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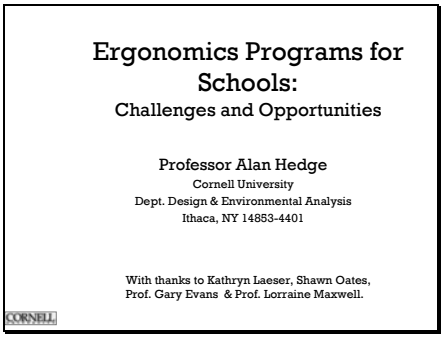

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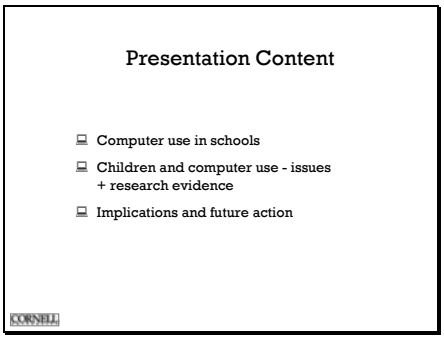

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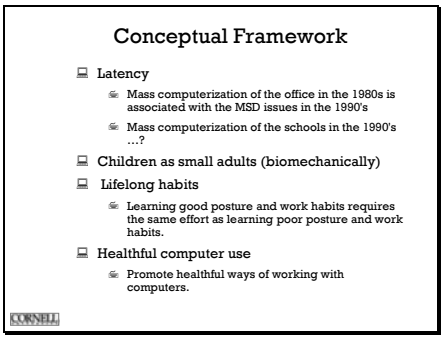

Slide 4

U.S . Schools 2001

- ~45 million students attend schools.
- ~ 86,000 public schools.
- The number of students is growing, up 9% since 1990.
- The Department of Education estimates that 2,400 new schools will be needed by 2003.
- Average age of the nation's schools is 42 years.
- Schools welcome computers in an attempt to raise performance.
- School technology plans focus on the technology. Ergonomics is seldom on the 'radar screen'.

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Slide 5

U.S. Schools Report

(American Society of Civil Engineers, 2001)

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Slide 6

U.S. Schools Repairs Report: D- Grade

- 75% of schools need repairs.
- Total budget need = $268 billion.
- Average repairs per school = $2.2 million ($3,800 per student).
- Where considered, ergonomics is seen as another cost.

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Slide 7

Computers in Schools

- Rapid proliferation of computers.
- Computer use in schools inevitably is increasing.
- Goal of ubiquitous computing.
- Competing budget constraints.
  - Primary focus on hardware and networking.
  - Secondary focus on software and curriculum.
- Teaching training/technology integration lags.
- Laptops increasingly favored over desktops. Physical ergonomic issues seldom considered.
- Computer ergonomics is a lifelong skill (Larson, 1999).
- Tomorrow's workers are in today's schools.

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Slide 8

Research Issues and Studies

- Risk Factors and Exposure
- Ergonomic Design Research
- Ergonomics Information Research
- Ergonomics Programs Research

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Slide 9

Computers in Schools

(Coley, ETS, Policy Information Center, 1999)

- 98% of all schools own computers
- 4.4 million computers in classrooms
- Current average student-to-computer ratio:
  - 10:1 (range 6:1 – Florida, Wyoming, Alaska, North Dakota to 16:1 – Louisiana), down from 125:1 in 1984.
  - 11:1 – Elementary schools
  - 9.7:1 – Junior High
  - 8.4:1 – Senior High

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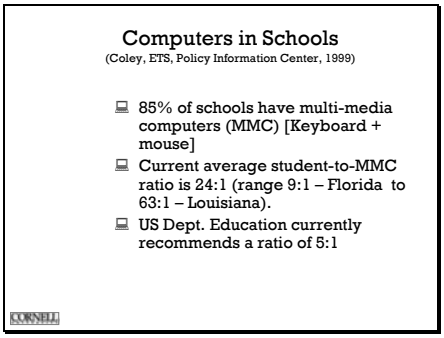
Slide 10



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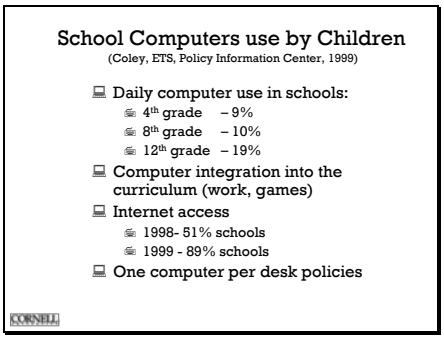

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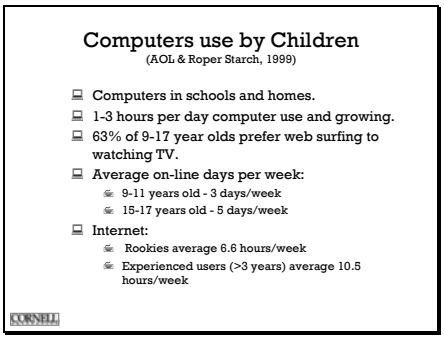

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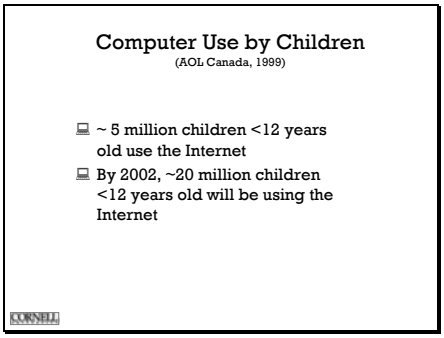

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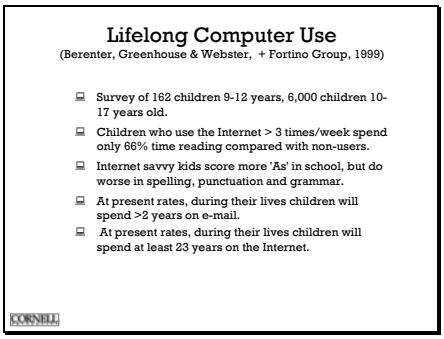

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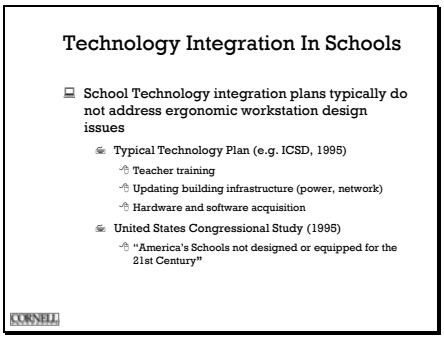

Slide 16

Computer Use Issues

- How much do children use computers in schools in 2001?

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Slide 17

Ergonomic Design Questions

- How should computer workstation design be addressed in school technology integration plans?
  - What is the impact of computer workstation design on a student's physical well-being
  - What is the impact of workstation design on the effectiveness of computer use

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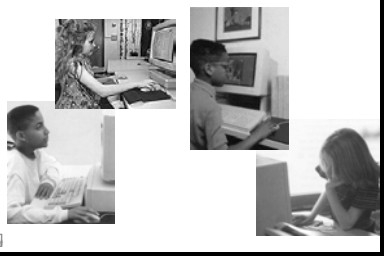
Risk Factors and Exposure:
How are children working at computers?



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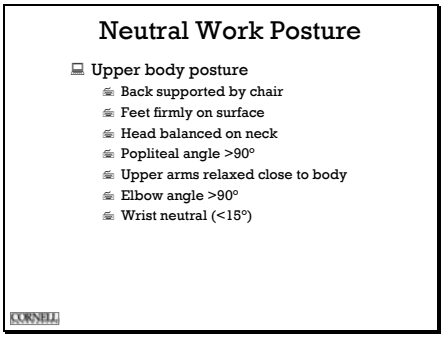

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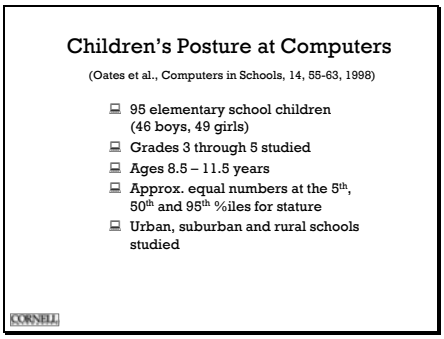

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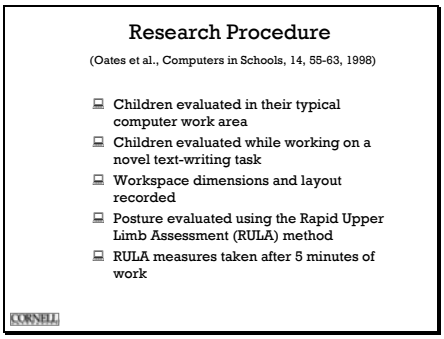

Slide 22

Workstation Dimensions

(Oates et al., Computers in Schools, 14, 55-63, 1998)

Dimension	Recommended	Observed
Keyboard height	21.5 – 24"	25.6 –39.4"
Monitor height	31.5 – 38"	37.4 – 51.2"
Backrest height	26 – 30"	23.6 – 31.5"
Seat pan width	13 – 15"	11.8 – 17.7"
Back rest angle	90 ° - 120°	90 ° - 108°

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Interpretation of RULA Scores

- (1-2) Posture is acceptable if it is not repeated for long periods of time.
- (3-4) Further investigation is needed and changes are required.
- (5-6) Further investigation and changes are required very soon.
- (7) Further investigation and changes are required immediately.

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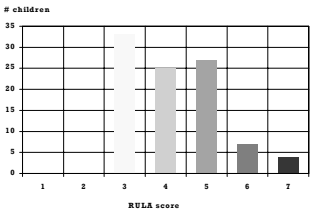
Slide 24

Overall RULA Results

(Oates et al., Computers in Schools, 14, 55-63, 1998)



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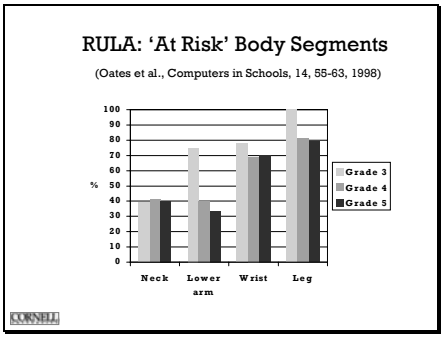

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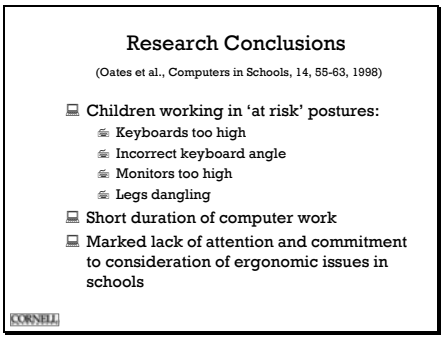

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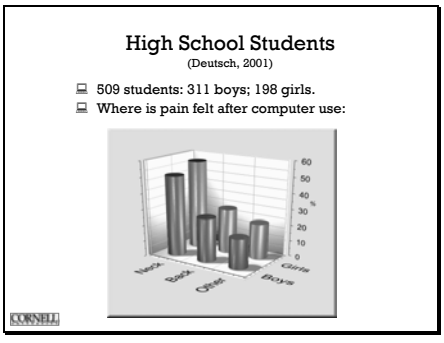

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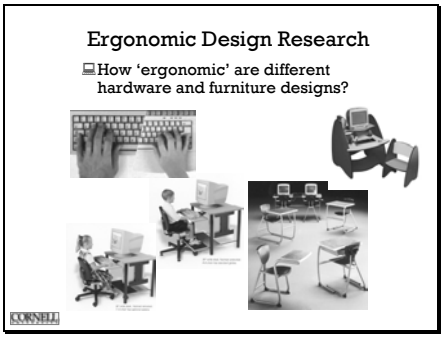

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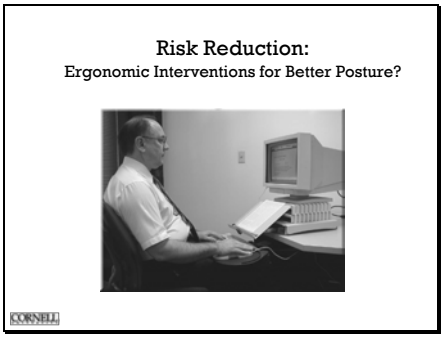

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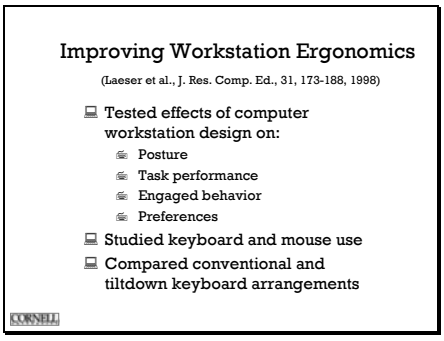

Slide 31

Research Design

(Laeser et al., J. Res. Comp. Ed., 31, 173-188, 1998)

- 58 middle school children tested:
  - 30 6th grade students
  - 28 8th grade students

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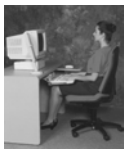
Slide 32

Research Design

(Laeser et al., J. Res. Comp. Ed., 31, 173-188, 1998)

- Keyboarding and mousing tasks performed under two conditions:
  - desktop arrangement
  - tiltdown keyboard system



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Slide 33

Experimental Measures

(Laeser et al., J. Res. Comp. Ed., 31, 173-188, 1998)

- Posture
  - RULA method
- Performance
  - computer program for each task
- Engaged Behavior
  - video tapes
- Preferences
  - interview

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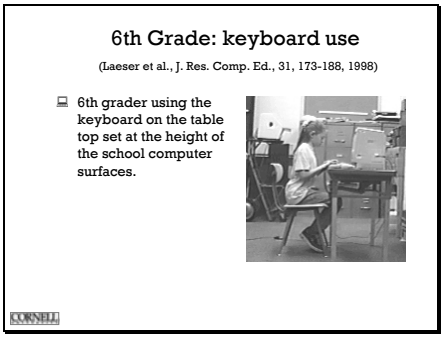
Slide 34



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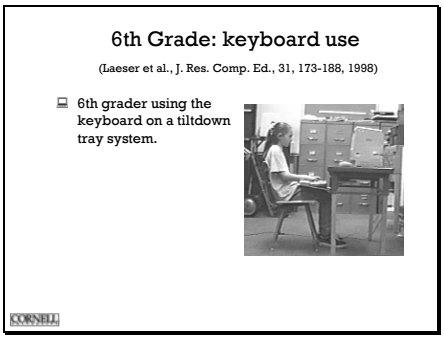

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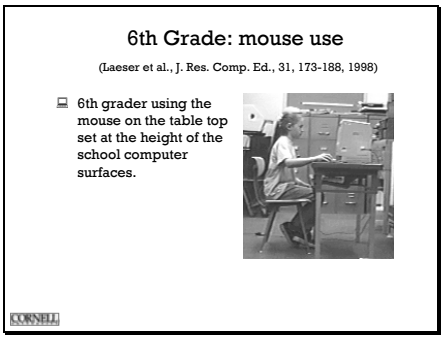

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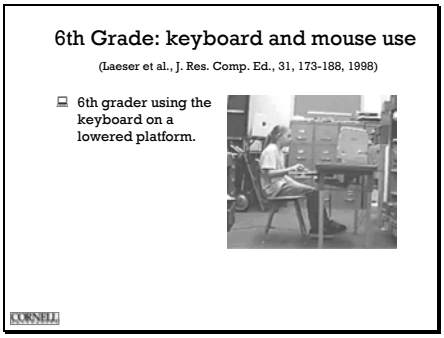

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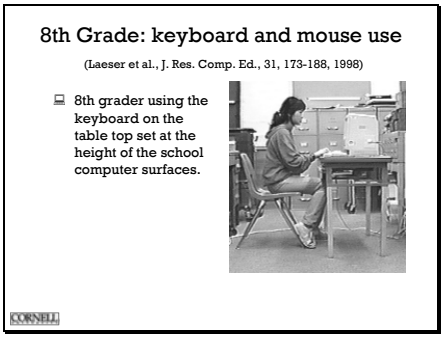

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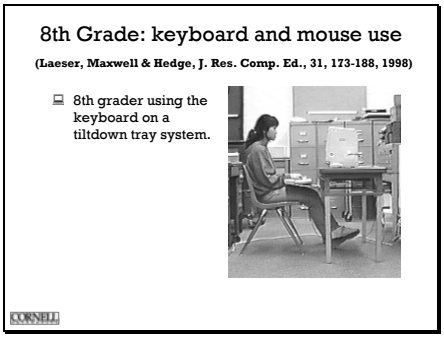

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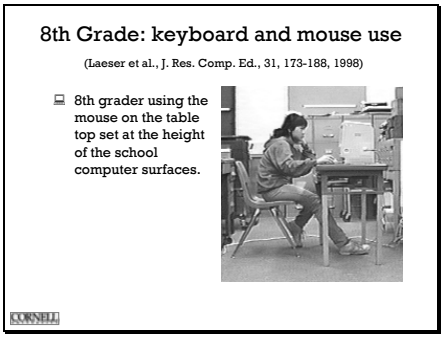

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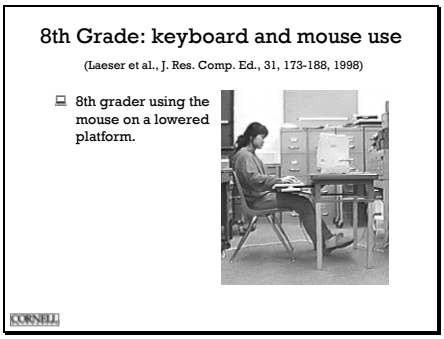

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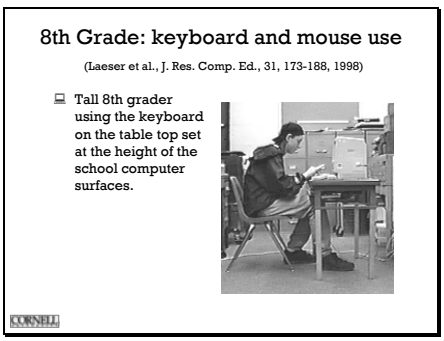

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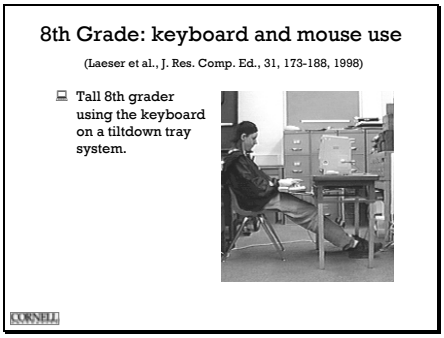

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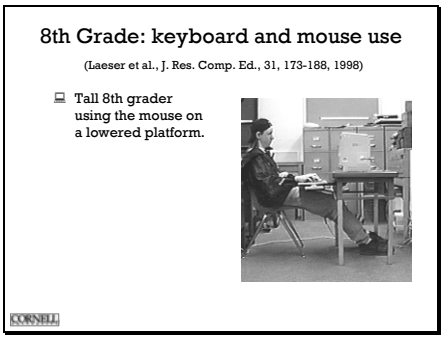

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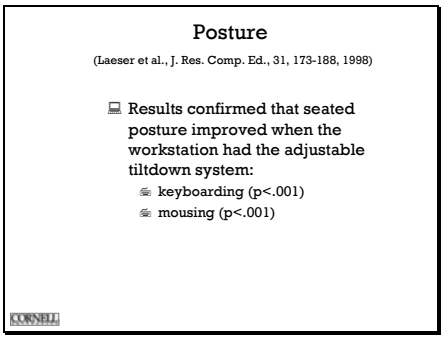

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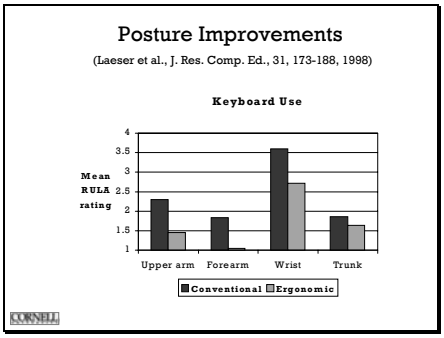

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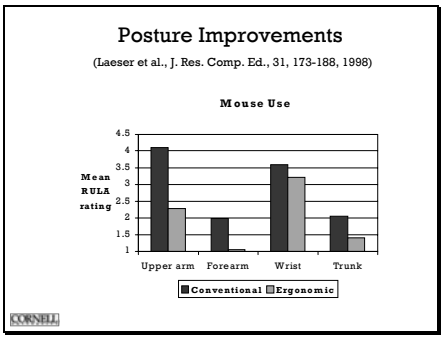

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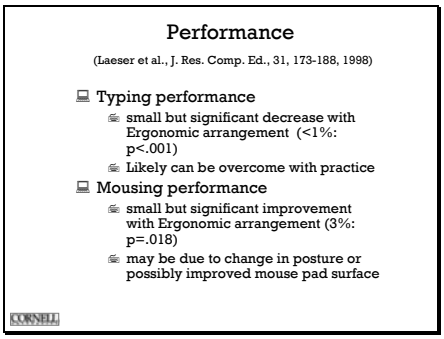

Slide 49

Limitations of the Study

(Laeser et al., J. Res. Comp. Ed., 31, 173-188, 1998)

- Implications limited to immediate effects of the workstation
- Students all from the same school
- Unequal number of males and females
- Self-selection – volunteer sample
- Normal ability children
- Desktop computer

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Slide 50

Ergonomics Information Research

- How effective is currently available ergonomics information?

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Ergonomics Programs Research

- "Get Techfit" program –Blackwell Elementary School, WA and Cornell University.
  - Classroom instruction on computer ergonomics
  - Class exercises on computer ergonomics
  - Parents booklet on computer ergonomics
  - Web-based program information
  - Teacher commitment (Diane Tien)

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Good or bad?

- What is right or wrong with these pictures?

Extract from an Ergonomics slideshow prepared by children for children at Blackwell Elementary School, WA.

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Laptop Computers in Schools

http://www.ammsa.com/sage/APRIL99.html

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Slide 54

Future Research and Actions

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Slide 55

Ergonomic Issues

- Children's Posture
- Children's age
- Computer design
- Furniture design:
  - Desktops
  - Laptops
- Laptop Weight
- Backpack design
- School and home use
- Effective Ergonomics Information
- Effective Ergonomics Education

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Slide 56

Ergonomic Design Issues

- Environmental conditions for computers:
  - Lighting
  - Ventilation (heat, IAQ)
  - Cable management/electrical fields
- Furniture for computer work
  - Worksurface
  - Monitor height
  - Keyboard tray
  - Mouse platform
  - Document holder
  - Chair
- Layout for computer work
  - Workstation layout
  - Classroom layout

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Slide 57

Future Agenda

- Intensify efforts to promote public awareness of the importance of Ergonomics in school and home computer use.
- Promote professional awareness of classroom ergonomics issues.
- Provide effective Ergonomics education information for schools and parents.
- Define effective Ergonomic designs for hardware, software and furniture.
- Continue encouraging professional initiatives for IEA/HFES to promote Ergonomics in Schools.

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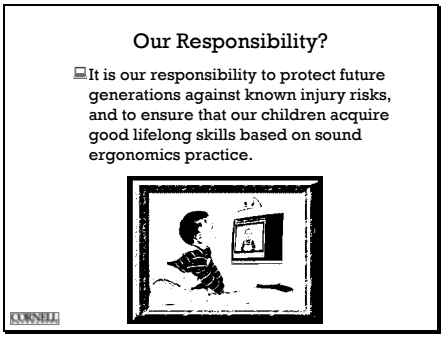

Slide 59