CRE-MSD Centre of Research Expertise for the Prevention of Musculoskeletal Disorders

What we Know about Prolonged Sitting and Standing – Implications for Wellness and MSDs

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60 YEARS HELPING TO REDUCE INJURIES AND DISABILITY

Importance and Role of Training:
Effects and Benefits in Office and Computer Work Environments

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October 3, 2016

Vision:

To be the premier research organization in the world dedicated to the reduction of injuries and disability

Mission:

To conduct innovative scientific research to help reduce injuries and disability at home, at work, in the community and on the road.

Overview

Creating Safe, Healthy, and Productive Office Environments

- Complexities of office & computer environments and their impact
- Holistic – Macroergonomics/Socio-technical systems approaches to prevention
- Conceptual model
- Use of Instructional System Design (ISD) approach
- Effects of training and sit/stand workstation intervention
- Take-aways

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Problem: Unsafe Work Environments and Poor Performance

- Computer and office work is associated with an increase in Work-Related Musculoskeletal Disorders (WMSDs) and Visual Discomfort

  Multiple contributing factors:

  – Physical workspace design
    - Prolonged mouse use related to increased risk of upper extremity MSD
    - Related physical exposure: non-neutral posture and static muscle loading; lack of movement and posture variation
    - Low level of usage of sit-stand function
  – Work organization and psychosocial factors
    - Lack of job control, high work pace, and low supervisory support
  – Technology design
    - Poor software interface design

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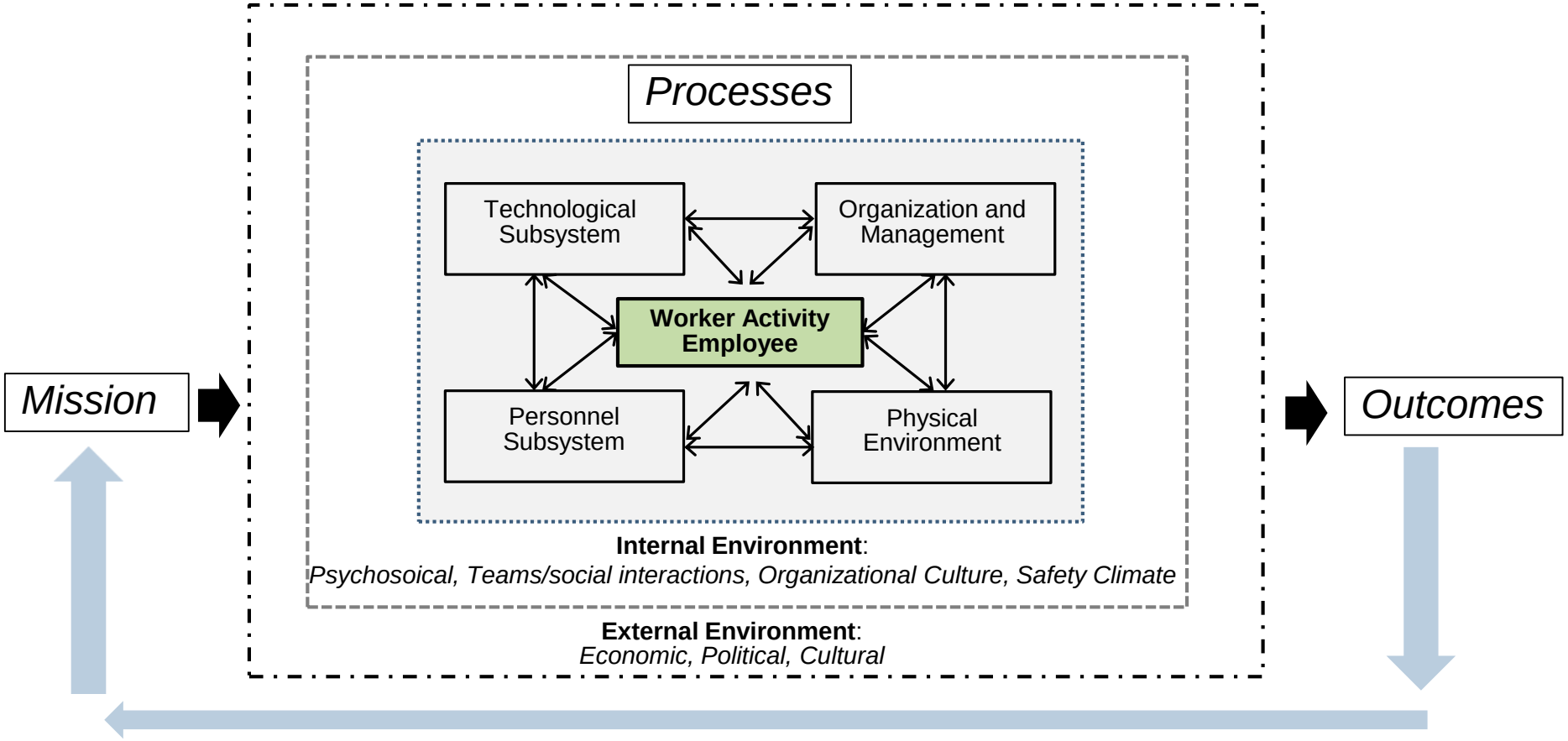
Bernard, et al., 1994; Bongers, 1993; 2009 Ijmker et al., 2007; Geer, et al., 2006, Aaras, et al., 2001; Katz 2000; Schlossberg, 2004; Burgess-Limerick 1999, Fagarasanu 2004, Hagg 2000; Wilks et al., 2006

Purpose of Research: Computerized Office Environment

- Study the effects of ergonomic training and adjustable/flexible workspace design on:
  - Musculoskeletal and visual discomfort
  - Computing behavior (sit-stand behaviors; work arrangement; postures)
  - Workspace satisfaction and comfort
  - Job & environmental control
  - Group effectiveness
  - Ergonomics climate (management support of ergonomics needs)
  - Performance: Business Process Efficiency; Quality

Studied cumulative effects of performing computer work

Work System Model: A Macroergonomics Framework



"The whole is more than the sum of the parts"

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Extended Laboratory Intervention Study: Training and Sit/Stand Workstation Design

Published: Robertson, Ciriello, & Garabet, Applied Ergonomics 44 (2013) 73-85

Studied cumulative effects of performing computer work

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Research Focus: Environmental Control

Training and Flexible Workplace Design → Control over Environment and Job

Control as a function of:

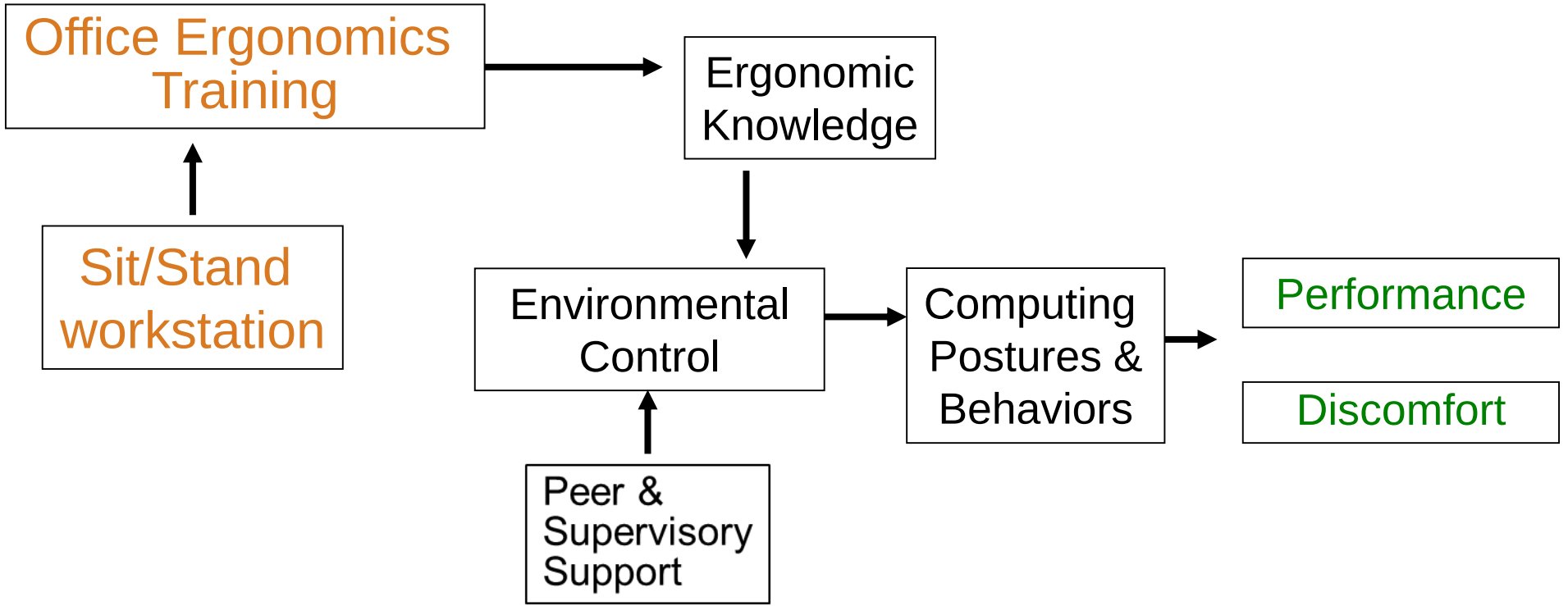
1. Training to enhance opportunities for control
   - Exert knowledgeable control over one's workspace
2. Availability of adjustable and flexible workspaces
3. Combination allows for frequent varied postures, movement, and pauses
   1. Vary distribution of static load by frequent posture changes

Conceptual underpinnings:

Job Control & Job Demand (Karasek & Theorell, 1990)

Job stress (McLaney & Hurrell, 1998)

Conceptual Model



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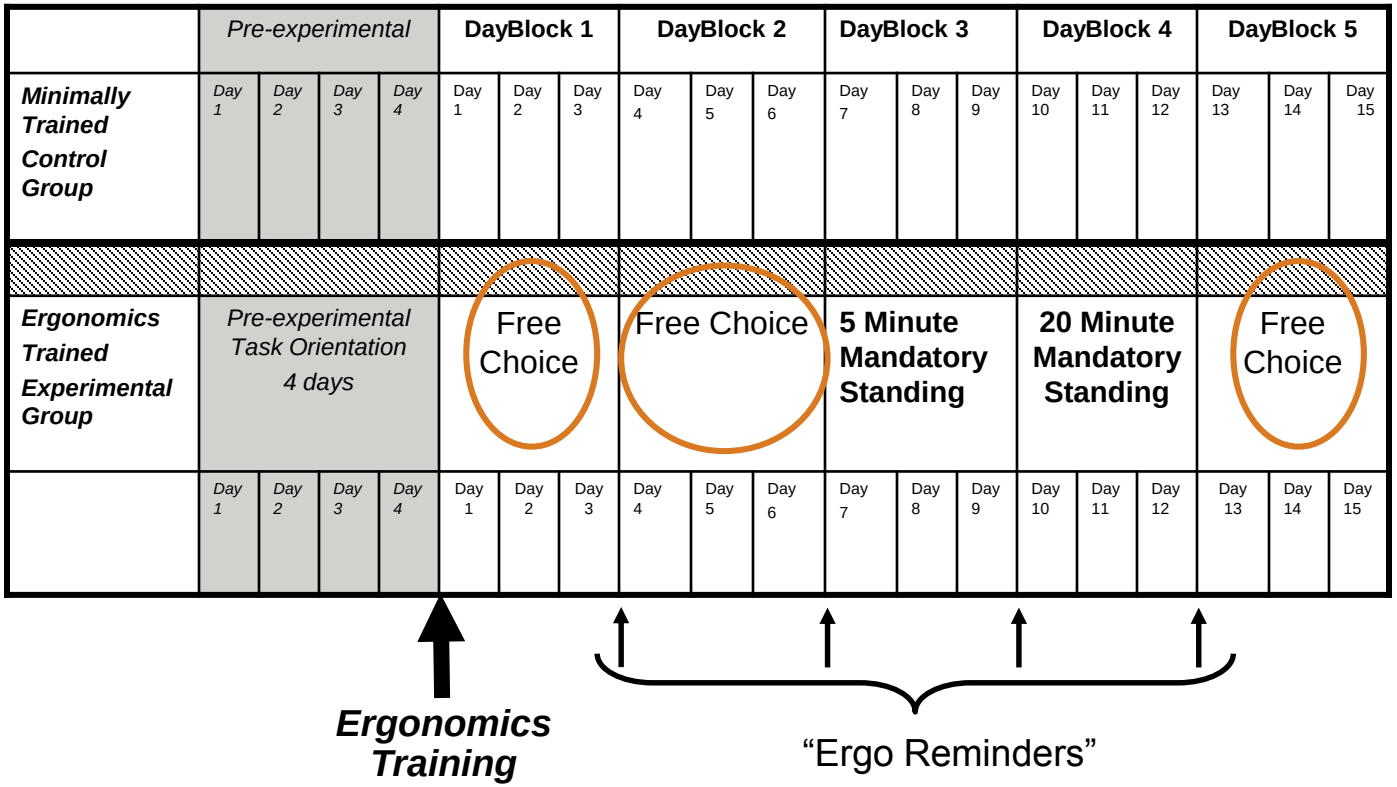
Research Questions

- Will musculoskeletal and visual discomfort be minimal as a function of training and workspace adjustability for the Trained group?
- Will performance be higher for the Trained group?
- Will office ergonomics knowledge and intent to arrange office workstation set-up increase for the Trained group?
- Will alternating between sitting and standing computing postures and the amount of time standing be higher for the Trained group?

Study Design: Randomized Control Trial



Randomized schedule of 3 cognitive demand levels

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Methods

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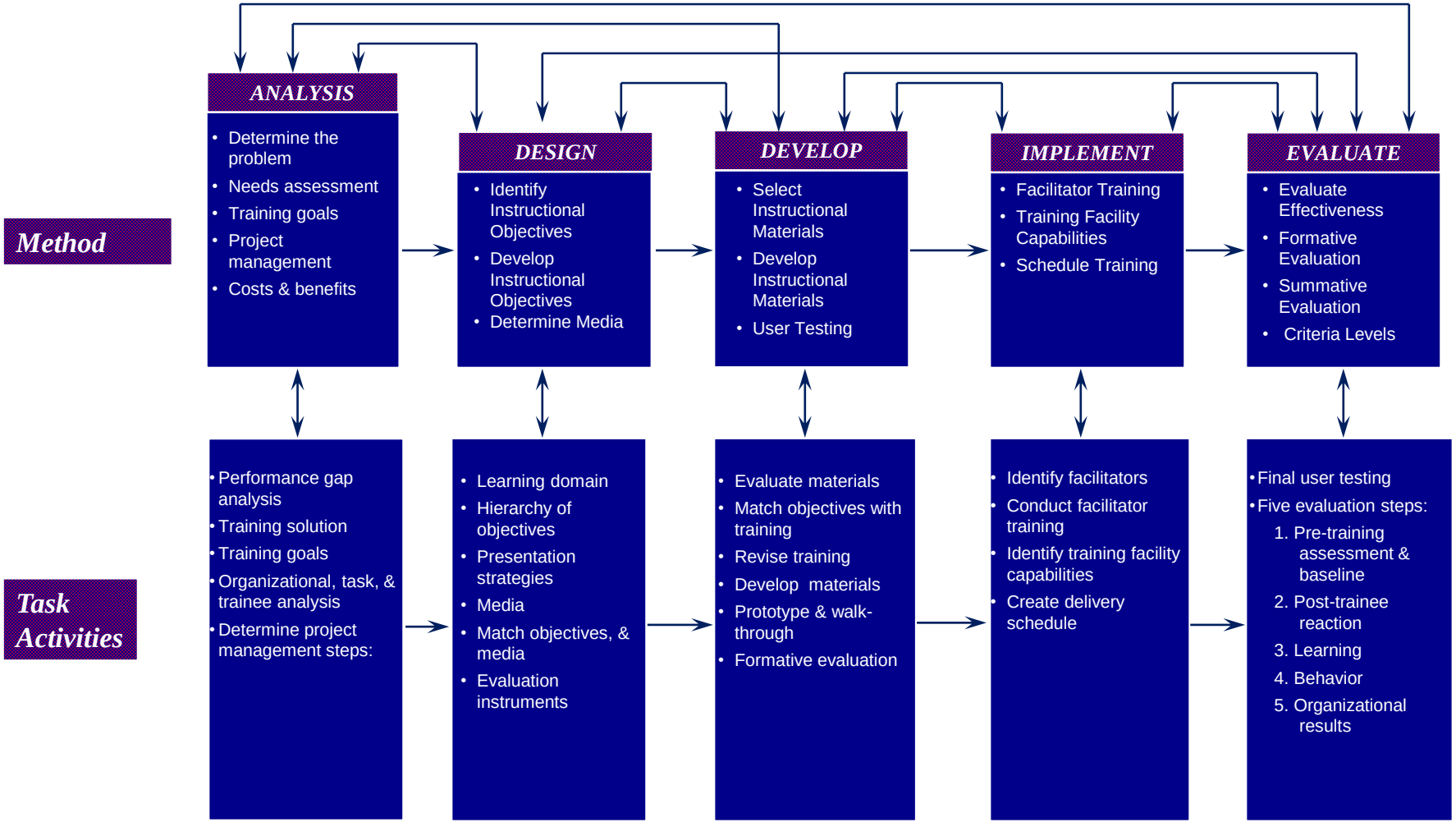
Participants and Tasks

- Participants:
  - 22 females without pre-existing musculoskeletal and visual symptoms
  - Basic administration computing skills
  - No significant difference between groups for age and BMI ($p>.05$)

- Experimental task and cognitive demand levels:
  - Simulated customer service representative job
  - Based on a job analysis, the following were determined:
    - Task complexity (cognitive demands)
    - Quality control and proficiency
  - 7 hour day; 15 days


Method
Task Activities
ANALYSIS
Determine the problem
Needs assessment
Training goals
Project management
Costs & benefits
DESIGN
Identify Instructional Objectives
Develop Instructional Objectives
Determine Media
DEVELOP
Select Instructional Materials
Develop Instructional Materials
User Testing
IMPLEMENT
Facilitator Training
Training Facility Capabilities
Schedule Training
EVALUATE
Evaluate Effectiveness
Formative Evaluation
Summative Evaluation
Criteria Levels
Performance gap analysis
Training solution
Training goals
Organizational, task, & trainee analysis
Determine project management steps:
Learning domain
Hierarchy of objectives
Presentation strategies
Media
Match objectives, & media
Evaluation instruments
Evaluate materials
Match objectives with training
Revise training
Develop materials
Prototype & walk-through
Formative evaluation
Identify facilitators
Conduct facilitator training
Identify training facility capabilities
Create delivery schedule
Final user testing
Five evaluation steps:
1. Pre-training assessment & baseline
2. Post-trainee reaction
3. Learning
4. Behavior
5. Organizational results

Ergonomic Training Objectives:

Training Objectives	• Recognizing work-related musculoskeletal disorders and risk factors
	• Understanding the importance of varying work postures
	• Knowing how to rearrange the workstation to maximize the "comfort zone",
	• Recognizing and understanding visual issues in the office environment and reducing visual discomfort
	• Understanding computing habits (rest breaks) and knowing how in to change work-rest patterns
	• Knowing how to use the various workspaces for individual and group work
	• Being aware of the company's existing health and ergonomic programs
	• Knowing how to obtain ergonomic accessories through the company's programs

Ergonomic Training & Experimental Set-up

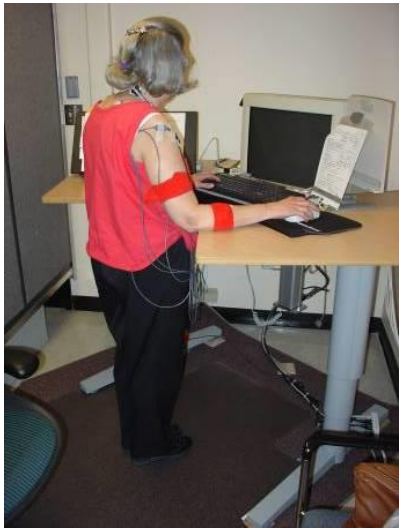
Trained Group received two-phase ergonomic training and practice periods

- Phase I:
  - 1.5 hr. workshop
    - Slide and video presentation
    - Case studies & de-briefing
    - Hands-on practice periods with “ergo buddies”
- Phase II:
  - Practice period of standing
  - Ergonomics reminders
    - Vary work postures; ergo breaks

Minimally Trained Group received:

- Brief, standard orientation of work setting
- Manufacturer pamphlet of chair adjustments

Participant Workstation



Data Collection

Data Collection and Outcomes

- **Musculoskeletal symptoms:**
  - Scale Range: 0-10 anchored by 8 descriptors
    - » *No Pain/Discomfort, Just Noticeable Pain/Discomfort, Very Little Pain/Discomfort, ….Extreme Pain/discomfort*
- **Visual discomfort/pain rating:**
  - *Yes/No* response
  - 6 symptoms (*blurry, difficulty focusing, itching, aching, sensitive, & burning*)
- **Performance Data:**
  - Quantity
    - Number of faxes completed daily
  - Quality Control
    - Daily accuracy score
- **Administered:**
  - Baseline
  - Hourly; 7 sessions per day
  - 15 days

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Results

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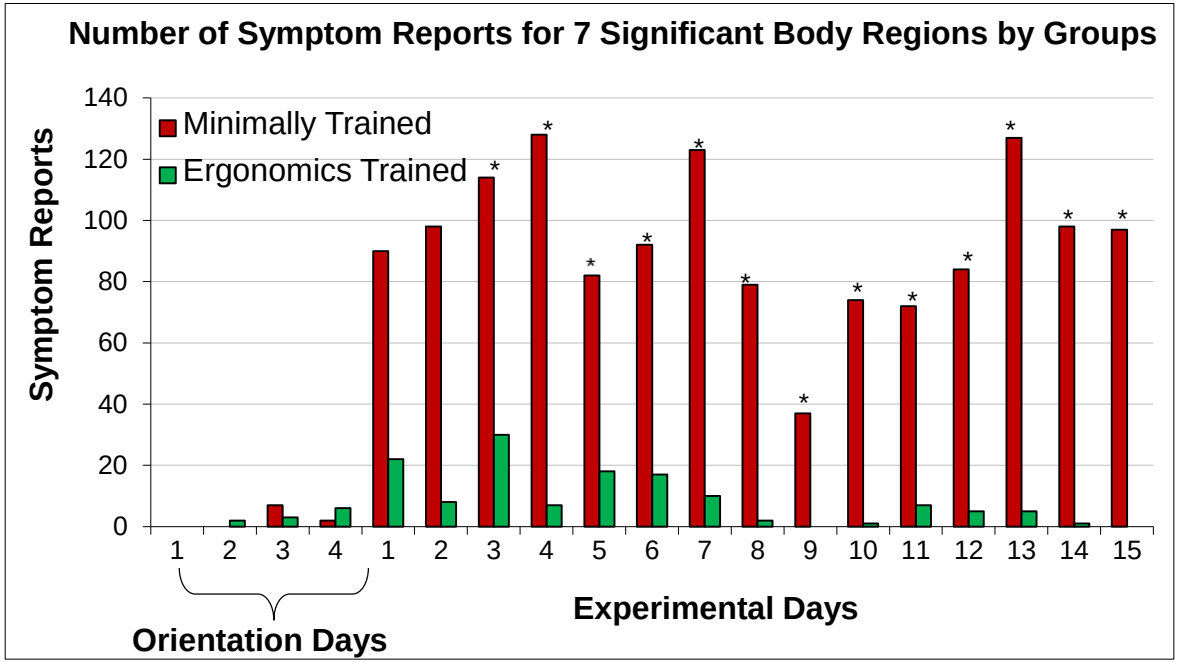
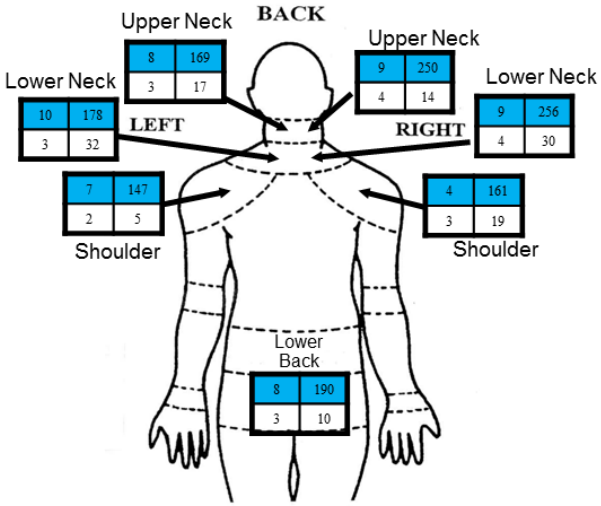
Number of Reported Musculoskeletal Discomfort for Top 7 Body Parts across All 15 Days



*All p<.05



	Number of People	Number of Symptoms
Minimally Trained	x	x
Ergonomics Trained	x	x

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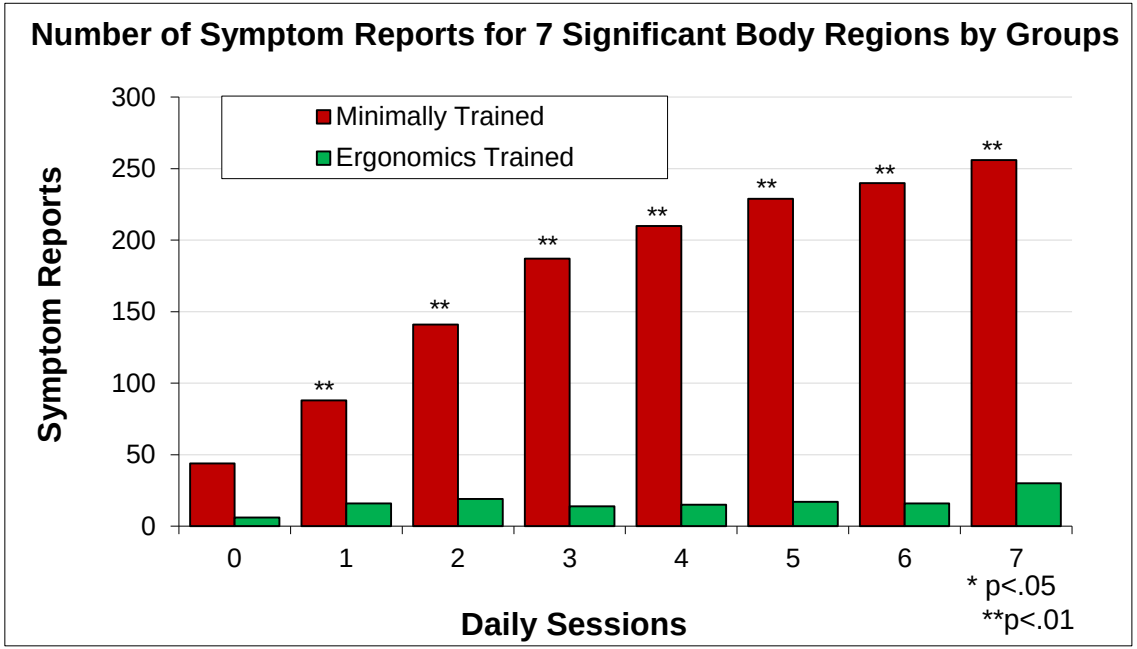
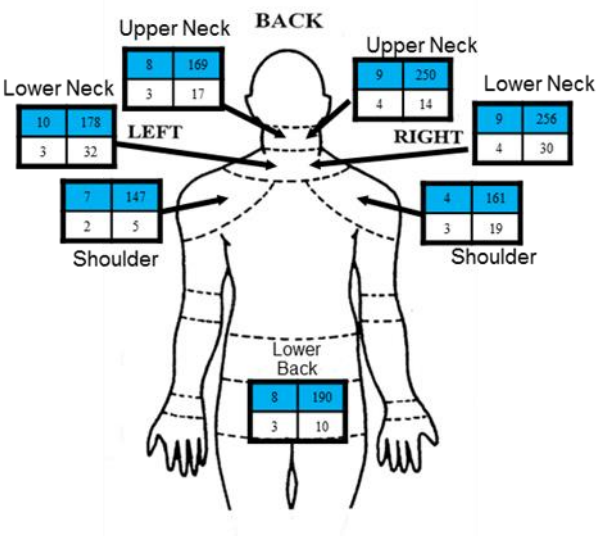
Reported Musculoskeletal Discomfort for Top 7 Body Parts across all 7 Daily Sessions





	Number of People	Number of Symptoms
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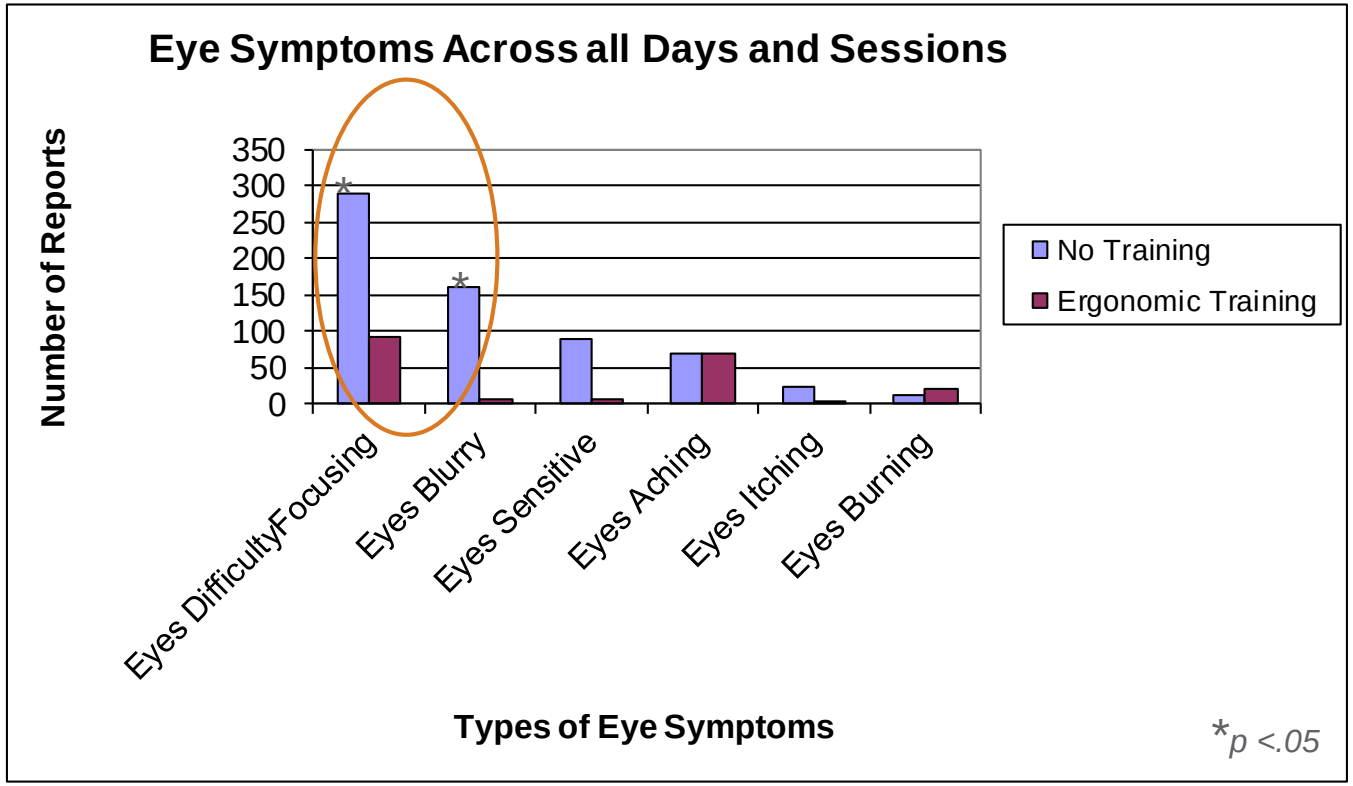
Visual Discomfort

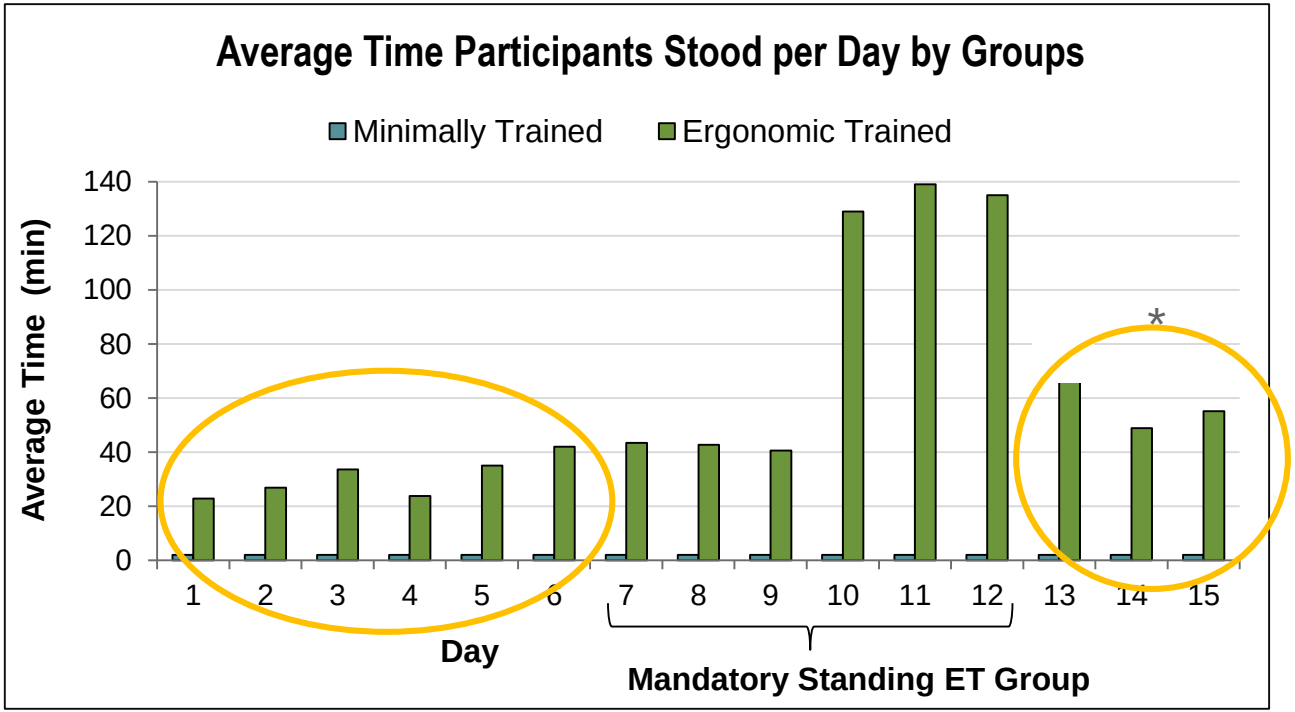


Performance Results: Quantity and Quality

- No significant difference found between groups for the number of faxes completed

- Significant difference found between groups for *accuracy* across all 15 days
  - Trained group exhibited higher quality scores

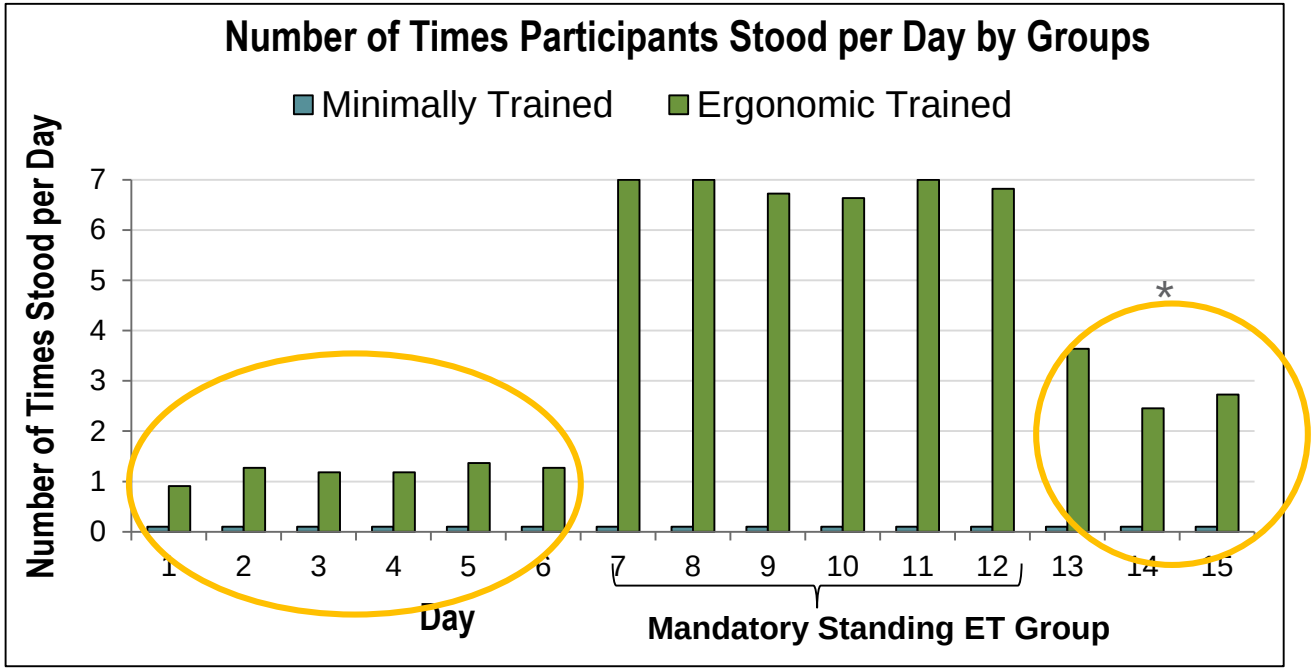
Behavioral Changes: Varying Computing Postures of Sitting and Standing



Minimally Trained group did not stand at all during the experiment

*p <.05

Behavioral Changes: Varying Computing Postures of Sitting and Standing



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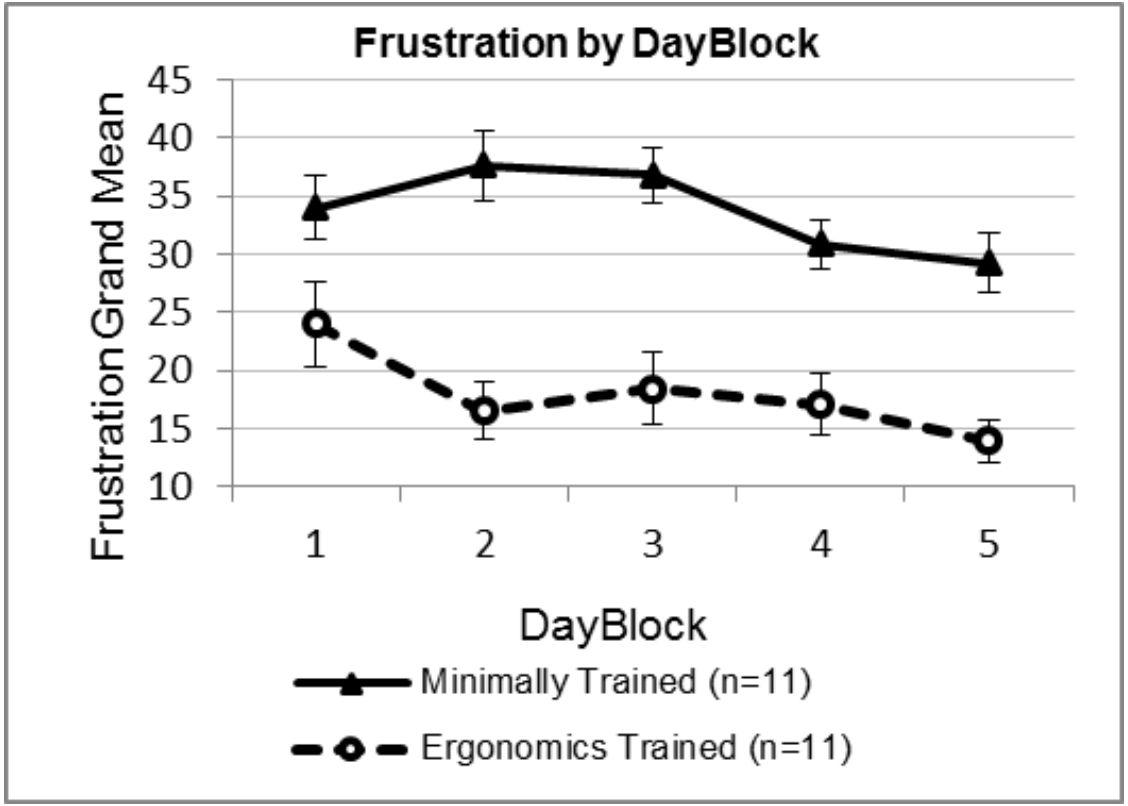
Subjective Ratings of Cognitive Demands



Minimally Trained group experienced significantly higher frustration compared to the Ergonomics Trained group in the afternoon periods during DayBlock 5 (p=.011).

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Summary

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Research Findings Summary

- Musculoskeletal and Visual Discomfort:
  - Significantly *greater* reporting of musculoskeletal and visual symptoms for Minimally Trained Group
  - Musculoskeletal and visual symptoms were *minimal* for Trained Group
- Workload: Number of faxes completed
  - *Equal, no-significant difference* between groups
- Performance accuracy (quality control)
  - Significantly *higher* for the Trained group
  - Consistent results with Chair + Training; 17.7% productivity increase—accuracy (Amick, Robertson et al., 2008; Robertson, Amick et al., 2009)
- Varying work postures
  - Significant changes in behaviors for the Trained group as reflected in standing *more often* and for *longer amounts of time*
- Greater *sense of control* over the work environment due to ergonomic knowledge for the Trained group
  - Consistent results with workspace + training field intervention (Robertson et al., 2008; Green & Briggs, 1989)

Concluding Remarks

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Take-aways: Designing Office Ergonomics & Safety Programs

- Use a systems-based approach
  - Comprehensive training and practice linked to business goals
  - Management commitment to create a sustainable and supportive culture
    - Being responsive to workers expressed ergonomics needs
- Leverage the concept of environmental control
  - Training allows employees to knowledgeably exert control over their adjustable/flexible physical environment
  - Providing flexible/adjustable work equipment, while important, is not sufficient
- Training is necessary for employees to optimize safety and effectiveness in their workspace
  - Training allows for the integration of ergonomics into the organization
  - Plays a key role in linking corporate goals to ergonomics practices

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