

Introduction to Workplace Ergonomics



Unit 7 Overview

This unit introduces your students to basic ergonomics information and concepts that are relevant to workers of all ages and to all types of work-places. Students are introduced to ergonomic risk factors by watching a video. Students then participate in some simple hands-on activities where they experience and try to apply some of these basic ergonomic concepts.

Activity A. Introduction: Why Is This Subject Important?

This section gives both the instructor and their students a brief overview of what ergonomics is and why it is important for all workers, including teen workers.

Activity B. DVD and Discussion

Students view the video, *Dr. Ergo*, which introduces them to different ergonomic risk factors found in all jobs and workplaces.

Activity C. Experiencing Injury Risk Factors

Students participate in hands-on activities that help to demonstrate some ergonomic risk factors. The first activity compares the strength of a power grip versus a pinch grip, and then compares neutral wrist to bent wrist power grip.

Activity D. Posture, Force, and Effort: Lifting

In this set of activities, students will lift and hold a weighted box in different positions, and evaluate the physical effort required to lift and hold the box using a rating scale. Next, students will use the boxes to practice safe lifting, while the other students evaluate their technique.

Activity E. Analyzing a Task for Ergonomic Hazards (Optional)

In this activity, teams of students evaluate the **ergonomic risk factors for specific** job tasks using a risk factor checklist.

Alternative activity or optional homework assignment. Electronic Devices

Have the students spend 10 minutes searching the internet for information and safety tips on computer, laptop, tablet and handheld device risk factors and ergonomic recommendations. Have them look at things such as hand, wrist, elbow, thumb strain; neck and back postures; glare and eyestrain. Discuss and summarize their findings and their own experiences. What changes might they make in their practices with this information?

Washington State Essential Academic Learning Requirements (EALRs)*

Health and Fitness

- 1.2 Safely participates in a variety of developmentally appropriate physical activities. Incorporates safety procedures into activities and individual fitness plans for leisure and employment.
- 2.3 Acquire skills to live safely and reduce health risks.
- 3.1 Understand how environmental factors affect one's health (air, water, noise, chemicals). Assess how the environment impacts choosing healthy places to live, work, and recreate.
- 3.2 Gather and analyze health information. Solve a health and fitness problem or issue:
 - List alternative courses of action.
 - Choose the course that most fully addresses the needs and requirements of the situation.
 - Back up the choice with evidence.
 - Evaluate the outcome.
- 4.1 Analyze health and safety information. Investigate the health and fitness requirements for occupational/career areas of interest.

Communication

- 3.2 Work cooperatively as a member of a group
- 3.3 Seek agreement and solutions through discussion

Reading

- 3.1 Read to learn new information
- 3.3 Read to perform a task

**See the link of the curriculum page on Education Standards for a complete matrix of state and federal educational standards.*

Introduction to Workplace Ergonomics

Learning Objectives

By the end of this lesson students will be able to:

- Define the terms ergonomics and work-related musculoskeletal disorders.
- Explain the risk factors for musculoskeletal injuries.
- Give at least three examples of work situations where young workers may be at risk for injury.
- Identify two ergonomic solutions to reduce the risk factors for musculoskeletal injuries.
- Describe and demonstrate the proper way to lift a load.

Preparing to Teach This Lesson

Before you present this lesson:

1. Access the video online prior to showing to students.
2. Make copies of handouts A, *Four Steps to Proper Lifting*, and B, *Proper Lifting Evaluation*, and for optional Activity E, copy handout C, *Ergonomic Checklist*.
3. Collect boxes for lifting exercises and two reams of office paper per boxes for the student small groups.

Time

65 minutes

Materials

- Computer with video playing capabilities
- Video: "[Dr. Ergo](#)" (*link is on the osha.washington.edu HSAWT site*)
- Two to three empty boxes per small group
- 2 reams of office paper per box
- Unsharpened pencils

Handouts

- A. Lifting Evaluation Activity Four Steps to Proper
- B. Proper Lifting Evaluation
- C. Ergonomic Checklist

Detailed Instructor's Notes

Slide 1

Activity A. Introduction:

Why is this subject important? (5 minutes)

1. As a warm-up discussion ask students:

What does the word "ergonomics" mean?

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Ergonomics is the study of how the human body performs tasks, and how to design equipment, or organize the task, to best fit our body's abilities and limits. In the workplace, this means fitting the job to the worker.

A good example of the early use of ergonomics was in designing the cockpits of airplanes. When you're flying miles above the earth at very high speeds, you want to make sure the controls, visibility, and comfort are as good as they can be so pilots can do their work safely and make the right decisions.

In more typical workplaces, it means setting up the worksite to meet the needs of the workers. In ergonomics, the worker is the central figure. When worksites are designed to suit the needs of the worker there are fewer cases of work-related musculoskeletal disorders (WMSDs), fewer days absent, higher productivity, and more comfortable workers.

2. *Why is ergonomics important?*

Injuries that result from poor ergonomics are some of the most common and frequent kinds of injuries, and they are found in all kinds of work-places and occupations. Many of these are musculoskeletal injuries, which we commonly refer to as strains and sprains. These often affect the back but other body parts are also involved such as hands and wrists, shoulder, neck, and knee.

The rise in the use of computers has contributed to a dramatic increase in injuries due to ergonomic factors. We don't yet know what a lifetime of working on a personal computer does to the body, because we only have about 25 years of experience. Ergonomic-related injuries can be serious and disabling.

Young people who get back injuries are more likely to have lifelong back problems, which can limit both work and recreational activities.

Using the principles of ergonomics, it is possible to reduce the risk of injury.

Activity B.

Video and Discussion (25 minutes)

1. Explain that the class will now watch a 14-minute video, *Ergonomics Awareness*, created by the WA State Department of Labor and Industries. The link can be accessed on the osha.washington.edu HSAWT website, under the General Curriculum, Unit 7.

Ask students to keep in mind these questions while they watch the DVD:

- a. What are the key ergonomic risk factors?
- b. What kinds of jobs have you done that involve these risk factors?
- c. What kinds of changes can be made to protect workers from these risks?

2. Show the video.

3. After showing the video, discuss the following questions with the class:

What are the key ergonomic risk factors?

- Working in awkward positions
- Using high hand force
- Performing repetitive motions
- Using the hand or knee to make repeated impacts
- Heavy, frequent or awkward lifting
- Exposure to moderate to high levels of vibration
- Standing too long in one position
- Mechanical pressure (leaning against a hard edge)

What kinds of jobs or activities have you done that involve these risk factors?

- Construction: lifting, vibrating tools, awkward positions, pinch grips
- Office work: repetitive keyboarding, lifting, sitting in one position for a long time
- Restaurant work: lifting, standing for long periods, repetitive kitchen work
- Other: e.g., the use of handheld devices and head, neck, thumb postures

4. Explain that the class will discuss these jobs and risks in more detail, along with possible solutions, in a later activity.

Activity C.

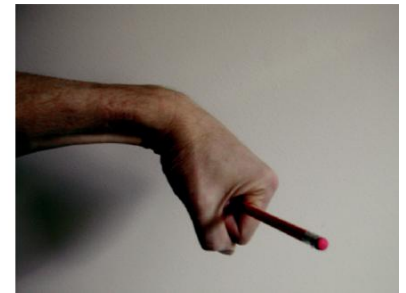
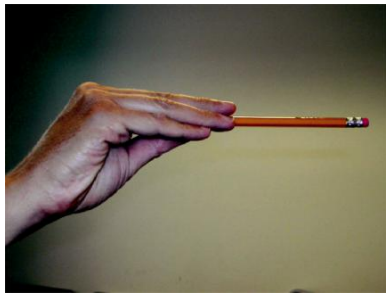
Slide 3

Experiencing Injury Risk Factors (15 minutes)

Certain body positions and postures are naturally stronger than others. Two exercises will demonstrate this for the hands/wrists and the lower back.

Strong and Weak Grips Grip Strength Tug-o-War

Students pair off and compete in a tug-o-war competition using pencils. Two separate comparisons will illustrate the difference between a pinch grip (Fig. A) competing with a power grip (Fig. 2), and a neutral wrist competing with a bent wrist posture (Figure 3). Students compare their strength using both techniques.



1. The first student holds the pencil in a pinch grip as in figure A. The other student tries to pull the pencil out of the grip. Then the first student holds the pencil in a power grip, figure B. The other student again tries to pull the pencil out of the first student's hand.

Ask students:

Which was easier to pull out, the pinch grip or the power grip? Why?

What does that tell you about doing a task with the hand in a pinch grip rather than a power grip?

The power grip is the stronger grip since all of the fingers and palm are supporting the pencil.

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2. Reverse roles and have the second student hold the pencil as in B (power grip with a straight wrist). Now the first student tries to pull it out. Now hold the pencil the same way but bend the wrist forward (down) as far as you can. Student 2 now tries to pull it out again.

Ask students:

Which was easier to pull out this time, straight wrist or bent wrist?

For the student holding the pencil what did it feel like trying to hold it with the wrist bent so far?

The straight wrist is stronger, which is the neutral posture for the wrist. Holding the wrist bent and trying to grip is uncomfortable.

Activity D.

Posture, Force, and Effort: Lifting (20 minutes)



In Activity D, Students will experience some different lifting and load-holding postures, and then practice proper lifting technique. Following the direction on Handout A, Lifting Evaluation Activity, students will assess posture, discomfort, and fatigue using a 1-10 scale. Next, following Handout B, Four Steps to Proper Lifting, students will practice proper lifting technique.

To set up for this activity, you will need 1 box per small group of students with 2 reams of office paper (total 10 lb load) in each box. Safety note: If any students need to reduce the load due to back or shoulder injuries, remove a ream for a total load of 5 lb.

Safety Note: Students with back or shoulder injuries should either not participate actively or lift only one ream of paper.

1. Divide students into groups of 2–4. Present them with this scenario:
You have a new job working in the kitchen of a pizzeria. Every morning boxes of ingredients are delivered to the back door of the kitchen. One of your job duties is to move these boxes into the kitchen. At the end of your shift, you also have to empty all the trash cans and carry the garbage to the dumpster behind the shop. After three weeks on the job, you have noticed that your back has started to feel sore and tired by the end of your shift.

Give students copies of Handout A, *Lifting Evaluation Activity*, and Handout B, *Four Steps to Proper Lifting*

2. Give each group 2-3 boxes with the reams of paper inside. Tell them their tasks are:

- Following the guide in Handout A, they each take turns holding a load in the described posture, and then evaluate how they feel using 1-10 Physical Effort Rating Scale. Record the evaluations on the handout.
- Following the steps in Handout B, practice safe and proper lifting techniques. Each student should take turns going through the 4 steps—sizing up, lifting, moving and lowering a box from one side of the room to the other. Have the students watching evaluate the lifting technique using the back page of Handout B.

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3. After everyone is done with the 2 activities and everyone is together as one group, discuss how it felt to hold the load in the various postures, and how it felt to use the “proper” lifting techniques. The students may find it feels funny bending the knees and lifting with their legs. Emphasize that many lifting tasks are not as straightforward as lifting compact boxes. Materials are often bulky, odd-shaped, and too heavy for any one person to lift safely. Sometimes what you’re lifting is a person, as in a hospital, nursing home, and when babysitting. Here, lifting with the knees may be impossible. Therefore, it’s very important to look for solutions that go beyond proper body movement to protect the health of your back. There are ways to change the workplace or the task to make lifting easier. Ask the students to think of these types of changes.

Some examples:

- Store boxes off the ground so they are at a height between the knees and the shoulders, in order to avoid high or low lifts.

- Have orders delivered in smaller (lighter) boxes.
- Use two people to lift.
- Use cranes, dollies, or other lifting devices.

Leave students with the message that good back care is important on and off the job, but it's always important to look at the job and equipment as well as what you can do yourself to protect your back.

Note: If students suggest wearing back belts, tell them that NIOSH (the National Institute for Occupational Safety and Health) does not recommend them. Back belts do not specifically protect the back and may even be hazardous themselves. They may give people the false impression that they can lift more than they should. Following safe lifting techniques is always essential.

Activity E (Optional). Analyzing a Task for Ergonomic Hazards (15 minutes)

1. Divide the class into groups of three or four. Assign each group one of the jobs mentioned in the previous discussion or a job shown below. Give students Handout C, the *Ergonomics Checklist*.
2. Ask each group to identify all the possible ergonomic risks involved in that job, using the checklist. Suggest that one person in the group mime different aspects of the job, so that the others can observe and identify possible risks. Ask each group to report back the following information:
 - All ergonomic risk factors
 - At least three possible changes that could be made to address those risks.
3. Bring the class back together. Ask each group to report back on their findings.
4. Review key points, summary, discussion.

Slide 6

OR

Electronic Devices (15-20 minutes)

Use this optional activity on electronic device ergonomics here or assign as homework. There are supplemental handouts for this topic on the HSAWT General Curriculum page

1. Direct the student to spend 10-15 minutes searching the internet for information and safety tips on computer, laptop, tablet and handheld device risk factors, and ergonomic solutions and recommendations.
2. Have them look at things such as
 - hand, wrist, elbow, thumb strain
 - neck and back postures
 - glare and eyestrain.
3. Discuss and summarize their findings and their own experiences.
4. What changes might they make in their practices with this new information?

Handout A Proper Lifting Evaluation Activity

Posture, Force, and Effort

Each partner will take turns lifting and holding the box in different positions as demonstrated in the photos on the back side of this handout.

Use the Physical Force Rating Scale to fill out the table. For each position, provide the Physical Effort Rating and write down where in your body you felt discomfort or fatigue after holding the position for 15 seconds.

Physical Effort Rating Scale

10 = Extremely difficult/fatiguing

9 = Very, very difficult/fatiguing

8 = Very difficult/fatiguing

7 = Difficult/fatiguing

6 = Somewhat difficult/fatiguing

5 = Moderate effort/moderate fatigue

4 = Some effort/some fatigue

3 = A little effort/a little fatigue






2 = Barely any effort or fatigue

1 = No effort/no fatigue

Safety Note: If lifting and holding the box with two reams of paper is too heavy for you, feel free to remove one ream of paper from the box

Handout A Proper Lifting Evaluation Activity

Physical Effort Observations

Position		Partner 1	Partner 2
<p><i>Instructions:</i></p> <p><i>Lift the box and follow the directed posture—holding for 15 seconds before lowering</i></p>		<p><i>1-10 Rating:</i></p> <p><i>Discomfort/Fatigue</i></p>	<p><i>1-10 Rating:</i></p> <p><i>Discomfort/Fatigue</i></p>
<p>No Box</p> <p>Stand in an upright position</p>			
<p>Box held close</p> <p>Lift and then hold the box close, about 1-2" in front of your body at waist level. Do not allow the box to touch or rest on your body. Hold 15s, then lower.</p>			
<p>Box held at mid-distance</p> <p>Lift and hold the box 8-10" in front of you with elbows slightly bent. Hold 15s.</p>			
<p>Box held far away</p> <p>Lift and hold the box straight out in front of you at waist height, no bend in your elbows. Hold 15 s.</p>			
<p>Box held low & far away</p> <p>Bend over, lift and hold the box in front of you, about 10-12" off the ground. Hold 15 s</p>			

FOUR STEPS TO PROPER LIFTING

1. SIZE UP THE LOAD

- Use a hand truck if possible.
- Get help if you need it.
- Check for slivers, nails, exposed staples.
- Use gloves if necessary.
- Make sure you have a clear path to where you are moving it to.



2. LIFT

- Bring the load as close to you as possible before lifting.
- Lift with your legs, not your back.
- Keep your head up, your back straight and bend at your hips.



3. MOVE

- Keep the load close to your body.
- Look where you are going.
- Shift your feet to turn, don't twist your body.



4. GET SET AND LOWER

- When setting a load down, let your leg muscles carry it down.
- Make certain your fingers and toes are clear before setting the load down.






Safe Lifting Checklist

Watch your fellow students lift the boxes. See if they follow the safe lifting method. Help them if they miss a step.

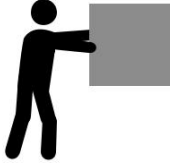
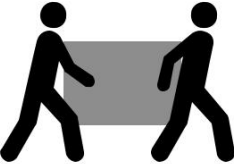





Did they...	Yes	No
Know where the boxes will be placed?	<input type="checkbox"/>	<input type="checkbox"/>
Check for obstacles and clear a path before moving the material?	<input type="checkbox"/>	<input type="checkbox"/>
Check the weight of the load before lifting it?	<input type="checkbox"/>	<input type="checkbox"/>
Have two or more people lift (or use a lift device) if necessary?	<input type="checkbox"/>	<input type="checkbox"/>
Avoid twisting while carrying?	<input type="checkbox"/>	<input type="checkbox"/>
Keep the load as close as possible to the body?	<input type="checkbox"/>	<input type="checkbox"/>
Lift with the legs and not with the back?	<input type="checkbox"/>	<input type="checkbox"/>
Lift the load slowly, avoiding fast jerky movements?	<input type="checkbox"/>	<input type="checkbox"/>
Use their leg and back muscles by bending their knees when setting the load down?	<input type="checkbox"/>	<input type="checkbox"/>

Comments

Ergonomics Checklist

Does the job include any of the following?		Yes	No	Not sure
	Repetitive bending or turning the wrist in any direction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Frequent reaching forward, behind, or out to the side with one or both arms stretched out	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Repeating the same motion over and over	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Frequent pinching, pulling or using force	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Lifting above shoulder height	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Wearing gloves that are too big or too small	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Lifting with forceful throwing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Ergonomics Checklist, cont.

Does the job include any of the following?		Yes	No	Not sure
	Exertion of force in awkward postures (to the side, overhead, extended reaches)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Lifting objects off the floor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Handling or hard-to-grasp tools or equipment (Poor handhold? Items difficult to reach?)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Regularly pressing hands or arms on sharp edges	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Hand tool vibration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Cold temperatures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Pace of work set by machines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Adapted from Massachusetts Department of Public Health