2005

Comparing office ergonomics test scores between injured and non-injured workers

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DOI: <https://doi.org/10.31979/etd.uyvb-baj7>

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COMPARING OFFICE ERGONOMICS TEST SCORES BETWEEN
INJURED AND NON-INJURED WORKERS

A Thesis

Presented to

The Faculty of the Department of Human Factors & Ergonomics

San Jose State University

In Partial Fulfillment

Of the Requirements for the Degree

Master of Science

By

Frances Mary Wagner

August 2005

UMI Number: 1429455

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ABSTRACT

COMPARING OFFICE ERGONOMICS TEST SCORES BETWEEN
INJURED AND NON-INJURED WORKERS

by Frances Mary Wagner

The purpose of this thesis is to measure differences in knowledge, attitude, and awareness of basic office ergonomic principles and guidelines. It is expected that injured workers have more knowledge and awareness of office ergonomic principles and guidelines than non-injured workers, and that injured workers are more willing to change their work environments and work behaviors than non-injured workers. This is based on the assumption that injured workers receive patient education after filing Workers' Compensation claims.

The test population consisted of 60 employees from the California Department of Health Services. Nine were injured workers with musculoskeletal disorders. Assessments were given before and after training, and the results were compared within groups (injured and non-injured) and between groups (injured vs. non-injured). The results did not show a significant difference between groups when compared before and after training, but did show a significant difference within groups before and after training.

ACKNOWLEDGMENTS

I am grateful to all my friends who supported me during this educational experience. They understood when I chose this over them, and they remained true friends until the end. I promised them I will never do this again.

I am most grateful for the support and encouragement I received from my classmates, Susan Tingley and Kristy Schultz. They kept me going during personal struggles, and for that I am forever in their debt. We laughed. We cried. We worked hard, and we played hard. Congratulations to them for their accomplishments. They are awesome women!

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Chapter 1

INTRODUCTION

Musculoskeletal disorders (MSDs) affect muscles, tendons, ligaments, nerves, and blood vessels. Symptoms include pain, numbness, stiffness, and weakness (Faucett, Garry, Nadler, & Ettare, 2002). They occur as a result of repeated or continuous exposure to certain risk factors over time, rather than as a result of a single event, such as a fracture from a fall. According to the U.S. Department of Labor, Bureau of Labor Statistics [BLS] (2002a), there were 487,915 reports of MSDs. The number of MSDs attributable to overexertion and repetitive motion is 421,700. Of the 487,915 total MSDs reported in 2002, 6,924 injuries were sustained by office workers, including General Office Clerks, Secretaries, Receptionists, Data-Entry Keyers, Order Clerks, and General Office Supervisors (BLS, 2002b).

The fate of American office workers is threatened by MSDs that can be related to computer use and computer-related job tasks. Coury (1998) discusses how the rapid growth of computer workstations has influenced workplace safety. She states that computers were introduced without any consideration given to how people work at computers, and without any safety standards for these work situations. Coury believes that these conditions have contributed to an increase in MSDs that are related to sedentary work. However, Coury notes that even simple ergonomic improvements can be effective in reducing pain and discomfort at computer workstations, especially with the improvements in computer furniture and equipment.

In this country, 2% of our workforce report MSDs every year, and these account for over one-third of all Workers' Compensation costs for medical care and lost wages (California Department of Industrial Relations [DIR], 2000; Faucett et al., 2002). For the worker, the cost of an MSD is difficult to measure, as it includes the loss of physical capacity, income, job opportunities, and an overall loss of acquired lifestyle. In many cases, it also includes the loss of self-esteem, or the "slacker stigma," as described by Stahl (1997, p. 13) that is associated with the loss of gainful employment.

In California, when an injured worker sustains a work-related MSD, a Workers' Compensation claim is filed. Usually, the injured worker receives immediate medical treatment, which can include physical therapy, cortisone injections, and surgery. Other non-invasive therapies can be administered concurrently, such as exercise and heat/cold applications. To receive these medical treatments, the injured worker is examined by doctors, nurses, physical therapists, and other allied health care professionals.

With the completion of prescribed medical modalities, and when it is medically reasonable, the injured worker returns to work. While treatment plans always include medical modalities, it is also important that they include awareness of the conditions at work that may have contributed to the onset of the injury. If the risk factors that may have contributed to the injury are still present when the injured worker returns to work, then the worker returns to the risk of re-injury, or even a new injury. How much information do medical and allied health care providers give to their patients

regarding ways to improve their own working conditions, such as body mechanics, equipment positioning at the workstation, and ways to change work habits and behaviors? These topics are otherwise known as ergonomic principles and guidelines for computer operators.

California's Workers' Compensation law provides monetary compensation in the form of temporary disability benefits to injured workers while they are off work, and this can create a disincentive to a speedy return to work. For those injured on or before January 1, 2005, it also provides some workers with opportunities to leave jobs they hate, and might not otherwise have the opportunity to leave. Since injured workers in California are covered by the Workers' Compensation law, they may not be motivated to correct problems at their workstations toward the goal of returning to work. Differences in motivation between injured and uninjured participants exist, as well as between injured workers.

It could be hypothesized that injured workers have higher levels of knowledge and awareness of basic ergonomic principles and guidelines if they received patient education during their medical treatment. This study will explore this hypothesis.

Problem Statement

The purpose of this study is to determine:

1. The level of awareness of basic ergonomic guidelines and principles for injured workers with MSDs who have filed Workers' Compensation claims (it is assumed that they have received medical treatment);

2. the impact of training on injured workers who have been treated for MSDs;
3. the impact of ergonomics training on injured workers' attitudes about their ability to prevent injuries by changing the way they work, and their willingness to change the way they work; and
4. the impact of ergonomics training on injured workers' perceptions of their awareness on how to adjust the chair or workstation, and their awareness of work technique.

The test is expected to prove that injured workers will have more knowledge and awareness of basic office ergonomic principles and guidelines than non-injured workers, and that injured workers will be more willing to change their work environment and work behaviors than non-injured workers. This expectation is based on the assumption that injured workers receive patient education while they are receiving medical treatment.

Constraints of the Study

The study is limited to employees of California's Department of Health Services who attended this training. Of those who attended, some are injured workers who have filed Workers' Compensation claims for MSDs and some have not filed claims for MSDs.

Definition of Terms

Education. Teaching and learning specific skills; the imparting of knowledge, good judgment, and wisdom (Wikipedia, 2005).

Knowledge: Awareness and understanding of facts, truths, or information gained in the form of experience or learning, or through introspection (Wikipedia, 2005).

Learning: A change in behavior, or the potential to behave in a certain way (Geller, 1996).

Motivation: The force which directs behavior (Bridger, 1995).

Training: "Formal or informal methods to assist individuals in acquiring knowledge, changing attitudes, or executing safe work behaviors" (Johnston, Cattledge, & Collins, 1994, p. 148).

A literature review was conducted to provide support of the hypotheses and is discussed in Chapter 2.

Chapter 2

REVIEW OF THE LITERATURE

Motivation

If we believe that MSDs are caused by workplace conditions and work behaviors, then it is important to understand if and how injured workers can be motivated to change the workplace conditions or their own work behaviors after sustaining injuries. Further investigation will show whether or not injured workers have a higher level of understanding than their non-injured co-workers of the conditions and behaviors that caused their injuries.

What motivates adults to learn and change their behaviors has interested educators and researchers in academia, but has eluded safety coordinators in business and industry as suggested by Workers' Compensation and Occupational Safety and Health Administration (OSHA) reporting data. Researchers and educators agree that there is a direct relationship between training and learning; however, motivation is a key influence in why adults learn (Haslam & Haslam, 2000; Johnston, Cattledge, & Collins, 1994; Knowles, Holton, & Swanson, 1998). Generally, however, people are motivated to maximize positive consequences and minimize negative consequences (Geller, 1996).

Wlodkowski (1999) tells us that achievement is a strong motivator, and that it is important for adults to feel a sense of competence while they are making efforts

to change. In the context of injured workers, this means that if physical improvement is seen after changing work conditions or behaviors, it is likely that injured workers will continue to make necessary changes as long as they continue to see the benefits of their efforts. Wlodkowski goes on to say that when what adults are learning makes sense and mirrors their values and perspectives, their motivation increases. Therefore, if medical care givers provide educational information that helps patients to manage their own pain, motivation will emerge to make necessary changes.

This, however, is not true for patients who are not motivated to, or who are resistant to manage their pain. So, how do we deal with patients who resist change?

According to Geller (1989), "We should teach people the skills and give them the tools to handle change, plus support those who set the right examples" (p. 227).

Rankin and Stallings (1996) recognize that patients are not always motivated to change their behavior, even if they know that to do so is beneficial for them. Despite providing information or training, some patients still choose unhealthy behavior.

Some injuries result in severe and permanent disabilities. Dell Orto and Marinelli (1984) tell us that when injuries result in disabilities, it may be more difficult to motivate workers. Disabled workers often lack involvement and motivation because the system treats them as passive participants, rather than active participants, in their treatment and recovery plans. Disabled workers do not always see themselves as having the power or control to effect improvements in their conditions.

Changing Behaviors

Haslam and Haslam (2002) believe that individuals go through distinct stages when changing behaviors: (a) Precontemplation (acting without any awareness of one's own behavior), (b) contemplation (thinking about changing one's own behavior), (c) preparation (planning to change one's own behavior), (d) action (changing one's own behavior), and (e) maintenance (working to prevent lapsing into past behavior). The authors suggest that the stage of change determines the receptiveness of the person to health education information.

Knowles et al. (1998) describe an "Andragogical" model (focuses on adult education) that is based on the following assumptions of adult learners: (a) Need to know (adults need to know why they need to learn something), (b) learner's self-concept (adults believe that they are responsible for their own lives), (c) experience (adults bring their own experiences into the learning environment), (d) readiness to learn (adults are ready to learn what they need to know to cope with life), (e) orientation to learning (adults will learn what they need to know for performing tasks or dealing with problems), and (f) motivation (adults are motivated by internal pressures, such as job satisfaction and self-esteem).

Geller (1989) defines learning as a change in behavior, or potential to behave in a certain way. Put simply, we learn from observing and experiencing events and behaviors in our environments. For injured workers to change work conditions or behaviors, it is important to understand that learning can occur as the result of any of

various approaches, including (a) classical conditioning (emotional or physical response to a stimulus), (b) operant conditioning (rewards consequences rather than punishes consequences), (c) observational learning (peer pressure, setting an example), and (d) overlapping types using all three approaches.

Many patients are expected to learn and carry out certain treatments at home or in their workplace (Falvo, 1999). Not only are patients expected to understand how to integrate treatment regimes into their daily activities, but also they must know and understand how to maintain functioning levels and prevent new or re-injury. This means that patient education is essential while he or she is in the health care system.

Rankin and Stallings (1996) discuss a Health Belief Model which predicts that a patient will learn from the health care provider when the patient: (a) Perceives that he or she has a disease or condition, or is likely to contract it; (b) perceives that the disease or condition is harmful and serious; (c) believes that the suggested intervention is of value; and (d) believes that the intervention is worth the cost and effort.

Rankin and Stallings (1996) refer to a study of this model by Rosenstock (1990) which suggested that the cost and effort are the most significant reasons for or against engaging in preventive health behavior or in behavior related to the illness treatment program. Some workers with MSDs simply are not willing to make the necessary changes (effort) in the way they work, and would rather suffer the pain and live with the limitations associated with the disorder. The work of Rankin and Stallings is a model that is used as the major structure in support of the hypothesis

in this study, and the injured worker's experience with healthcare is the primary independent variable in this study.

Are our health care providers effective in patient education? Do injured workers ever learn what workplace conditions and personal work behaviors might have caused their injuries? Or do they simply receive medical treatment without any education? In the case of the latter, it is likely that injured workers will sustain new injuries, or exacerbate old injuries. If the health care provider is not educating the patient, is the employer providing this information?

According to Falvo (1999), chronic pain for MSDs can be managed with medication, physical therapy, transcutaneous electrical nerve stimulation (TENS), and relaxation techniques. More extreme treatment can include surgery. Vocationally, individuals returning to work may require workplace modifications, such as raising or lowering worksurfaces, adjusting chairs, improving body mechanics, or changing the way job tasks are performed. If the MSD is treated without giving attention to these considerations in the workplace, then our health care providers are simply returning their patients to the very conditions that may have caused the injuries. Patient education should include basic ergonomic principles and guidelines; however, educating the patient is only the first step in this process. How do we know whether or not the patient does anything at all with the information obtained through patient education? The perception of pain varies from person to person, but it is also affected by other factors, such as workers' compensation, that may influence the worker's

motivation to recover. Some injured workers may be hesitant to learn new ways to work if in doing so they will lose financial benefits, or they will return to jobs they do not like. Not everyone is committed to avoiding unhealthy situations (Rollnick, Mason, & Butler, 1999).

Who is responsible for the outcome of patient education? Rollnick et al. (1999) suggest that the health care provider cannot be responsible for the outcome of education if the patient is not willing to help him/herself. The authors concede, however, that the health care practitioner can effect behavior change by the way education is delivered, and suggest practitioner/patient discussion about change as opposed to abruptly dispensing medical expertise.

Rankin and Stallings (1996) believe that lecture is an effective teaching method when used with participant discussion. It can be enhanced with handouts, pictures, and visual aids that the participant can relate to. Other keys to successful lecture training include the following:

1. The material must be at the learners' level of understanding.
2. Participants should have an opportunity to ask questions.
3. Length must be appropriate without being too lengthy.
4. Learners must have the opportunity to apply their new knowledge or skills.

While these four features are important, they are not critical in this study. Furthermore, these features were not manipulated in this study as they are outside of the scope of this study.

When assessing the effectiveness of training or education, it is important to look for changes in behavior as well as attitude (Corry, 1998). Workers' behaviors can be changed if they are involved in the problem identification and solution process. This concept is referred to as "participatory ergonomics." With this approach, the likelihood of reducing MSDs increases because employees feel an ownership and commitment to the corrective actions implemented. These changes in behavior, however, occur after workers gain ergonomic awareness that comes to them in the form of training (Haines, Wilson, Vink, & Kaningsveld, 2002; Loisel et al., 2000; Schurman, Silverstein, & Richards, 1994). This process that combines worker training with problem identification and solution, which Schurman et al. (1994) refer to as "empowerment learning," heightens workers' awareness of physical and psychosocial risks, but it also gives them the opportunity to change their own workspaces, work activities, or work demands.

Loisel et al. (2001) evaluated a four-step participatory ergonomics program. An outside ergonomist solicited input from injured workers in each of the four steps. The study showed that about half of the recommended solutions were implemented. For the remaining half, the primary reason for not implementing recommended solutions was because of work disruption. There are many important considerations with respect to the development of an ergonomic training program; however, these are not the focus of this study.

Training Effectiveness

Johnston et al. (1994) define training as “. . . formal or informal methods to assist individuals in acquiring knowledge, changing attitudes, or executing safe work behaviors” (p. 148). Within the context of ergonomics, Bohr (2000) describes “education” as a way for workers to “. . . work safely through increased knowledge and awareness of appropriate equipment use and working condition” (p. 244).

Effective training achieves two goals. First, it increases workers’ awareness of problems at their workstations, and second, it gives workers the ability to assess their own workstations, and make changes in their workstations whenever possible (Menozzi et al., 1999).

Worker training is important and necessary in protecting the health and safety of workers. The emphasis for an effective training program is placed on the design and delivery of the training program (Lindell, 1994). According to Lindell, the purpose of safety training is to ensure that “. . . workers learn appropriate actions to take on the job and how to perform them correctly” (p. 211). He discusses a model of safety training that looks at four criteria for evaluating training:

1. Reactions--what the worker thought of the training;
2. learning--measured changes in the worker's knowledge, skills, or abilities;
3. behavior--actual performance on the job; and
4. results--measurable differences in organizational objectives, such as productivity, accuracy, and workers' compensation costs.

If workers regard what they learn in training to be unnecessary, or as a barrier to getting the job done, the training will have little effect on changing job safety behaviors. Lindell says that workers' motivation is a function of ". . . the arousal, direction, and persistence of behavior that reduces the likelihood of occupational injury or disease" (p. 213). The arousal and persistence of motivation are described as a tradeoff between time, effort, and energy necessary to perform a task, on one hand, and the feelings of comfort, on the other hand.

Curriculum Design

Training and education can be delivered in many formats. According to Coury (1998), the educational approach to reducing MSDs in the workplace ". . . represents an essential element in the interaction between the worker, the workstation, and the work procedures" (p. 415). Coury states that, with computer operators, it is most important to provide information about risk factors in the workplace, and corrective measures that workers can implement themselves when risk factors are found. Self-assessments are effective measures of acquired knowledge through training.

Many studies have looked at training and education models. Outcomes vary, depending upon the model implemented. The effectiveness of interactive programs, such as those on CD-ROMS, and self-instructional books have been studied, as have Internet training programs (Coury, 1998). In a study by Coury, a self-instructional preventive program was evaluated for effectiveness. The program was designed for subjects to identify problems related to their physical comfort in their workspace, and

provide them with improvement options for the problems identified. In this study, subjects had no access to an instructor, and information was delivered by letters and a booklet only. Subjects were asked to assess their discomfort levels on two questionnaires after implementing improvement options throughout the training. The results of the study showed that musculoskeletal symptoms increased in number and severity.

Schurman et al. (1994) discuss training curriculum designs for workplace health and safety interventions:

1. Simultaneous intervention. Interventions must incorporate both worker training and work place changes.
2. Direct participation. Training must provide opportunities for participants to apply what they have learned by addressing the health and safety problems in their own work environments.
3. Functional similarity. Training must be functionally similar to real-life experiences within the context of participants' work environments.

This curriculum design would seem to be effective for injured workers because it affords the opportunity to change the workplace at the time the learning occurs. The failure of this, and other studies, is that the timing of the worker training is not discussed. The purpose of worker training is to provide injured workers with the skills to make changes in the work space, as well as changes in work behaviors. When the training does not coincide with the onset of the injury, these changes are delayed. Or, worse yet, when injured workers return to the work place before receiving training or

education, they run the risk of re-injury, since they are exposed to the same conditions that caused the original injury.

This is an evaluative literature review. In summary, it is not enough simply to provide the training and education. Workers must be receptive to new information and, in some cases, be willing to change their behavior. This willingness is understood to be influenced by the model developed by Rankin and Stallings (1996). Overall, the effectiveness of the training and education that is delivered to injured workers can be measured by whether or not they can demonstrate the skills necessary to make changes in their work places or in their work behaviors.

Based upon the work by Rankin and Stallings, the hypothesis in this study is tested. The structure, hypothesis, and methods of this study follow in Chapter 3.

Chapter 3

METHODOLOGY

This study was designed to test the following null hypothesis:

- There is no relationship between safety and health education and the injured worker's level of awareness of basic ergonomic guidelines and principles as they apply to the office workstation.

This writer's alternative hypothesis is:

- Education is significantly and positively related to the level of awareness, such that injured workers will have a working understanding of basic ergonomic guidelines and principles as they apply to the office workstation.

In California, most workers who are injured on the job are treated, at least once, by a physician or chiropractor. Subsequent treatment modalities, such as physical or occupational therapy, might be used during the course of treatment. Each contact with a medical or allied health care provider offers opportunities for providers to pass valuable information about ergonomic principles and guidelines on to their patients. This information, along with medical treatment, could potentially aid injured workers in improving their physical conditions.

The purpose of this study is to measure the awareness levels of office ergonomic principles and guidelines among previously injured computer operators who filed Workers' Compensation claims, and were treated for work-related MSDs.

Awareness levels were measured before and after training. A pre-training assessment measured overall knowledge, attitude, and perceived awareness of office ergonomic principles and guidelines among injured and non-injured workers. A post-training assessment measured overall knowledge, attitude, and perceived awareness levels of office ergonomic principles and guidelines among injured and non-injured workers.

Participants

A random sample of computer operators was selected by a unit manager from the California Department of Health Services. The maximum sample population was set at 200 since this was the maximum number of participants that the department could provide at one time for this study; however, the actual sample population was 60. Since the sample was random, it was anticipated that some participants would have sustained work-related MSDs. Of those who sustained work-related MSDs, some would have received treatment, and some would not have. This means that each of the participants would fall into one of two categories: Non-injured worker, or Injured worker who filed a Workers' Compensation claim for MSD.

Apparatus or Instrumentation

To measure the participants' overall awareness of office ergonomic principles and guidelines, training was provided and pre- and post-training assessments were administered. Since all participants attended the same training class, all participants received the same information in the training. Prior to the training, participants completed a pre-training assessment that measured awareness of office ergonomic

principles and guidelines. Upon completion of the training, the same assessment was administered to measure any increase in overall awareness levels subsequent to training.

At the time of the post-training assessment, participants were asked to complete a demographic survey that identified injured workers who received treatment after filing Workers' Compensation claims. The survey was completed after the training, as it contained information and terminology that was covered in the training.

Each participant was issued a packet of handouts to follow during the training. Each packet was identified with a number, ranging between 1 and 100. Each participant was asked to write his or her identification number on the pre-training assessment, post-training assessment, and the demographic questionnaire. To assure anonymity, at no time were names associated with identification numbers. The purpose of the study was explained to the participants, and they were asked to cooperate fully by responding to the tests questions openly and honestly.

Procedures

Subjects were asked to sign an Employee's Agreement to Participate in Research (Appendix A) prior to completing the pre-training assessment on the day of training. They were advised of the purpose of the study, and that their responses would remain anonymous. Each packet of Lecture Handouts (Appendix B) was numbered 1 through 200. These handouts were used in conjunction with the training, and participants were instructed to record their identification number on the first page

of their Pre-Training Assessment (Appendix C). Participants were instructed to complete the pre-training assessments, and to direct any questions to the instructors. Participants completed the pre-training assessments and turned them in to the instructors. All pre-training assessments were accounted for before the training began.

One-hour training was provided by two instructors. The training covered basic office ergonomic guidelines and principles, including:

- Introduction to ergonomics
- Musculoskeletal disorders (MSDs)

Definitions

Causes

Symptoms

- Risk factors for MSDs
- Control strategies for preventing MSDs
- Photo analysis
- Adjusting the computer workstation--making it fit
- Questions and answers/discussion

After the training, the Post-Training Assessment (Appendix D) and the Demographic Survey (Appendix E) were distributed. Participants were instructed to write their identification numbers on each of these documents before completing them. When completing the post-training assessment, they were allowed to refer to the training handouts. Participants were instructed to direct their questions to the instructors.

Chapter 4

RESULTS

The purpose of this study was to measure knowledge, attitude, and awareness of basic ergonomic principles and guidelines among office workers. The dependent variables are participants' perceptions of their attitudes and awareness, and their knowledge. "Attitude" refers to the participants' beliefs that they can prevent injuries by changing the way they work, and their willingness to change the way they work. "Awareness" refers to participants' perceptions of their awareness of ways to adjust the chair and the workstation, and safe working techniques. "Knowledge" refers to the participants' understanding of basic ergonomic guidelines and principles. All dependent variables were measured in pre- and post-training assessments. The independent variable in this study is the training class which covered basic ergonomic guidelines and principles for computer users.

The population of this study consisted of two groups: (a) Injured, those who have filed Workers' Compensation claims for MSDs; and (b) Non-injured, those who have not filed Workers' Compensation claims for MSDs. Subjects who reported having MSDs but did not file Workers' Compensation claims for them were considered to be non-injured.

Out of 86 attendees, 60 participated in the study by remaining for the entire training, completing both the pre- and post-training assessments, and the

demographic survey. Many attendees left before the completion of the training due to previous time commitments. The pre-training assessments of those who left early were not considered in the analysis of the data.

Demographic data were collected to define the test population (Table 1). Twenty-three of the 60 participants (38.33%) reported musculoskeletal discomfort, but did not file Workers' Compensation claims. Another 28 of the 60 (46%) never had musculoskeletal discomfort. These 51 participants (85%) are considered to be non-injured because they never filed Workers' Compensation claims, despite some reporting musculoskeletal discomfort. The remaining nine (15%) reported musculoskeletal discomfort and filed Workers' Compensation claims. These participants are considered to be injured because they filed Workers' Compensation claims.

Table 1

Test Population: Break-down Between Injured and Non-injured Participants

	Did not file WC claim Non-injured N = 51	Filed WC claim Injured N = 9	Total N = 60
Had MSD	23 (38.33%)	9 (15%)	32 (53%)
Did not have MSD	28 (46%)	0	28 (47%)
Total	51 (86%)	9	60 (100%)

This is a mixed factorial study with one within-subject variable (pre- and post-training assessments to measure knowledge, attitude, and awareness), and a between-subject variable (injured and non-injured). A two-way ANOVA was calculated for every question on the pre- and post-training assessments to explore whether or not interactions exist between the two variables.

Knowledge

There was a possible 15 correct score. When comparing the differences of pre- and post-assessment scores within the groups (Table 2), the result is significant (Sig. = .000), indicating that training had an effect on the entire population. When determining differences in pre- and post-assessment scores between groups of injured and non-injured subjects, the difference is not significant (Sig. = .226). However, the interaction of one variable on the other is marginally significant (Sig. = .161).

Table 2

Significance of Knowledge Scores
(scores within groups [A] and between groups [B])

N = 60	SS	df	MS	F	Sig.
Pre- and post- training assessments [A]	393.072	1	393.072	95.783	.000
Injured vs. non-injured [B]	11.475	1	11.475	1.498	.226
A x B (interaction)	8.272	1	8.272	2.016	.161
Total		59			

Attitude

To measure attitude, participants were asked to answer "Yes," "No," or "Maybe" to the following questions on the pre- and post-training assessments: (a) Do you believe that you can prevent an injury by changing the way you work? and (b) Are you willing to change the way you work?

In response to question #1 on the pre-training assessment (Table 3), 49 out of 60 (82%) answered Yes, one (2%) answered No, and 10 (17%) answered Maybe. Of the nine injured participants, seven (78%) answered Yes and two (56%) answered Maybe on the pre-training assessment. None of the injured participants answered No. Of the 51 non-injured participants, 42 answered Yes (82%), one answered No (2%), and eight answered Maybe (16%).

Table 3

Responses to Pre-training Attitude Question #1
(responses within Injured and Non-injured, and between Injured and Non-injured)

Question #1: Do you believe that you can prevent an injury by changing the way you work?	Injured and Non-injured N = 60	Injured N = 9	Non-injured N = 51
Yes	49	7	42
No	1	0	1
Maybe	10	2	8
Total	60	9	51

In response to question #1 on the post-training assessment (Table 4), 56 out of 60 (93%) answered Yes and four (7%) answered Maybe. None of the participants answered No to this question on the post-training assessment. Of the nine injured participants, eight (89%) answered Yes and one (11%) answered Maybe on the post-training assessment. None of the injured participants answered No to this question on the post-training assessment. Of the 51 non-injured participants, 48 answered Yes (94%) and three answered Maybe (6%). None of the non-injured participants answered No to this question on the post-training assessment.

Table 4

Responses to Post-training Attitude Question #1
(responses within Injured and Non-injured, and between Injured and Non-injured)

Question #1: Do you believe that you can prevent an injury by changing the way you work?	Injured and Non-injured N = 60	Injured N = 9	Non-injured N = 51
Yes	56	8	48
No	0	0	0
Maybe	4	1	3
Total	60	9	51

In response to question #2 on the pre-training assessment (Table 5), 54 out of 60 (90%) answered Yes and six (10%) answered Maybe. None of the participants answered No to this question on the pre-training assessment. Of the nine injured

participants, eight (89%) answered Yes and one (11%) answered Maybe on the pre-training assessment. None of the injured participants answered No to this question on the pre-training assessment. Of the 51 non-injured participants, 46 answered Yes (92%) and five answered Maybe (10%). None of the non-injured participants answered No to this question on the pre-training assessment.

Table 5

Responses to Pre-training Attitude Question #2
(responses within Injured and Non-injured, and between Injured and Non-injured)

Question #2: Are you willing to change the way you work?	Injured and Non-injured N = 60	Injured N = 9	Non-injured N = 51
Yes	54	8	46
No	0	0	0
Maybe	6	1	5
Total	60	9	51

In response to question #2 on the post-training assessment (Table 6), 60 out of 60 (100%) answered Yes.

A two-way ANOVA was calculated on the attitude question of prevention (Table 7), indicating that the differences within groups (Sig. = .119) and between groups (Sig. = .711) are not significant; however, one could argue that the within-

group's difference is marginally significant at .119. The interaction between the variables is not significant.

Table 6

Responses to Post-training Attitude Question #2
(responses within Injured and Non-injured, and between Injured and Non-injured)

Question #2: Are you willing to change the way you work?	Injured and Non-injured N = 60	Injured N = 9	Non-injured N = 51
Yes	60	9	51
No	0	0	0
Maybe	0	0	0
Total	60	9	51

Table 7

Significance of Responses to Attitude Question #1: Ability to Prevent Injury
(scores within groups [A] and between groups [B])

Question #1: Do you believe that you can prevent an injury by changing the way you work? N = 60	SS	df	MS	F	Sig.
Pre- and post-training assessments [A]	.05899	1	.05899	2.505	.119
Injured vs. non-injured [B]	.00588	1	.00588	.139	.711
A x B (interaction)	.000656	1	.000656	.028	.868
Total		59			

A two-way ANOVA was calculated on the attitude question of willingness to change (Table 8), indicating that the differences within groups (Sig. = .063) and between groups (Sig. = .906) are not significant. The interaction between variables is not significant (Sig. = .906).

Table 8

Significance of Responses to Attitude Question #2: Willingness to Change (scores within groups [A] and between groups [B])

Question #2: Are you willing to change the way you work? N = 60	SS	df	MS	F	Sig.
Pre- and post-training assessments [A]	.04183	1	.04183	3.595	.063
Injured vs. non-injured [B]	.00016	1	.00016	.014	.906
A x B (interaction)	.00016	1	.00016	.014	.906
Total		59			

Awareness

Two questions were asked regarding subjects' awareness of the application of general ergonomic principles and guidelines. The first question addressed the subjects' awareness of chair and workstation adjustments, and the second question addressed subjects awareness of ways to change work technique to work safer.

To measure awareness, participants were asked to rank their perceptions of their awareness of chair and workstation adjustments as well as work technique on

a five-step Likert scale on the pre- and post-training assessments. The five ranks were Unaware = 1, Unaware of most ways = 2, Somewhat aware = 3, Aware of most ways = 4, and Fully aware = 5. Responses of 1 and 2 were considered to be low awareness levels while responses of 4 and 5 were considered to be high awareness levels.

In response to awareness question #3 on the pre- and post-training assessments (Table 9), a two-way ANOVA indicated that the only significant difference was in the pre- and post-training assessments (Sig. = .000), suggesting that the training made a difference in awareness levels overall on this topic. There was no significant difference in the way injured and non-injured participants rated their awareness of this topic.

Table 9

Significance of Responses to Awareness Question #3
(scores within groups [A] and between groups [B])

Question #3: Are you aware of ways to adjust your chair or workstation to make it safer? N = 60	SS	df	MS	F	Sig.
Pre- and post-training assessments [A]	9.333	1	9.333	17.900	.000
Injured vs. non-injured [B]	.608	1	.608	.443	.509
A x B (interaction)	.00016	1	.00016	.000	.986
Total		59			

In response to awareness question #4 on the pre- and post-training assessments (Table 10), a two-way ANOVA indicated that the only significant difference was in the pre- and post-training assessments (Sig. = .000), suggesting that the training made a difference in awareness levels overall on this topic. There was no significant difference in the way injured and non-injured participants rated their awareness of this topic.

Table 10

Significance of Responses to Awareness Question #4
(scores within groups [A] and between groups [B])

Question #4: Are you aware of ways to change your work technique to make it safer? N = 60	SS	df	MS	F	Sig.
Pre- and post-training assessments [A]	21.650	1	21.650	17.990	.000
Injured vs. non-injured [B]	0.316	1	0.316	0.264	.609
A x B (interaction)	0.01634	1	0.01634	0.028	.868
Total		59			

Chapter 5

CONCLUSIONS

Each contact with a medical or allied health care provider offers yet another opportunity to pass on valuable information to the injured worker. With so many opportunities to receive ergonomic information, how much and what kind of information is given to injured workers at the time of their injuries and while receiving treatment, and as they attempt to return to work? When information is provided, do injured workers follow instructions so they can return to their jobs without exacerbating their injuries, or sustaining new injuries? Is the learning that takes place after an injury simply the result of education from the medical provider? Or does the pain and suffering from the injury motivate one to make necessary changes toward the goal of pain management? These are questions that could be addressed in subsequent studies by graduate students.

In this study, it is not known whether or not any of the participants had received prior ergonomic information. For those who had received prior ergonomic information, this could account for greater knowledge, more positive attitudes, and higher levels of awareness before taking the pre-training assessment. On the other hand, if they regard the information they received in prior training as unnecessary or irrelevant, the training will have little effect on changing the way they work (Lindell, 1994). This could skew the results of the pre-training assessment scores

for knowledge, attitude, and awareness when compared against those with no prior ergonomic information.

While the training appeared to be effective within groups (injured and non-injured participants), it did not appear to make a difference in knowledge scores, attitudes, or awareness levels between injured and non-injured participants. This might be due to the small number of injured participants in this study. Perhaps, with a larger population of injured participants, the results might have indicated significant differences between injured and non-injured participants. On the other hand, the results of this study indicate that injured and non-injured participants have about the same knowledge, attitudes, and awareness levels of basic office ergonomics, suggesting that the medical community is not making an effort to educate and train its injured workers to prevent injuries, nor to improve their work environment or work techniques.

With workers' compensation costs increasing in California, medical care providers can impact bottom-line dollars and cents. They can reduce the likelihood of exacerbation or re-injury by providing basic ergonomic information at the same time they are treating their patients. Are the medical care providers failing to provide necessary patient education, or is the education they are providing ineffective or inadequate? The responsibility for reducing workers' compensation costs does not fall solely on the shoulders of the medical care providers. Employers can and should be more proactive in preventing injuries by training their employees to recognize ways to

work safer. Employers, however, may be reluctant to provide such training for reasons such as work disruption (Loisel et al., 2001). One must ask those employers if losing valued employees to workers' compensation injuries are "work disruptions." This study shows that basic training is effective; however, even with basic training, some employees are not motivated to change the way they work, as suggested by Rankin and Stallings (1996) and Rollnick et al. (1999). If employees receive training that increases their awareness and provides them with the means to make changes in their work stations (Corry, 1998; Menozzi et al., 1999), the burden of basic office ergonomic training has been met. Some problems at the work station are beyond the capabilities of the employees to solve by themselves, and that is when a specialist in ergonomics needs to be called in.

For future thesis studies, it would be interesting to survey workers' compensation medical care providers to determine to what extent and in what ways they are educating their patients who sustain musculoskeletal disorders. Furthermore, it would be interesting to study the differences in knowledge, attitudes, and levels of awareness between patients who received prior training and those who did not receive prior training. A study could further compare the same measures against non-injured employees who have not received prior ergonomic training.

In the final analysis, many things must happen in order to reduce risk and prevent injuries. It is not the responsibility of any one entity, but rather a combination of efforts to make the work place a safe place.

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APPENDIX A

Consent Form

**San José State
UNIVERSITY**

Department of Industrial
& Systems Engineering
Room 283, Engineering Building
One Washington Square
San José, CA 95192-0085
Voice: 408-924-3301
Fax: 408-924-4040
E-mail: isengr@email.sjsu.edu
http://www.engr.sjsu.edu/ise

EMPLOYEE'S AGREEMENT TO PARTICIPATE IN RESEARCH

Responsible Investigators: Susan Tingley and Fran Wagner

Title of Protocol: Office of Ergonomics Training

1. You have been asked to participate in a research study investigating awareness of ergonomics principles and guidelines in the office work setting.
 2. You will be asked to:
 - a. Complete a pre-training assessment.
 - b. Participate in a 1-1/2 hour office ergonomics lecture style training class. You will receive training handouts.
 - c. Complete a post training assessment.
 - d. Complete a demographic survey.
 3. No safety risks are anticipated. You are encouraged to stand or change position as needed for comfort during the training class.
 4. You may benefit from this research project by receiving training and increasing awareness of ergonomics principles.
 5. Although the results of this study may be published, no information that could identify you will be included.
 6. There is no compensation for your participation in this study.
 7. Questions about this research may be addressed to:

Susan Tingley, PT, CAE	Fran Wagner, MS, CIE
PO Box 2277	PO Box 60268
Granite Bay, CA 95746	Sacramento, CA 95860-0268
(916) 784-0321	(916) 482-5741
 8. Complaints about the research may be presented to:

Kevin Corker, HFE Department Director
Industrial & Systems Engineering Department
San Jose State University
One Washington Square
San Jose, CA 95192
(408) 924-3988 Kevin.corker@sjsu.edu

Questions about research subjects' rights or research-related injury may be presented to:
Pamela Stacks, Ph.D., Interim Associate Vice President
Graduate Studies and Research
(408) 924-7029
 9. No service of any kind, to which you are otherwise entitled, will be lost or jeopardized if you choose to "not participate" in the study.
 10. Your consent is being given voluntarily. You may refuse to participate in the entire study or in any part of the study. If you decide to participate in the study, you are free to withdraw at any time without any negative effect on your relations with San Jose State University or with any other participating institutions or agencies.
 11. At the time that you sign this consent form, you will receive a copy of it for your records, signed and dated by the investigator.
- ☐ The signature of a subject on this document indicates agreement to participate in the study.
- ☐ The signature of a researcher on this document indicates agreement to include the above named subject in the research and attestation that the subject has been fully informed of his or her rights.

The California State University:
Chancellor's Office
Bakersfield, Channel Islands, Chico,
Dominguez Hills, Fresno, Fullerton,
Hayward, Humboldt, Long Beach,
Los Angeles, Maritime Academy,
Monterey Bay, Northridge, Pomona,
Sacramento, San Bernardino, San Diego,
San Francisco, San José, San Luis Obispo,
San Marcos, Sonoma, Stanislaus

_____ Signature	_____ Date
Susan Tingley, PT, CAE _____ Signature	_____ Date
Fran Wagner, MS, CIE _____ Signature	_____ Date

APPENDIX B
Lecture Handouts

Ergonomics in the Office

Presented by

Susan Tingley, PT, CAE

Fran Wagner, MS, CIE

APPENDIX C

Pre-Training Assessment

Write your ID number on each page of this assessment: ID# _____

Circle the answer that most closely matches your opinion

1. Do you believe that you can prevent an injury by changing the way you work?

Yes

No

Maybe

2. Are you willing to change the way you work?

Yes

No

Maybe

3. Are you aware of ways to adjust your chair or workstation to make it safer?
(circle only one number)

Unaware	Unaware of most ways	Somewhat aware	Aware of most ways	Fully aware
1	2	3	4	5

4. Are you aware of ways to change your work technique to make it safer?
(circle only one number)

Unaware	Unaware of most ways	Somewhat aware	Aware of most ways	Fully aware
1	2	3	4	5

5. Is there anything you have already done or that you will do to your chair, workstation, or work techniques to make it safer? If so, please briefly list below.

Read each question below. Then, select the BEST response from the choices to the right of each question. *Select only one response for each question.* Print your response in the box to the right.

EXAMPLE: Read the question below:		Select the BEST answer. Select only one response for each question:	Record Your Answer
	What does ergonomics do for you?	a) Reduces my risk for injury b) Helps me understand my job tasks c) Reduces my risk for heart disease d) I don't know	A

Read the questions below:		Select the BEST answer. Select only one response for each question:	Record Your Answer
---------------------------	--	--	--------------------------

1	What are common signs and symptoms of MSDs?	a) Rash and itching b) Infection and fever c) Pain and swelling d) I don't know	
---	---	--	--

2	What are some of the work-related risk factors that we know can cause or contribute to work-related musculoskeletal disorders (MSDs)?	a) Age, gender and heredity b) Force, static posture, contact pressure, vibration, temperature extremes and job pressures c) Smoking, poor nutrition, pre-existing medical conditions d) I don't know	
---	---	--	--

3	How can you reduce repetitive hand motions	a) Use the mouse more and the keyboard less b) Use the keyboard more and the mouse less c) Handwrite notes first, then type them into the computer later d) I don't know	
---	--	---	--

4	How can you reduce awkward hand motions	a) Move your hand more forward onto the mouse b) Place only your fingertips on the mouse, keep the heel of your hand on the work surface c) Use a "windshield wiper" motion with your wrist to move the mouse d) I don't know	
---	---	--	--

Read the questions below:		Select the BEST answer. Select only one response for each question:	Record Your Answer
5	What is the guideline of the backrest to be at the correct height to fit you?	a) The curve of the backrest is slightly higher than the deepest curve in my back b) The curve of the backrest is slightly lower than the deepest curve in my back c) The curve of the chair back fits snugly into the deepest curve in my back d) I don't know	
6	When the seat height of the chair is correct, how high is the seat compared to your standing knee height?	a) The seat is at or slightly below my knees b) The seat is 3 inches or more higher than my knees c) The seat is 3 inches or more below the height of my knees d) I don't know	
7	For people with low back pain, what seated posture is generally more comfortable?	a) Sitting upright (90 degrees) b) Sitting slightly forward c) Sitting slightly reclined d) I don't know	
8	What is the guideline for using the armrests on the chair:	a) My arms should rest on the arm rests only while keying b) My arms should rest on the armrests only between keying activities c) My arms should always be on the armrests d) I don't know	
9	What is the guideline for keyboard height?	a) It should be slightly higher than my elbows b) It should be at or slightly below my elbows c) It should be 29- 30" above the floor d) I don't know	
10	If you are using the mouse frequently while keying, where should the mouse be placed?	a) The mouse should be as close to the keyboard as possible, in the near reach zone b) The mouse should be at least an arm's length away, in the mid reach zone c) The distance of the mouse is not important. d) I don't know	

Read the questions below:		Select the BEST answer. Select only one response for each question:	Record your answer
11	When keying, what is the guideline for wrist posture?	a) You should rest your wrists on the wrist rest while keying b) You should lift your wrists off the wrist rest and keep your wrist straight (flat) while keying c) You should lift your wrists off the wrist rest and bend (flex) at the wrist while keying d) I don't know	
12	When looking at the monitor, what do you need to do if you are lifting your chin up and tilting your head back to see the top of the screen?	a) Raise the monitor a couple inches at a time b) Raise the chair or lower the monitor c) Nothing. This is the proper way to position the monitor. d) I don't know	
13	The monitor should never be more than an arm's length away from your eyes.	a) True b) False c) I don't know	
14	When viewing a document while using the computer, what is the guideline for placement of the document?	a) The document should be on a document holder, next to or below the monitor b) The document should lie flat on the worksurface, next to the monitor c) The document should lie flat on the worksurface, next to the keyboard d) I don't know	
15	How can we be more comfortable at our computer workstations?	a) We will be more comfortable at our computers if all our workstations are set up the same b) We will be comfortable at our computers if each workstation is set up for the individual user c) We will be more comfortable at our computers if we use more built-in furniture "One size fits all". d) I don't know	

APPENDIX D

Post-Training Assessment

Write your ID number on each page of this assessment: ID# _____

Circle the answer that most closely matches your opinion

1. Do you believe that you can prevent an injury by changing the way you work?

Yes No Maybe

2. Are you willing to change the way you work?

Yes No Maybe

3. Are you aware of ways to adjust your chair or workstation to make it safer?
(circle only one number)

Unaware	Unaware of most ways	Somewhat aware	Aware of most ways	Fully aware
1	2	3	4	5

4. Are you aware of ways to change your work technique to make it safer?
(circle only one number)

Unaware	Unaware of most ways	Somewhat aware	Aware of most ways	Fully aware
1	2	3	4	5

5. Is there anything you have already done or that you will do to your chair, workstation, or work techniques to make it safer? If so, please briefly list below.

Read each question below. Then, select the BEST response from the choices to the right of each question. *Select only one response for each question.* Print your response in the box to the right.

EXAMPLE: Read the question below:		Select the BEST answer. Select only one response for each question:	Record Your Answer
	What does ergonomics do for you?	e) Reduces my risk for injury f) Helps me understand my job tasks g) Reduces my risk for heart disease h) I don't know	A

Read the questions below:		Select the BEST answer. Select only one response for each question:	Record Your Answer
---------------------------	--	--	--------------------------

1	What are common signs and symptoms of MSDs?	e) Rash and itching f) Infection and fever g) Pain and swelling h) I don't know	
---	---	--	--

2	What are some of the work-related risk factors that we know can cause or contribute to work-related musculoskeletal disorders (MSDs)?	e) Age, gender and heredity f) Force, static posture, contact pressure, vibration, temperature extremes and job pressures g) Smoking, poor nutrition, pre-existing medical conditions h) I don't know	
---	---	--	--

3	How can you reduce repetitive hand motions	e) Use the mouse more and the keyboard less f) Use the keyboard more and the mouse less g) Handwrite notes first, then type them into the computer later h) I don't know	
---	--	---	--

4	How can you reduce awkward hand motions	e) Move your hand more forward onto the mouse f) Place only your fingertips on the mouse, keep the heel of your hand on the work surface g) Use a "windshield wiper" motion with your wrist to move the mouse h) I don't know	
---	---	--	--

Read the questions below:		Select the BEST answer. Select only one response for each question:	Record Your Answer
5	What is the guideline of the backrest to be at the correct height to fit you?	e) The curve of the backrest is slightly higher than the deepest curve in my back f) The curve of the backrest is slightly lower than the deepest curve in my back g) The curve of the chair back fits snugly into the deepest curve in my back h) I don't know	
6	When the seat height of the chair is correct, how high is the seat compared to your standing knee height?	e) The seat is at or slightly below my knees f) The seat is 3 inches or more higher than my knees g) The seat is 3 inches or more below the height of my knees h) I don't know	
7	For people with low back pain, what seated posture is generally more comfortable?	e) Sitting upright (90 degrees) f) Sitting slightly forward g) Sitting slightly reclined h) I don't know	
8	What is the guideline for using the armrests on the chair:	e) My arms should rest on the arm rests only while keying f) My arms should rest on the armrests only between keying activities g) My arms should always be on the armrests h) I don't know	
9	What is the guideline for keyboard height?	e) It should be slightly higher than my elbows f) It should be at or slightly below my elbows g) It should be 29- 30" above the floor h) I don't know	
10	If you are using the mouse frequently while keying, where should the mouse be placed?	e) The mouse should be as close to the keyboard as possible, in the near reach zone f) The mouse should at least an arm's length away, in the mid reach zone g) The distance of the mouse is not important. h) I don't know	

Read the questions below:		Select the BEST answer. Select only one response for each question:	Record your answer
11	When keying, what is the guideline for wrist posture?	e) You should rest your wrists on the wrist rest while keying f) You should lift your wrists off the wrist rest and keep your wrist straight (flat) while keying g) You should lift your wrists off the wrist rest and bend (flex) at the wrist while keying h) I don't know	
12	When looking at the monitor, what do you need to do if you are lifting your chin up and tilting your head back to see the top of the screen?	e) Raise the monitor a couple inches at a time f) Raise the chair or lower the monitor g) Nothing. This is the proper way to position the monitor. h) I don't know	
13	The monitor should never be more than an arm's length away from your eyes.	d) True e) False f) I don't know	
14	When viewing a document while using the computer, what is the guideline for placement of the document?	e) The document should be on a document holder, next to or below the monitor f) The document should lie flat on the worksurface, next to the monitor g) The document should lie flat on the worksurface, next to the keyboard h) I don't know	
15	How can we be more comfortable at our computer workstations?	e) We will be more comfortable at our computers if all our workstations are set up the same f) We will be comfortable at our computers if each workstation is set up for the individual user g) We will be more comfortable at our computers if we use more built-in furniture "One size fits all". h) I don't know	

APPENDIX E

Demographic Survey

ID # _____

Have you ever had a work-related musculoskeletal disorder (MSD)?

_____ No. Stop here. Do not continue.

_____ Yes. Please continue.

Did you file a Workers' Compensation claim for your MSD?

_____ No.

_____ Yes.