Welcome!

Ergonomics in the Classroom Webinar

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Provider Name:
Ohio Facilities Construction Commission

Provider Number: G442

Course Title: Ergonomics in the Classroom

Course Numbers: Web25

Credits: 1.0 LU/HSW

Speakers: W. Gary Allread, Ph.D., CPE

Dates: October 18, 2017

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Course Description

Dr. Allread will review basic ergonomics principles that affect human-work interactions and show how they can be applied generally to learning environments. He will also present a summary of some ergonomics research that has been done related to students and the classroom. The research also involve studies on furniture and computer equipment designs as well as backpacks, with results focused on posture, level of comfort, attention, and performance. In addition, Dr. Allread will provide some examples of ergonomics-based solutions that have either been implemented or proposed to address these concerns.

Learning Objectives

1. Learn basic ergonomics principles and how they apply to learning environments.
2. Learn about students in the classroom and ergonomics research.
3. Learn about studies on furniture and computer equipment designs research.
4. Learn about examples of ergonomics-based solutions.

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Ergonomics in the Classroom

Potential Issues, Possible Solutions

Ohio Facilities Construction Commission

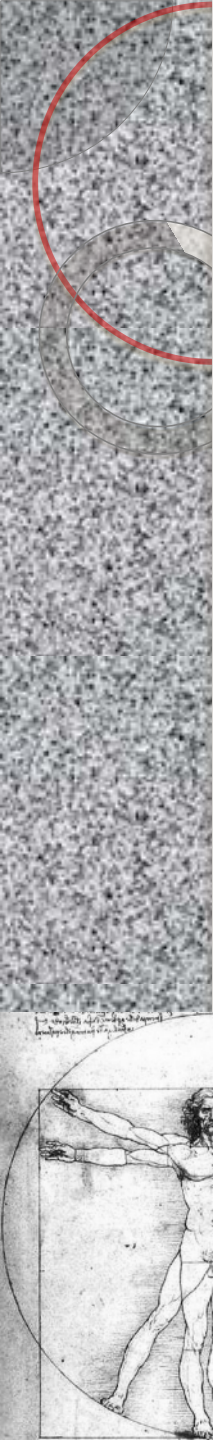
Webinar

October 18th, 2017

W. Gary Allread, PhD, CPE

SRI•Ergonomics

THE OHIO STATE UNIVERSITY



Session Topics

- Basic ergonomics principles...and how they apply to learning environments
- Students & the classroom: Ergonomics research
- Examples of ergonomics-based solutions

ERGONOMICS… APPLIED TO PLACES OF LEARNING

Ergonomics…Defined

- The science of work
- An applied science, concerned with designing and arranging things people use so that the people and things interact most efficiently and safely (Merriam-Webster)

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Ergonomics…Defined
for learning environments

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Ergonomics & Ohio Facilities Construction Commission

- Goals
  - *To build quality facilities that promote excellence*
  - *To facilitate projects that are well planned, on time, and on budget*
  - *To embrace innovation and encourage continuous growth*
  - *To cultivate partnerships for success*

Ergonomics & Ohio Facilities Construction Commission

- Goals

Opportunities for the integration of ergonomics principles

  - *To build quality facilities that promote excellence*
  - *To facilitate projects that are well planned, on time, and on budget*
  - *To embrace innovation and encourage continuous growth*
  - *To cultivate partnerships for success*

DISRUPTING THE STUDENT – LEARNING RELATIONSHIP

Exposures that Can Lead to Discomfort, Distraction…

- Forceful efforts
- Awkward postures
- Repetitive actions
- Static postures / lack of “micro-breaks
- Contact against hard surfaces
- Unfavorable environment

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WHAT DOES THE ERGONOMICS RESEARCH TELL US?

Ergonomics Research
Discomfort Prevalence

- Musculoskeletal discomfort reported among both:
  - Grade school students, and
  - College students
- Discomfort at least partly linked to students' computer use

Ergonomics Research
Students and Furniture

- Among students in grades 5 - 12:
  - Very large percentage of students sat in furniture not matched to their body size
  - Many reported having pain
    - Middle-lower back (49% of students)
    - Neck (36% of students)
    - Upper back (26% of students)
  - Girls had more discomfort than boys

Source: Brewer, Davis, Dunning, Succop, Does ergonomic mismatch at school impact pain in school children? *Work*, 2009.

Ergonomics Research
Students and Furniture

- High level of body mismatch with desk-chair combinations
- This also was found for adjustable furniture available in the market

Source: Ramadan, Does Saudi school furniture meet ergonomics requirements?, *Work*, 2011.

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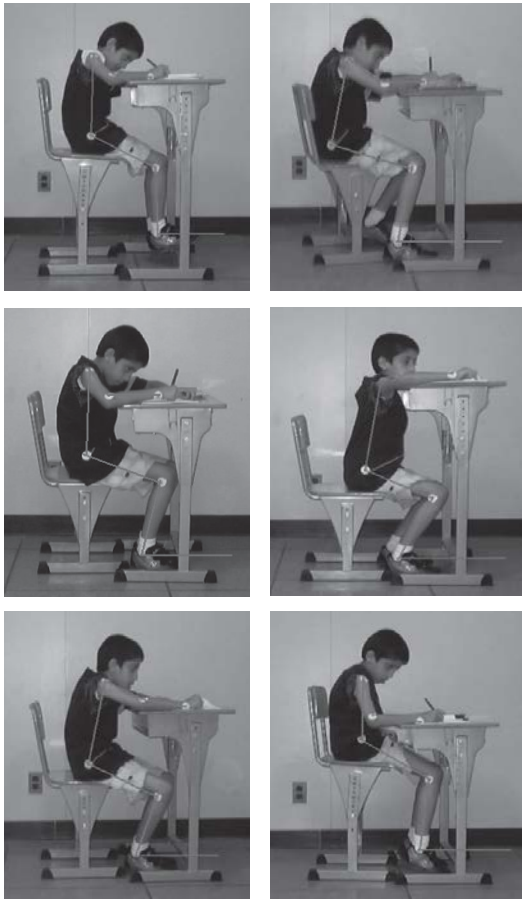


Source: Ramadan, Does Saudi school furniture meet ergonomics requirements?, *Work*, 2011.

Ergonomics Research
Students and Furniture

- Most students sit on **chairs** that are too high or too low
- Many other students sit at **desks** that are too high

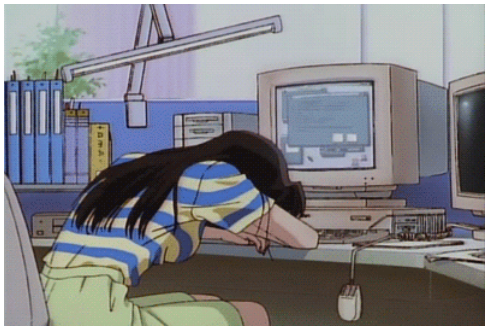
This design put the least stress on student's backs

This design put the most stress on student's backs and was rated "most uncomfortable"

Source: Ramadan, Does Saudi school furniture meet ergonomics requirements?, *Work*, 2011.

Ergonomics Research
Student Computer Use

- Compared to professionals, students spend:
  - More time on computer per day
  - Longer periods of uninterrupted work
  - More frequent upper extremity discomfort



Source: Noack-Coopera, Sommerich, and Mirka, College students and computers: Assessment of usage patterns and musculoskeletal discomfort, *Work*, 2009.

Ergonomics Research
Computers in the Classroom

- New technology, old furniture

Examples

Ergonomics Research
Computers in the Classroom

- Equipment made for adults, used by children

Examples

Ergonomics Research
Students at Computers

- Desk/table not matched to student and seat can:
  - Cause physical fatigue due to improper posture
  - Negatively affect student performance

Tall student sitting in seat at full height

Tall student sitting in an unraised seat in order to reach the table

Source: Rudolf and Griffiths, Evaluating the ergonomics of a student learning environment, *Work*, 2009.

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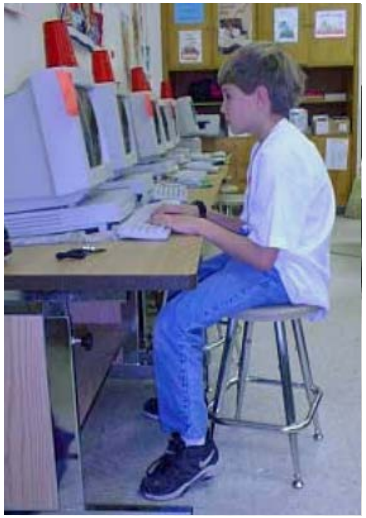


Unsupported feet
→ More hip rotation
→ More spine loading

Supported feet
→ Less hip rotation
→ Less spine loading

Ergonomics Research
Student Backpack Use

- Each year:
  - More than 14,000 children are treated for backpack-related injuries
  - About 5,000 children go to the emergency rooms for these injuries

Source: U.S. Consumer Product Safety Commission

Results of Less-than-Optimal Ergo Design

- Discomfort or pain
- Distraction
- Irritability
- Diminished learning
- Altered attitudes about school

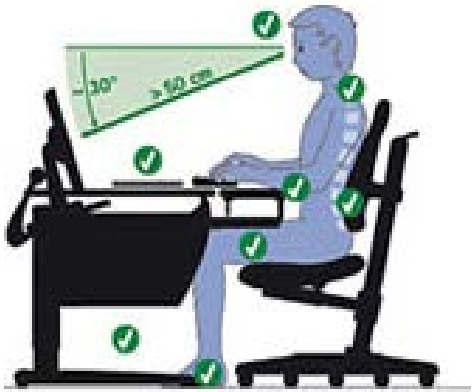
USING ERGONOMICS TO IMPROVE THE LEARNING ENVIRONMENT

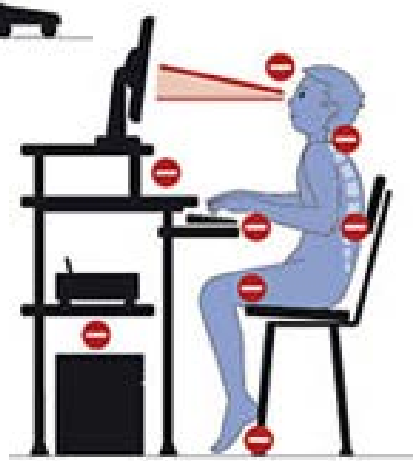
Provide Basic Ergonomics Knowledge

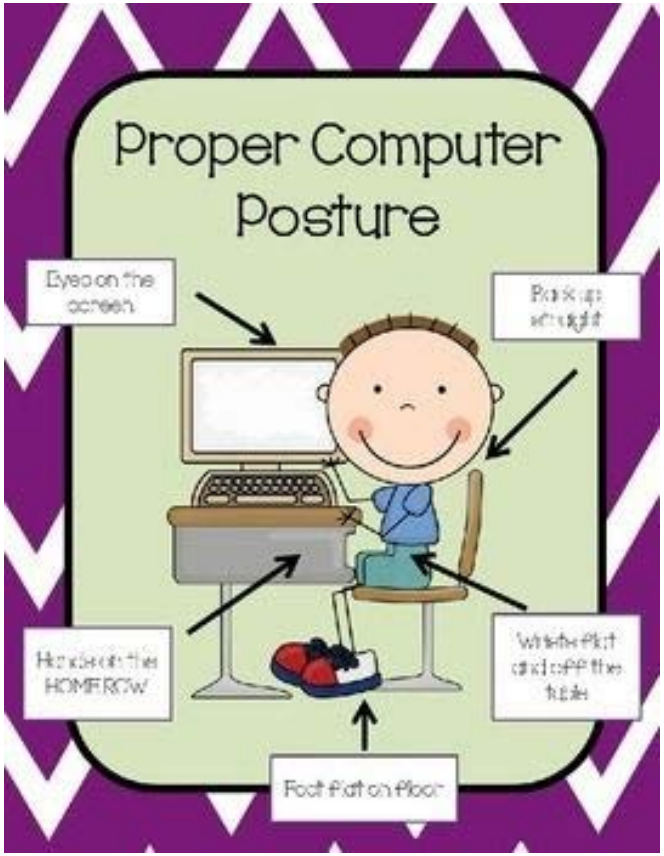
- For educators
  - How basic ergonomics principles apply to the student learning environment
  - Methods to properly adjust furniture, postures, work practices…

Provide Basic Ergonomics Knowledge

- For students...and their parents







Classroom Furniture
Do Your Research

- Budget to buy new desks, chairs?
  - Has manufacturer used child body size data in its design?
  - Can the furniture be adjusted for differing body sizes, shapes?

Chair Height	10"	12"	14"	16"	18"
Table Height	~19"	~22"	~24"	~27"	~29"

3-4 year olds	50% OF CLASS	50% OF CLASS			
Kindergarten		50% OF CLASS	50% OF CLASS		
Grade 1			100% OF CLASS		
Grade 2			25% OF CLASS	75% OF CLASS	
Grade 3 - 4				100% OF CLASS	
Grade 5				50% OF CLASS	50% OF CLASS
Grade 6 - 12					100% OF CLASS

Source: Smith System

Classroom Furniture
Do Your Research

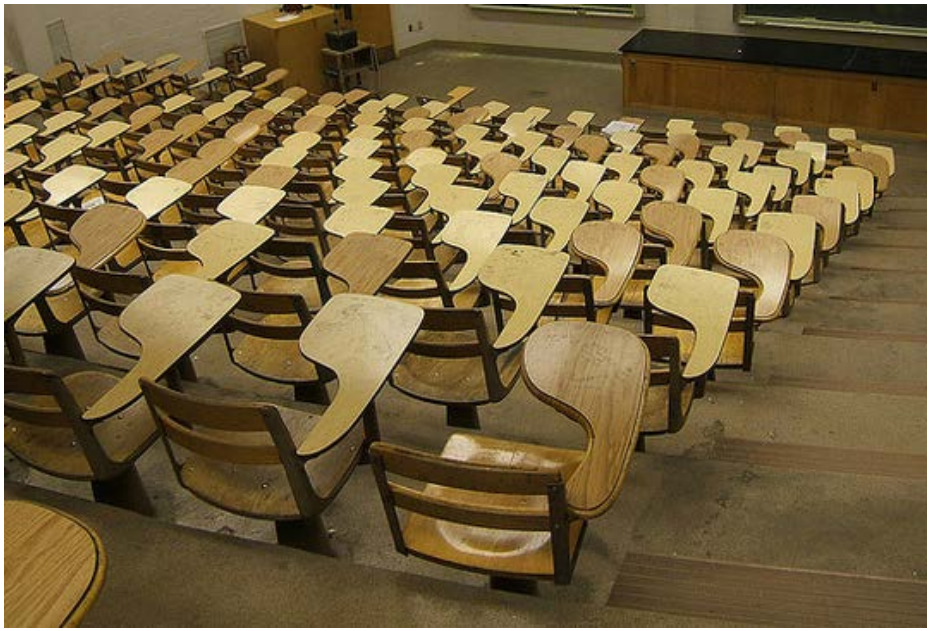
- Consider standing while learning?
- Differences between sitting and standing:
  - Students who stood were more engaged
  - This effect was more pronounced among overweight and obese children

Source: Mark Benden, Texas A&M University

Classroom Furniture
Do Your Research

- Is handedness accounted for?

Where do the lefties sit?



Example desk that accounts for handedness

Chair Modifications

- Adjust “non-adjustable” chairs

Before (not getting support from chair)

After (pillow to fill space between student, chair)

Source: Oregon Occupational Safety and Health

Don’t Forget About the Educators

- These principles apply to teacher work activities as well

Source: Posture People

Computer Work Considerations

- Place most-used equipment close

Before (keyboard interferes with mousing activity)

After (move mouse when keyboard isn't needed)

Source: Oregon Occupational Safety and Health

Computer Work Considerations

- Use, placement of keyboard tray

6th Grader

Before

After

8th Grader

Before

After

Source: Cornell University (http://ergo.human.cornell.edu)

Computer Work Considerations

- Use, placement keyboard & mouse

Before

After

Source: Cornell University (http://ergo.human.cornell.edu)

Computer Work Considerations

- Eliminate glare sources

Monitors parallel with windows – More potential for glare, eye strain

Monitors perpendicular to windows – Less glare, eye strain

Child's Backpack Recommendations

- Design
  - **Lightweight fabric**
  - Thick shoulder straps (both used)
  - Length of torso, ending ~two inches below waist
  - Waist strap

Sources: Dr. Rob Danoff, US Consumer Product Safety Commission, American Academy of Orthopaedic Physicians, Elise G. Hewitt

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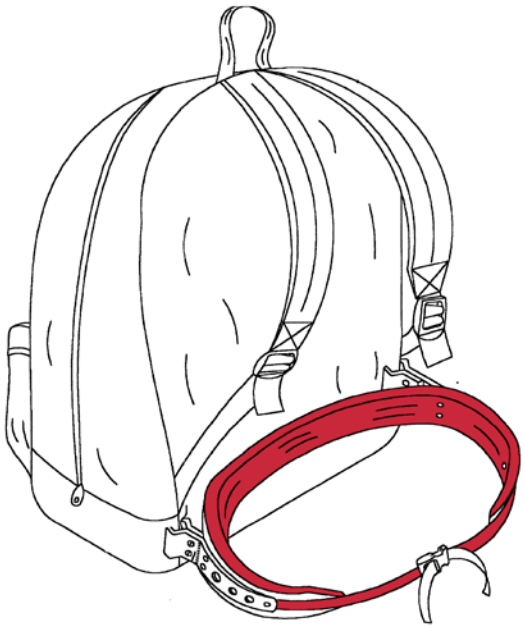

Sources: Dr. Rob Danoff, US Consumer Product Safety Commission, American Academy of Orthopaedic Physicians, Elise G. Hewitt

Child's Backpack Recommendations

- Use
  - No more than 15% of body weight
  - Pack heavy things at the bottom and close to the back

Weight of Child (in pounds)	Maximum Backpack Weight
60	5
60-75	10
75-100	15
100-125	18
125-150	20
150-200	25

Sources: Dr. Rob Danoff, US Consumer Product Safety Commission, American Academy of Orthopaedic Physicians, Elise G. Hewitt

TAKE-HOME MESSAGES

Take-Home Messages

- Ergonomics principles apply directly to the classroom
- The impact can be physical or mental/cognitive
- A significant amount of research in this area has been done
- Awareness is needed to determine the best improvement solutions

Take-Home Messages

- Result of using ergonomics: Students who are:
  - More comfortable and alert
  - Better prepared to absorb information
  - Healthier and happier

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Questions?

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This concludes The American Institute of Architects Continuing Education Systems Course

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