ErgoKids: How will Future Generations Deal with Current Exposures

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Children, the future of our generation and of all generations have often been described as sponges, for their unique ability to absorb knowledge, learn new concepts and languages and develop new abilities without the negative affects of age and opinion. Children are in their developing years and their bones and physical structure has not yet fully developed to a point of resiliency that can withstand stress, pressure, and a modicum of physical abuse. Adult ergonomists have only relatively recently (within the last 14 years) focused on controlling stress, pressure, and force exposures to adults from their interaction with technology. Little has been done to protect the most vulnerable of our populations. Adults have designed 'new' and 'ergonomic' furniture to reduce the affects of technology use in adult populations; 'ergonomic' chairs, 'ergonomic' workstations, 'ergonomic' mice, 'ergonomic' keyboards. New international efforts are now focusing on the design of workstations (classroom) for children to address ergonomic and anthropometric concerns of fostered through the education of young adults. Technology is not the only 'culprit' in this new age onslaught. Adults' desire to have the most well-education population ever has driven educators of the young to provide multiple learning opportunities; in the classroom and at home through the use of that dreaded word – homework. We have advanced technology and advanced knowledge, yet we have regressing health in our younger population. Ergonomics, children, technology and health are integral and inseparable. We need to start NOW to protect those who cannot protect themselves because we have not given them the knowledge to do so themselves. What do you plan to do to protect YOUR ErgoKids?

INTRODUCTION

This effort began as with many efforts as primarily the idea to evaluate ergonomic efforts that have focused on children or that have used children as the participants in their research effort. However, as the investigation began, it was soon realized that there are a number of aspects of kids and ergonomics that are intertwined, intermingles, and quite frankly, inseparable. Therefore the approach taken here is to provide a synopsis, neither an exhaustive nor complete review, or the efforts that are either on-going or should be started that are focused on Ergonomics and kids. ErgoKids is meant to identify a generation or generations of young people who will bridge the gap between no ergonomic thought given to kids and their exposures to adult-like conditions and a generation or generations who will have everything ergonomic. What are you doing to integrate the principles of ergonomics into the lives of your children, the children at school and your community?

RESEARCH EVALUATION

Musculoskeletal Disorders (MSDs)

Musculoskeletal Disorders (MDSs) are the most frequently reported work-related illness. Controversy exists to the MSD relationship with work. Workers also suffer the brunt of skepticism from cynical health care providers, employers, and even peers who attribute the victim's complaints to psychological problems or malingering. Posture during work can create postural derangement which, in turn, can adversely affect the nervous system and contributes to the functional changes that occur when muscle groups go out of balance, Resulting in conditions such as Thoracic Outlet Syndrome, nerve entrapment, Cubit Tunnel Syndrome (dual site ular nerve injury), etc. (Pascarelli, and Hsu (2001).

Postural deterioration is clearly a concern for adults. Do you recall your parents advising you on maintaining proper posture? "Sit up straight (actually may not be a good thing), don't slouch."

Postural deterioration can occur gradually in someone who is poorly conditions, working constantly, repetitively, and forcefully on tasks requiring the use of smaller peripheral musculature of the forearms and the

hands (Pascarelli, and Hsu (2001).. How much time do your kids spend playing Nintendo™, Gameboy™, or working at the computer? Who was the computer workstation setup for anyway?

Backpacks and Posture

Lifting, carrying, pushing, and pulling have been studied by many since the publication of the seminal article by Snook (1978). Although such studies have used young, health college students as participants to predict capabilities of older workers, few studies have addressed the lifting, handling, and carrying of backpacks by young, developing children. There have been articles in the popular press (magazines and newspapers) that have raised the issue of how much weight is appropriate. The answer has been provided by the American Pediatrics Society of 10% of a child's body weight. But what is the impact?

Sheir-Neiss, Kruse, Rahman, Jacobson and Pelli (2001) found statistically significant associations between back pain and backpack use, female gender, body mass index, general health, physical functioning, and bodily pain, as reported within 4 weeks of their interview. However, statistically significant associations were not found between back pain and backpack weight or between back pain and the ratio of backpack weight to body weight.

Two articles in the Journal Spine have found relationships among children's perceptions of load and the experiencing back pain. In the first, Grimmer, Williams and Gill (1999), found that there was a significant change in craniovertebral angle at every year level when compared with standing posture with no backpack and when carrying a backpack. These results seems logial in reference to most backpacks are arried with both straps over the deltoid muscle on one side of a chil's body. In addition, these authors found a differential postural response per gender and per level of spinal development.

Negrini and Carabalona (2001) found that daily backpack carrying is a frequent cause of discomfort for schoolchildren. More dramatically, these researches found that school backpacks were perceived as heavy to 79.1 % of the children participating in the study, were to cause fatigue from carrying the backpacks by 65.7 % of the participants and caused back pain in 46.1% of the schoolchildren.

The National safety Council (Roth, 2001) has published guidelines for parents regarding backpack weights and even has provided a table with the child's weight and appropriate weight limit. However, no references are provided regarding the source of the recommendations.

Three interesting articles have focused on the effects of carrying backpack loads. In the first, Hong, Li, Wong, and Robinson (2000) evaluated heart rate, blood pressure and energy expenditure of 15 male participants of age 10 years. These researchers found a significant difference in oxygen uptake, energy expenditure, and the recovery of blood pressure rise between backpacks that weight 10% and 20% of the participant's boy weight, respectively.

Wang, Pascoe and Weimar (2001). Evaluated accumulated mean and peak impact forces per stride and per meter for 2 backpack loads (empty and 15% of body mass) for 30 college students. Their results indicated a significant decrease in walking speed, and an increase in impulses per stride and per meter.

Student Posture and Furniture

The working positions of school children has been studied sing the mid-90's. Storr-Paulsen and Aagaard-Hensen (1994) surveyed the working positions of schoolchildren. These authors found that 435 of the schoolchildrens' time was spent in a backward-leaning posture, while 57% of the time they were in a forward-leaning posture. No percentage of the time was recorded that was not leaning.

A similar study in 1999 (Troussier and Tesnier) found that ergonomically design furniture was preferred by schoolchildren but there was no modification in back pain prevelance nor physical symptoms of the 263 children aged 8 to 11 who participated in the study.

Linton, Hellsing, Halme, and Åkerstedt (1994) evaluated the effects of ergonomically designed school furniture on 10th grade pupils' attitudes, symptoms and behavior. The participants were randomly assigned to a control group using traditional furniture or to an experimental group using 'ergonomic' furniture. These authors found that the experimental group rated their furniture to be more comfortable than the control group. The experimental group also reported less musculoskeletal discomfort than the control group. However, differences in actual sitting behavior was not statistically different implying the need for instruction on how to use the 'ergonomic' furniture to their postural benefit.

Although studies have compared traditional to 'ergonomic' furniture, few studies have compared furniture dimensions to childrens' anthropometric dimensions. Parcells, Stommel and Hubbard (1999) compared the dimensions of classroom furniture to student body dimensions. There findings indicated that fewer than 20% of the 37 female and 37 male 6th through 8th grade students who participated in the study could find acceptable chair-desk combinations. Most students

found the chairs were too high, the desks were too high and the seatpans were too deep which promoted students' forward-leaning posture.

Anthropometric dimensions of 1293 Costa Rican children, focusing on regional differences have recently been measured (Matriz, Ramírez, Serrano, and Schulze, 2003). As would be expected, variability within each age group was low but between groups was high lending to the truism that each grade will have different anthropometric dimensions and, thusly, different furniture requirements.

Computers, Children and Schools

There have been more articles written on computers and children than furniture and children. A selected number are reviewed here.

Glencross, Bluhm, and Earl (1989) conducted a field study of intensive computer keyboard training with schoolchildren. There researches found that training improved the speed and error rate of keying across gender and age groups, but they did not look at keying posture.

Laeser, Maxwell, and Hedge (1998) found evidence that computer workstation design should be addressed when schools plan the implementation of technology. Student well being was established and they found then when provided with ergonomic tools (chairs, workstations, etc.), the students made their own adjustments according to their own body types and work / task requirements. Improvements were found more for mousing than for keyboarding indicating a need for training on proper keyboarding (i.e., proper wrist posture).

ZSaito, Sotoyama, Jonai, Akutsu, Yatani, and Marmoto (2000) found that the introduction of computers into schools should be given more careful consideration. These authors also indicated that ergonomic guidelines for the use of computers in schools should be addressed.

Hedge, Barrero, and Maxwell (2000) evaluated the ergonomic issues for classroom computing. After reviewing research, similar to what has been done here, they concluded that the comfort and safety of child computer users may be at risk, based on the configuration of most computer workstations. They also correctly identified that fact that there are no current standards that address the use of computers in classrooms save for the possible application of the ANSI/HFES 100 standard, which was originally developed for adult users.

Dr. Leon Straker has been associated with many of the most recent articles regarding technology se in the classroom (Straker, Harris, and Zandvliet, 2000; Harris and Straker, 2000; Zandvliet and Straker, 2001; and Straker 2001). What Dr. Straker and his colleagues have found is that there has been little thought about the implementation of information technology into the classroom with respect to its impact on children's health. The greatest impact has been the lack of introducing appropriate computer workstations, appropriate organization of workspace for both individual and group work, lighting and air quality. These investigators have also found that autonomy and task orientation were independently associated with students' satisfaction with learning. In addition, due to the lack of longitudinal or in-depth epidemiological studies, it is not know to this point whether children are more at risk of developing cumulative trauma disorders from their exposure to pore computer-interactive posture during their developmental years.

Most recently, Bennet (2001) has developed a program for low-cost implementation of ergonomics in elementary schools. Bennet has also brought the effort of Ergonomics in the Classroom to the forefront of international focus.

Children and Health

Upsizing, fast food, dual career families with no time to prepare meals at home are having an impact, at least in the United States, and dare say the world, on the health and safety of our children. In 1986, about 9% of the US child population was considered overweight; in 1998 nearly 19% were considered overweight. Being overweight has been linked to diabetes and both have been linked to an increased prevalence for symptoms of Carpal Tunnel Syndrome. In fact, there has been a 33% increase in diabetes in the last 10 years

WHERE DO WE GO FROM HERE (IN ORDER)?

1. Collect anthropometric data for all grade levels for use in furniture specification and design; the Anthropometry for Infants, Children and Youths to Age 18 was published in 1977.
2. Develop ergonomic guidelines for use of technology in schools.
3. Train teachers, students, parents, and purchasing agents of school districts in the principles and application of ergonomics.
4. Conduct more evaluations of classroom conditions
5. Conduct epidemiological studies to identify the impact of technology, including computer games, on the health of children.
6. Conduct studies comparing workstation configuration and child anthropometry in homes.

7. Develop addition on-line ergonomics assistance for home and school computer use and include assistance for the use of laptop computers.
8. Develop assistance for parents in understating the relationship between their childrens' health, activity levels, exposure to technology and the development of cumulative trauma disorders later in life.

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