levels of personal responsibility to participate in a BB safety process than will individuals in a control condition.*

H6: Personal control will indirectly affect personal responsibility through its influence on employee trust in management. That is, employees in a personal control condition will report higher levels of trust in management than will employees in a control condition. In turn, trust in management will be associated with increases in personal responsibility to participate in a BB safety process.

H7: Employee personal responsibility to participate in a BB safety process will be directly related to actual participation. In other words, the greater an employee's personal responsibility to participate, the greater will be the frequency of actual participation.

H8: Individuals who conduct more behavioral observations of their coworkers will demonstrate increases in their own safety-related behaviors at work.

H9: Individuals who conduct more behavioral observations of their coworkers will demonstrate increases in their own safety-related behaviors in contexts outside of work (i.e., safe driving behaviors).

Method

Participants and Setting

Participants will be 490 employees working at a foundry located in southwest Virginia. More specific data regarding employee demographics will be provided in the final dissertation.

Measures

All surveys will consist of seven-point Likert style items ranging from 1 (*strongly disagree)* to 7 *(strongly agree)*. Items comprising each survey can be reviewed in Appendix A.

Personal control manipulation check. Based on a review of the personal control literature, items have been developed specifically to assess the degree to which employees perceive personal control of the design and implementation of BB safety process.

Interdependence. Interdependence will be measured with the 11-item scale developed by Wagner and Moch (1986). The scale assesses the extent to which an individual focuses on self versus group interests in a team context. The scale is further broken down into three dimensions. The first dimension is labeled *beliefs* and measures statements regarding whether the work group is perceived to be more effective when working as a collective. The second dimension is called *values* and assesses an individual's preferences for working in an independent environment versus a more collectivistic or interdependent environment. The final dimension is labeled *norms* and measures an individual's prescriptions for how others should behave. These prescriptions may be either interdependent or independent in nature.

Group Cohesion. Group cohesion will be measured with items adapted from the scale developed by Wheeless, Wheeless, and Dickson-Markman (1982). Their solidarity scale taps the "togetherness" that individual members tend to experience in their group. It is designed to be an indicator of experienced cohesion or the social-affective dimension of a group.

Trust in Coworkers. Trust in peers will be measured with a six-item scale developed by Cook and Wall (1980). The scale is broken down into two factors, faith in peer intentions and faith in peer abilities. The scale is intended to yield ascriptions of capability and intentions of coworkers.

Trust in Management. Trust in management will also be measured with six items developed by Cook and Wall (1980). Similar to the items designed to measure trust in peers, the trust in management items also form two factors (i.e., trust in management intentions, and trust in management abilities).

Personal Responsibility for Participation. Personal responsibility will be assessed with three items designed specifically for this study. Based on the felt responsibility literature review, items attempt to tap the degree to which an individual feels a sense of duty or obligation to participate in a BB safety process.

Participation in a BB Safety Process. Actual participation in the BB safety process will be tracked via actual behavior including number of observations performed, number of times observed, as well as number of self-observations performed.

Frequency of Safe Behavior Performance. Frequency of safe behavior both on and off the job will be assessed via self-report methods (e.g., In the last week, how often have you used the safety-belt while in a motor vehicle).

Procedures

Employee Training. All front-line employees in the organization will undergo a four-hour training/education class. Just prior to the start of all training sessions, each employee will be assigned an experiment number. The number will consist of the first two letters in their mothers maiden name and the last four numbers in their social security number. Employees will be told that the experiment number should be placed on any paperwork they complete that is related to the current study. Each employee will receive a card the same size as a business card on which to write this number. The card will have instructions for determining the experiment number on it.

Researchers will be sure to make sure all employees understand and correctly determine their ID number. In addition, instructions for determining the number will be posted in a visible place within the organization and remain posted throughout the experiment. As such, should an employee lose this card at some point during the experiment it will be possible to determine the assigned number without much of a problem. By doing this we will be able to ensure participant anonymity and still track participation behaviors for all individuals.

During training, employees will be educated and trained in the principles and theories underlying BB safety. Employees will learn how to perform BB observations and complete a critical behavior checklist (CBC). Employees will also learn how to perform a self-observation. All of the training sessions will be facilitated by an advanced graduate student in psychology. The training will be identical in content and delivery for all training sessions.

Personal control manipulation. For half of the training/education sessions, questions designed to facilitate a sense of personal control will be administered to employees. These surveys will ask the following questions: a) How many BB observations should be performed on a weekly basis? b) How many times should individuals be observed per week? c) How many self-observations should employees perform per week? d) Where should behavior checklist data collection boxes be placed? e) Where should the data collected be posted so employees will be able to see results on a weekly basis?

It will be explained to employees in the personal control condition that their responses will be used to structure the safety process. For groups not receiving the personal control manipulation questions, a brief survey asking them for their perceptions of behavior-based safety will be administered. In other words, after all employees have received BB training, half the individuals will have given their input regarding what the BB process should be like. They will also see that their input has had an impact on the actual process. In contrast, the other half of the trained employees will not have any input into the process. They will be part of a process developed by their coworkers. Also during training, employees will be asked for self-reports of their current rate of safe behavior performance in a number of contexts (on the road and at work)

Personality survey administration. One week after all training has been completed, a survey assessing the personality variables of interest will be distributed. This will give researchers a chance to post results of the personal control questions so they are visible to employees. As such, employees in the personal control condition should perceive they have helped to shape what the process looks like.

Participation data. In order to track degree of participation per employee, data-collection boxes will be set up at various locations throughout the plant. The location of these boxes will be based on responses gathered from employees during BB training sessions. The data-collection boxes will be locked and only accessible to research personnel.

Whenever employees perform a self-observation, they will be instructed to write their experiment number at the top of the checklist, and as soon as convenient, drop their checklists in a data collection box. Likewise, after observing a fellow employee, the observers will write their ID number at the top of the card and give it to the individual observed. Subsequently, any individuals observed will write their ID number in the space provided at the top of the checklist designated for the observee, and as soon as convenient drop the checklist in a data collection box. The data cards will be taken from collection boxes each week.

Data Analysis

Data Analyses for Hypotheses 1 – 7. Based on hypotheses proposed in the current study, a structural model was constructed as shown in Figure 1. The proposed model will be analyzed using structural equation modeling procedures. Model fit will be assessed via three methods. First, the model will be assessed by an examination of the solution. Specifically, the model will be examined for significant and correct sign parameters. In addition, overall fit will be assessed with a number of recommended fit indices. Fit indices to be used include χ^2, GFI, AGFI, ECVI, and RMSEA.

Finally, as recommended by a number of researchers knowledgeable in structural equation modeling methods (MacCallum, 1998), competing structural models have been constructed in order to assess relative fit of the hypothesized model. The decision tree framework discussed by Anderson and Gerbing (1988), and recommended by Medsker, Williams, and Holahan (1994) will be used to select the best fitting model. The hypothesized model is displayed in Figure 1. The competing models are found in Appendix B.

Insert Figure 1 about here.

Data analysis for hypotheses 8 and 9. Analysis of Covariance (ANCOVA) procedures will be performed to test these hypotheses. The dependent variable will be self-reported safety behaviors. The independent variable will be number of observations performed on coworkers. A median split will be performed on number of observations to separate high participation from low participation. The co-variates for the analysis will be number of self-observations performed, as well as number of times observed by a coworker.

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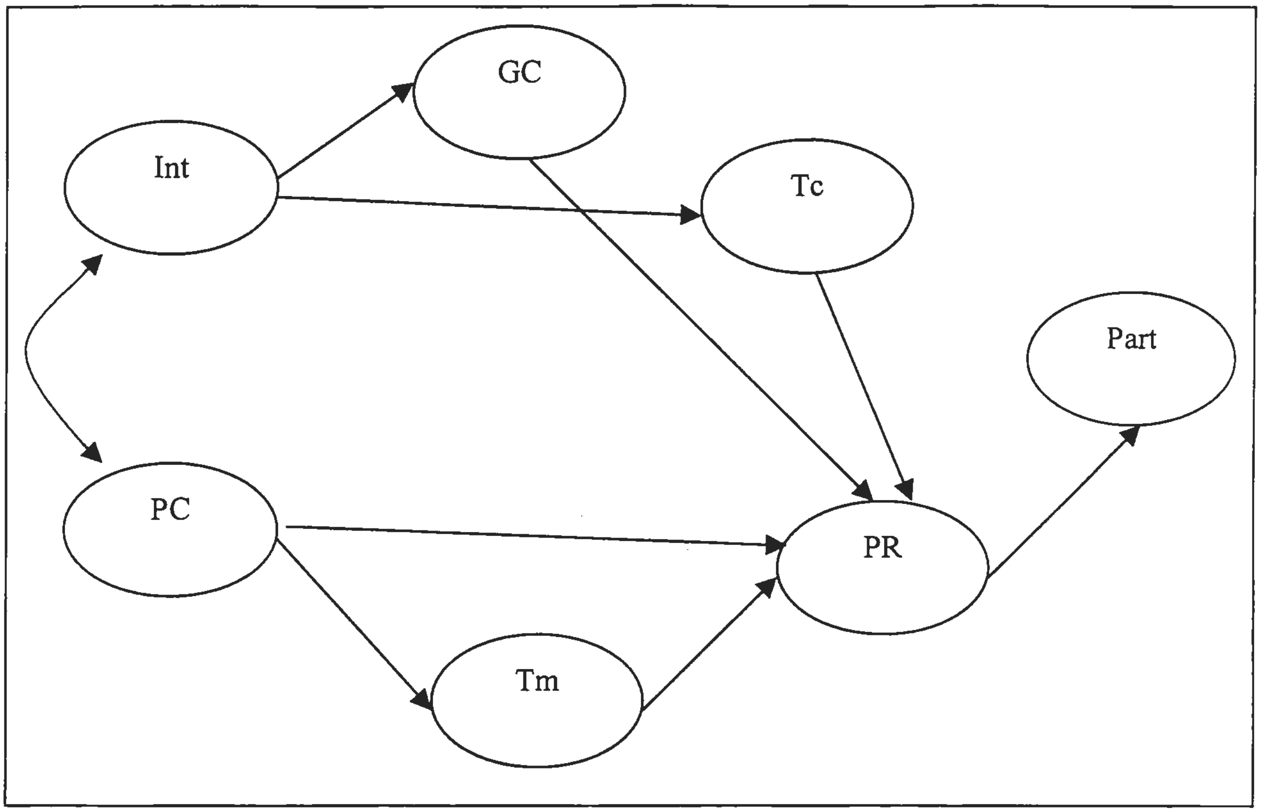
Figure 1. Hypothesized structural model



Int = Interdependent Self-Construal; PC = Personal Control; GC = Group Cohesion; Tc = Trust in Coworkers; Tm = Trust in Management; PR = Personal Responsibility; Part = Participation