The increase of repetitive strain injuries in the workplace is forcing business to look at how work is completed. In today’s technical work environment, work must be adapted to the person rather than the person adapting to the work. With proper ergonomics, benefits can include higher morale, improved quality of work and productivity, greater efficiency, reduced absenteeism, lower turnover, and fewer lower back and repetitive trauma injuries. Graduates from Organizational and End-user Information Systems (OEIS) programs are in a position to implement sound ergonomic practices in the workplace. In order to prepare students for this role, the OEIS Model Curriculum suggests opportunities for four-year undergraduate programs to integrate ergonomic components into the curriculum. This can be accomplished through a variety of methods, including case studies, team projects, presentations, field-based research and guest speakers.

PURPOSE

The purpose of this paper is to provide a broad view of ergonomics and its importance in the workplace. Areas to be covered include ergonomic and economic issues, current ergonomic legislation and establishment of a proactive approach to ergonomics through an ergonomic awareness program and workstation design. Most importantly, the Organizational End-user Information Systems (OEIS) Model Curriculum will be examined to illustrate how sound ergonomic practices can be integrated into individual courses within the curriculum.

ASSESSING THE CHANGING ENVIRONMENT

Ergonomic Awareness

When most people think about safety issues, they conjure up images of a manufacturing facility with dangerous moving machinery and heavy equipment. The new workplace, however, is changing rapidly, devoid of reminders of a potentially dangerous factory setting. Instead, what you see are offices with carpeting, desks, padded chairs, computers, printers, telephones and other office equipment. What you do not see in this seemingly benign environment are the escalating rates of back injuries and repetitive strain injuries (RSI) caused by the lack of ergonomically-sound environments. Some writers on the subject have concurred that finding solutions to problems posed by ergonomic hazards will be the single most significant issue faced by organizations in the next millennium (Atkinson, 1991; Fernberg, 1994; Leavitt, 1994; Springer, C. J., 1993).

Organizations are realizing that designing ergonomically sound business environments makes economic sense. Safety programs and safety awareness are also part of this program. In the long run, these efforts can generate long-term savings. These savings come in decreases in the number of sick days taken and medical claims submitted (Johnson, 1993; Neuborne, 1997; Taslitz, 1994).

Ergonomics Defined

Ergonomics is the science of designing equipment to maximize worker productivity by reducing
operator fatigue and discomfort while improving safety (Fernberg, 1993; Joyce, 1989; Schneider, 1993; Springer, C. J., 1993). The word "ergonomics" comes from two Greek words: ergon, meaning "work," and nomos, meaning "laws." Ergonomics literally means, "laws of work." Ergonomics is an applied scientific/engineering discipline concerned with the interaction between systems and the people who operate and maintain them. Thus, whenever a human becomes part of the operation of a system, ergonomics becomes a necessary consideration. The most basic principle of ergonomics is designing the work environment to meet the needs of the worker (Arndt, 1991; Dainoff, 1990; Grandjean, 1987).

The Occupational Safety and Health Administration (OSHA) defined ergonomics as the study of the design of requirements of work in relation to the physical and psychological capabilities and delimitation of people; that is, ergonomics seeks to fit the job to the person rather than the person to the job. The aim of the discipline is to prevent the development of occupational disorders and to reduce the potential for fatigue, error, or unsafe acts through the evaluation and design of facilities, environments, jobs, tasks, tools, equipment, processes and training methods to match the capabilities of specific workers (U.S. Department of Labor, 1990). The views on ergonomics can be summed up as follows:

**Past:** Fitting jobs to people  
**Present:** Designing tasks, equipment, tools, and the environment for integration with the person in control—an ergonomic design approach.  
**Future:** Focus on integrating basic human capabilities and limitation, values, and needs into the creation of a productive work environment—an ergonomics approach. Results in increased health and safety of workforce and workplace and a higher quality of work and work life (National Safety Council, 1993).

In summary, ergonomics emphasizes two points: first the process of work must be adapted to human capabilities rather than asking the human to adapt to the technology; and second, the objective of ergonomic changes is to promote health and safety, and to optimize productivity (Arndt, 1991).

**Changing Demographics**

Like many things today, ergonomics is just another word for an old common sense idea. Since the beginning of recorded history, we have strived to shape our environment to meet our needs. Improvements over the centuries in clothing, shelter and design of hunting tools all reinforce that fact that the philosophy of ergonomics has been with us a long time.

Demographics in the American office have changed. The Baby Boom Generation comprises a large share of the computer users; thus, a generation of employees is aging. The effects of age on the human body are well documented. Presbyopia, the inability to focus on near objects, begins in the forties. Musculoskeletal injuries are more common after 40 as well, such as carpal tunnel syndrome (Leavitt, 1994). These effects of age coupled with poor ergonomic workplace design can have an impact on productivity and the bottom line.

Ergonomic design in office settings has become increasingly important, particularly because of the increased use of computers. Recent years have brought dramatic growth in the number of white collar office workers, with a corresponding large increase in the number of computer users (Atkinson, 1991; Leavitt, 1994). Approximately 40 percent of the workforce, about 40 million people, work at computer keyboards (CTD’s taking, 1995; Leavitt, 1994; Springer, C. J., 1993).

The continuous use of computers in the workplace usually means increasingly sedentary jobs. Employees simply are moving less as they work. Work is becoming increasingly abstract. Secretaries no longer get up and file actual papers in real file folders. Instead, they move icons that represent documents into icons that represent file folders on a computer screen without leaving their chairs.
ERGONOMIC ISSUES IN THE WORKPLACE

THE BUSINESS IMPACT OF POOR ERGONOMICS

A lack of concern for ergonomics can have a direct negative impact on corporate expenses, insurance rates and the bottom line. The business costs associated with poor ergonomics in the workplace affect individuals as well as the bottom line. Individual concerns include decreased health and well being, job dissatisfaction and unsatisfactory performance. Besides the adverse effects upon the individual, there are also direct and indirect costs to the organization in increased health care costs, worker's compensation premiums, absenteeism and turnover and decreased productivity (Atkinson, 1991; Arndt, 1991). The American Academy of Orthopedic Surgeons estimated that job-related motion injuries for all occupations cost $27 billion a year in medical treatment and lost income. OSHA estimated that by the turn of the century, 50 cents out of every dollar spent in medical costs will go toward treating cumulative trauma injuries if businesses ignore ergonomic problems (Cornell, 1995; Taslitz, 1993).

Insurance claims are becoming more frequent and expensive now that computers have become the mainstay of almost every industry (Springer, T. J., 1994; Taslitz, 1994). The most common insurance claim is Carpal Tunnel Syndrome, sometimes called repetitive strain injury or RSI, which occurs when tendons in the hand and wrist become inflamed and put pressure on the median nerve. The result is a numbness and cramping of the fingers, which, if left untreated, can require surgery and may cause a loss of function of the hand (Taslitz, 1994). Repetitive motion injuries are among the fastest-growing categories of workplace injuries documented by the U.S. Bureau of Labor Statistics (Cornell, 1995; Neuborne, 1997; Springer, T. J., 1994; Taslitz, 1993).

ERGONOMIC LEGISLATION

Because of the growing incidence of "white collar injuries," elimination of physical stressors in the office has become a popular target for legislation. Laws in most states, provinces and municipalities have been proposed to mandate improved working conditions in the office.

The State of Maine has a law that requires ergonomics education programs for most computer users. The Occupational Safety and Health Administration (OSHA) of the federal government listed ergonomics as a key factor in preventing musculoskeletal injuries in the workplace. OSHA recognized the problem and currently cites employers under the General Duty Clause (GDC). When reviewing the "accident log" they will look for repetitive motion disorders that include carpal tunnel, tennis elbow, certain back disorders and tendinitis. When these injuries are present, they will inspect and issue citations under the GDC for ergonomic hazards (Heilbroner, 1993; Taslitz, 1993).

OSHA suggested that any ergonomic standard have five components: surveillance, systematic analysis, prevention and control, healthy management, and training and education. Employers of computer-using workers can be proactive in these areas by beginning to evaluate their employees' jobs and by examining their own OSHA logs and medical records to decide what problems exist and by providing employees with training in relevant posture, vision and work organization issues (Cornell, 1995).

PROACTIVE APPROACHES TO ERGONOMICS

MEASURING THE BENEFITS OF ERGONOMICS AWARENESS AND SAFETY

Ergonomic awareness and safety programs have become increasingly important to companies trying to avoid OSHA fines and criminal liability for workplace safety problems. Employers are finally realizing that these programs can generate long-term savings. These savings come in decreases in the number of sick days taken and medical claims submitted, decreases in employee discomfort, and increases in employee productivity (Dainoff, 1990; Lesin, 1994; Mallory, 1989; Marley, 1994; Neuborne, 1997; Taslitz, 1994; Sauter, Schleifer, & Knutson, 1991; Schafer, 1993).

Training, education and information programs can help raise awareness and reduce
the severity of repetitive strain injuries. People are seeking assistance earlier and cases requiring treatment are less severe and more easily remedied. In a pilot program at Michigan State University, it was shown that teaching people about ergonomics and the benefits of posture and appropriate accommodation of furniture and equipment had a dramatic impact on the experience of discomfort and the propensity to develop symptoms of RSI (Springer, C. J., 1993; Springer, T. J., 1994).

A report made by Blue Cross of California showed a savings of $2 million in insurance dividends over a two-year period for computer ergonomic training and improvements. Similarly, L. L. Bean has shown that it saves between 10 and 100 times its investment on computer ergonomics (Springer, T. J., 1994; Wood, 1995). A program at The Sacramento Bee newspaper advised computer users about ergonomics and safety. The effect of this program reduced the injury-related costs from $2.2 million in 1990 to $490,000 in 1994 (Peterson, 1995).

Ergonomic interventions have the objectives of increasing user health and comfort while simultaneously, encouraging optimum productivity. Research findings support the effectiveness of ergonomic interventions. Dainoff found a five percent increase in productivity in a laboratory situation, and T. J. Springer reported a 10 to 15 percent improvement in transactions per hour for computer operators at an insurance company when seating and workstation were improved. Dr. Springer further reported that about five percent improvement was due to seating improvements alone (Dainoff, 1990; Sauter et al, 1991; Springer, T. J., 1994).

AN ERGONOMICS AWARENESS PROGRAM

Developing a good ergonomics program involves systematic review and discussion of jobs, often involving a team of people, including ergonomist, hourly employees, managers and engineers.

The first step is educating everyone involved. Employees who are well-informed will be keen observers of problems at the beginning stages, before there are significant discomfort and expense. Purchasing agents and facility managers who are well-informed will spend their dollars wisely and will resist vendors who do promise instant and often incorrect solutions. If upper management is well informed about ergonomics, they will ensure that programs result in action, not just rhetoric. This in turn ensures a cycle of active, wise intervention.

Informative education programs are not simply lists of rules and guidelines; rather, such programs must provide users with the physiological information needed for them to make appropriate posture choices and alternative ways to reach postural objectives. Good education programs cover what users can do for themselves and what must be provided in the workstation, the software, the lighting and the like. The implementation of an effective ergonomic awareness program can increase worker productivity and decrease employee illness and job turnover.

GOOD WORKSTATION DESIGN

Making sure employees get the most out of their workstation is becoming an increasingly important supervisory function as these workstations take on greater importance in the day-to-day functioning of the modern business. A well-planned workstation environment contributes to employee comfort, which can result in great efficiency and productivity. A simple adjustment in lighting, noise level, and air quality can help create a more efficient workstation.

The size and type of workstation an employee needs to work efficiently depends on his or her work assignments. The workstation should be large enough to accommodate various types of work and allow easy access to files and equipment. Office chairs need to be suitable for office work, such as using the telephone, reading, taking notes, meeting with others and work involving the use of computers.

What do employees need to know about workstation design can be summed up in one word “adjustability.” Every component of the workstation—terminal, chair, desk, lighting, heating, air conditioning, should be adjustable (Arndt, 1991; Cornell, 1995; Dainoff, 1990).
Benefits of Ergonomics Awareness

Making ergonomic improvements in the workplace can have many benefits. Applying ergonomic principles to job analysis provides an opportunity to show employees that the company cares about preventing occupational injuries and illnesses and is serious in wanting to do something about them. Improving the ergonomic environment in the workplace can result in:

- Higher morale
- Improved quality of work
- Greater efficiency
- Improved productivity
- Reduced absenteeism
- Lower turnover
- Fewer lower back injuries
- Fewer repetitive trauma injuries

Making ergonomic improvements to the workplace need not be expensive or too complicated. Significant changes can be made if problems are approached with objectivity, good analysis of work methods and strong knowledge of basic ergonomic principles (Fernberg, 1994; Dainoff, 1990; Sauter et al, 1991; Springer, T. J., 1994; Taslitz, 1994).

Integration into the OEIS Model Curriculum

Ergonomics and the Curriculum

LaBonty’s (1997) study looked at how office information systems personnel assessed their workstation environments related to ergonomic practices. This research can be used to shape the office systems curriculum and to help office systems personnel and graduates mold safe and productive workplace environments. Currently enrolled OEIS students can begin to engage in this process of assessing the current work environment through their coursework.

When the revised model curriculum for Organizational End-user Information Systems (OEIS) was created, the Office Systems Research Association (OSRA) Curriculum Revision Group’s goal was to provide a model that could be customized within a variety of four-year undergraduate programs. Therefore, there are various ways to incorporate ergonomics into the OEIS Model Curriculum depending upon how a four-year school has adapted the model curriculum.

In Organizational and End-user Information System Concepts (OEIS-1), the first course in the model curriculum, the study of ergonomics can be incorporated into the module entitled workplace performance and productivity.

One university incorporates ergonomics into a field-based work station analysis project where students evaluate and redesign an existing work site using sound ergonomic principles. Teams of students research ergonomic topics, observe and analyze the workflow and office design of a local organization, and use software in the redesign of the layout. The project includes the following: research skills, written and oral communications, critical thinking, ability to work with others in a team setting, and the application of technology to solve problems. Individuals from the organizations whose offices were used in the project are invited to attend the project team’s formal presentation and lend an added sense of realism to the assignment.

Another way to heighten awareness of ergonomics as a critical issue in business is to require “expert” papers on research topics related to the workplace. For example, the subjects could include carpal tunnel syndrome, workplace health and productivity, the noise factor in the workplace, intelligent buildings, and safety requirements in the workplace. The students become experts in their topic through researching and writing a paper as well as presenting their findings to the class. In the course of the discussion following each presentation there is an interchange of ideas, and interpretation of findings especially when students have referenced the same sources.

Ergonomics can be integrated into Designing and Managing Organizational Training (OEIS-5). Although this may seem to be an unlikely place to introduce this area, students can design training modules such as Ergonomics 101—Improving Your Workstation or CTS Prevention. Once the
module is completed, students would conduct an in-class mini-training session based upon the training module.

The Cases in Organizational and End-user Information Systems (OEIS-7) course gives the instructor the flexibility to incorporate ergonomic issues. Appropriate cases and applicable research can be used to enhance the students' understanding of human factors considerations and ergonomics.

Special Topics (OEIS-9) is designed to provide students with up-to-date information on special contemporary topics. A college/university may decide to offer a full-semester course devoted to ergonomics since one of the suggested topics in the OEIS model curriculum is human factors engineering. The course could focus upon the interaction of people, technology, procedures and the work environment. Environmental issues include office layout and design. Teaching methods could include lectures, guest speakers such as furniture vendors, facility managers and ergonomists. An in-depth study of a real business incorporating ergonomic design and principles could be a requirement for this course.

SUMMARY

Ergonomics is a critical issue for businesses today. With the proliferation of PCs on the desktop, ergonomics is an area in which OIS graduates should be knowledgeable. While finding the appropriate place to incorporate ergonomics is the task for each college/university, the OEIS Model Curriculum is flexible and ergonomic topics can be incorporated in a variety of courses.

REFERENCES


Neuborne, E. (1997, January 9). Workers in pain; employers up in arms.USA Today, 1B-2B.


