Effectiveness of Ergonomics Education on Employees in the Workplace

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Introduction

In the opinion of many experts in the field of ergonomics, the definition of the science is the study of how people interact with the environment in which they work (Johnson, 2008). However, members of the workforce who are asked about their perspective and definition of ergonomics regularly provide a response that their understanding of the field of ergonomics is that it has something to do with adequate lifting techniques or sitting appropriately while at a computer workstation. Ergonomics is rarely considered a field which is of tremendous importance and this is frequently demonstrated when obtaining responses from most anyone who has diminutive knowledge of the field. In many instances, experts in the field of ergonomics are presented with identical answers from those in the workforce and although this is quite a common response to individual perceptions of ergonomics, there is considerably more to the field than most individuals may perceive. Because of frequently encountered barriers with redesigning the work environment, many experts are supporting ergonomics education as a method of preventing workplace injuries (Bohr, 2000). Much of this deficiency of knowledge may be attributed to the lack of education, which justifies the need to explore the effectiveness of ergonomics education. Johnson (2008) reported that the effectiveness of ergonomic education and the techniques used to facilitate learning of the subject is not regularly found in literature nor is there an abundance of research which discusses what employees perceive as the reason multiple barriers exist in regards to current ergonomics educational techniques.

With this said, are the experts in the field of ergonomics, those who clearly have an immense knowledge of the field, providing sufficient education to their students and or the workforce? It has been argued that lack of training is one of the principle barriers to effective use of ergonomic tools and knowledge (Rohmert and Laurig, 1977). One of the foremost objectives
of ergonomics training is to properly inform participants to ensure full comprehension of the material so that reproduction of the obtained knowledge can be utilized on the job. Along with this, employees must also assume personal responsibility and utilize individual methods of implementing ergonomics (Johnson, 2008). If training is inadequately presented and employees do not feel they are responsible for using knowledge they have been provided, that information will more than likely not be utilized when completing job tasks and training conducted can be considered highly ineffective.

In the past, I heard a phrase from a fellow educator which I communicated with during coursework which truly cemented itself in my brain. This individual mentioned that although they did not possess twenty five years of experience in the particular field they were in the near future going to begin teaching; they did not for a second doubt that they knew how to actually teach and would gather that their counterparts in the field could not say the same. The equivalent can be said of the field of ergonomics in that although educators have achieved the highest level of certification, have obtained master’s or doctorate degrees and may have completed numerous research projects, the fact remains that they may be ineffectively teaching and training those who attend their courses. Bohr and Barrett (1997) stated that, “the translation of knowledge to safe and healthy work practices is difficult to measure, yet it is critical to the evaluation of training program effectiveness.” (p. 241). Without adequate evaluation of training, the end result may never be the result we desire.

**Statement of the problem**

The purpose of this paper is to examine the effectiveness of ergonomics education. To further investigate this topic, the present study addressed the foremost problem; the lack of effective ergonomics training and education resulting in lower retention from participants. In this
paper we address the following research questions: Do employees understand and apply ergonomic techniques after receiving training and education? Do employees feel the method of training was effective in achieving the goal of applying ergonomics on the job? Do employees feel that after receiving this training they have an understanding of the risks they face? Previous research led to the belief that training may be ineffective however there has been research that has indicated training in the field of ergonomics is effective when delivered appropriately. Unfortunately however, there has been minimal importance placed on ergonomics education as a method of preventing workplace injuries (Bohr and Barrett, 1997) and due to limited research in the past, supplementary studies on the topic are needed to facilitate improvement in educational delivery methods in the field.

**Additional Research Need**

The science of ergonomics has been around for centuries, and over the years various research has indicated positive outcomes when providing ergonomics education. According to King, Fisher and Garg, (1996) results showed training to have a significant effect upon knowledge of ergonomics. In association with this research, Johnson (2008) reported that both didactic and participatory methods of educating the workforce was successful in facilitating constructive changes to employee behaviors resulting in safer performance while completing job tasks. The participants' perceptions of the barriers which influence these changes may improve their understanding of the process of translating knowledge into practice in the workplace (Johnson, 2008).

Despite the research which has indicated that training can have a positive effect on participant knowledge of ergonomics, there are amongst those beneficial research results, unfavorable research findings as well. Martimo et al. (2008) reported there is no evidence to
support use of advice or training in working techniques with or without lifting equipment for preventing back pain or consequent disability. These findings challenge the overwhelmingly popular methods of educating the workforce on proper lifting techniques (Martimo et al., 2008). Their research revealed that a potential reason training was ineffective is because the intervention was not inappropriate (Martimo et al., 2008). According to Burke et al (2005), as training becomes more engaging, workers gain a greater level of understanding and ultimately the number of injuries decrease. “Accordingly, we classified the training methods based on learners’ participation, but we did not find a more positive outcome for studies that involved more intense training methods.” Martimo et al. 2008 (p. 5).

Various ergonomics specialists may understand a great deal about the science and what they must communicate to employees, nevertheless the problem is that educators may not entirely comprehend how to properly deliver effective education methods to guarantee adequate retention of the information for later application on the job. Although research conducted by Martimo et al. (2008) was geared towards lifting equipment and back pain specifically, it does speak to the possibility that training can be ineffective if delivered inappropriately. Further research on the subject of effective ergonomics educational methods needs to be performed so that educators in the field will not only understand appropriate methods of training delivery but also why that delivery is most effective. Stone (2008) stated that although the personalities of both educators and learners will not change we may be able to further enhance learning if we become aware of the impact of their differences. We must be able to know with some certainty that the training delivered is effective and without further research, training may continue to be ineffective.
Informal discussions between ergonomics specialists and educators have taken place on countless occasions regarding ergonomics and effective training and education methods. Why is ergonomics education not given more attention? When personally partaking in these discussions, the answer most repeatedly is that there is no formal rule in place to enforce implementation. Because the field of ergonomics is dealt with by every employee in every field on a daily basis one might conclude that a program of its magnitude would be considered by upper management in a corporation to be of grave importance. This however, does not appear to be the case which makes educating those in the workforce especially challenging. Educating students involved in undergraduate, graduate or doctorate level ergonomics education who will eventually become specialists in the field can be complicated, but even more complicated is the education of those in the workforce. Because research on the topic of effective ergonomics education appears to be somewhat limited, additional research is necessary and will assist all professionals in the field in their delivery of effective training and education to participants. Liker, Evans, Ulin, and Bradley (1990) discuss the significance of positive reinforcement of training techniques as well as instruction that is based on work site specific job tasks performed. Employees must receive a form of reinforcement when learning about job tasks they perform. Accomplishing this however can be a challenge when time allotted for a class is less than two hours.

As already discussed, one cannot find endless amounts of research concerning the topic of ergonomic education effectiveness; nevertheless there has been of late an assortment of comprehensive studies on the topic which distinctively mention effective ergonomics education techniques. One study in particular revealed that the conclusion from several narrative reviews has been that most training interventions lead to positive effects on safety knowledge, adoption of safe work behaviors and practices, and safety and health outcomes (Burke et al., 2005). Jensen
and Friche (2007) found that proper education and training was effective in obtaining an increase in the number of employees using newly taught working methods and a decrease in the number of reports of work related discomfort. Conversely, it seems quite clear that additional research needs to be done to definitively answer the ergonomics education dilemma. What is the most effective method? Do participants actually find training effective? Are certain teaching methods or techniques useful whereas others are not? Without further research it does not appear that this question will be definitively answered.

**Methods**

In the present study we examine an ergonomics education class delivered to a small group of library employees. One of the main objectives with this class is to determine if employees in attendance find the course effective in facilitating participants understanding of the subject matter to be later applied on the job. An hour long ergonomics course geared specifically towards library employees and the tasks they perform was developed to inform employees of the hazards they face on a recurring basis as well as to provide them with compulsory subject matter and ergonomic techniques that can later be utilized while performing job tasks. The course was delivered in a lecture style format however facilitation of participant discussions also occurred. In order to collect the desired information, discussions with both library upper management staff and internal human resources personnel took place in order to adequately clarify the intent of the study as well as to describe how the desired information was ultimately going to be acquired; however, no formal permission to administer the survey and collect data was required.

One of the many critical objectives of ergonomics education courses is not only to effectively educate employees, but to also help decrease injury risk and ultimately the number of work related injuries. This also helps describe my role in this training session and study which is
not only to educate employees in library ergonomics but also to discover what effects the training session had on the employees in attendance, to determine if this information was well received and if newly learned skills will later be used on the job in order to improve safety and decrease injury risk. Myself as well as those on my staff will ultimately utilize this knowledge when designing and conducting future classes. In conclusion of this study, the results of this research will also be beneficial for additional ergonomics educators who also provide awareness training to employees in the workforce as well as provide a measure of training effectiveness. Because of somewhat limited research on workforce education courses specifically in ergonomics, research on this particular aspect will be especially useful to future educators of the subject.

To collect desired information from employees in attendance a survey, as shown in Appendix B, was created to specifically address the library ergonomics subject matter to be delivered to employees in attendance. The survey, which was administered immediately following the completion of the class, contained sixteen questions related to perception of ergonomics, prior ergonomics education, previous injury on the job, employee status, class delivery method perception, hazard reporting as well as other ergonomic education effectiveness related questions. The survey was provided to a group of sixteen total library employees who attended the course. To accommodate the varying schedules of library employees, the class was delivered on two separate occasions; however the class material was delivered in the same manner in each session. After delivery of the course, the statistical package for the social sciences program was used to analyze the collected data.

Results
The results of the library ergonomics course, as also shown in Appendix A, shows that 11 out of 16 (69%) employees in attendance were part time employees and the remaining five employees (31%) were of full time status. Over half of all employees attending the course (62%) reported that their attendance at the training session was mandatory and all remaining employees reported either their own personal interest in the subject or mentioned other reasons for attending the course. Just less than half (44%) of employees reported that they had experienced some sort of discomfort working on the job in the past and 56% had received ergonomics training in their careers.

Results also show that 56% of participants feel ergonomics is an important to know about and 87.5% of employees either agreed or strongly agreed that the ergonomics course was necessary given the job tasks performed. The remaining 12.5% of employees answered neutral and none of the participants disagreed or strongly disagreed. Of the sixteen participants in attendance, all but one (94%) either agreed or strongly agreed when asked if they would use the ergonomics skills taught in the course. This helps address earlier questions as to whether or not employees understand and plan to apply ergonomic techniques after receiving training and education. When asked if the delivery of the class was appropriate, 31% of employees agreed and 62% strongly agreed (93% total). After taking the course, all sixteen (100%) of employees answered that they have a pretty well or very well understanding of injury risk factors and all sixteen (100%) also answered that they have a pretty well or very well understanding of ergonomics techniques after taking the course. These outcomes help demonstrate and answer earlier research questions that after receiving training employees have an understanding of the risks they face. Only 50% of employees said they feel comfortable reporting ergonomic hazards...
in the workplace and 19% either were neutral or disagreed when asked of their comfort level reporting hazards.

Another important result of this study revealed that employee’s knowledge of ergonomics after taking the course had improved. Of the sixteen employees in attendance, two (12.5%) reported very low knowledge of ergonomics, three employees (18.8%) reported low knowledge of ergonomics and two employees (12.5%) reported neutral knowledge of ergonomics. The remaining nine employees (56.3%) reported a high level of ergonomics knowledge before taking the class however, none of those attending the class reported a very high knowledge of ergonomics. After taking the class however, all sixteen employees (100%) reported either a high or very high level of knowledge (44% and 56% respectively). These results reveal that the knowledge of ergonomics specifically for library tasks has improved after taking this class which again begins to clarify in greater detail earlier inquires as to whether employee’s knowledge of subject matter improves as a result of the class.

Further analysis results shown in Table 1.4 in Appendix A indicate that full time employees were statistically different from part time employees when comparing scores in the category of how important employees feel ergonomics is to their co-workers (p=.001) as well as their own knowledge of ergonomics before attendance in the course occurred (p=.005). Inspection of the two group means indicates that the average response for part time employees when asked about their knowledge of ergonomics before the course was that this group had a lesser knowledge of ergonomics (M = 2.73) whereas full time employees typically had a greater understanding of ergonomics (M = 4.00). This reveals that full time employees have a statistically greater understanding of ergonomics than do part time employees. When asking employees their perception of how important the subject of ergonomics was to their co-workers,
the two group means indicate that the average response for part time employees was that employees did not believe their co-workers felt ergonomics was extremely important (M = 3.00) whereas full time employees reported they perceive their co-workers feel ergonomics is important (M = 4.00). The t is statistically significant in both cases when looking at scores for employees knowledge of ergonomics before the course, t(10.0) = 3.55, p = .005, and how important employees feel ergonomics is to their co-workers t(13.2) = 4.12, p = .001. The effect size d for employee’s knowledge of ergonomics before the course score is -2.13 and the effect size score regarding how important employees feel ergonomics is to their co-workers is -2.07. Both of these scores indicate a very high effect size and strength of relationship which is much larger than typical. These outcomes indicate that part time employees may have a significantly lower understanding of ergonomics and thus need additional training and education to improve their knowledge of the subject.

Conclusively, these results will contribute to the field of ergonomics and will help professional educators in the field comprehend that training can be effective in increasing employee knowledge of the subject matter so that it can later be applied on the job. In addition, this will help educators understand that when training is delivered effectively, employees will have an improved awareness of potential for injury and possible causes of those injury risks.

**Conclusion**

Although the results of this study reveal that employees understand and plan to apply ergonomic techniques after receiving training, have a greater understanding of the risks they face, feel the method of training was effective and will result in and increased employee willingness to apply ergonomics on the job, further and more comprehensive investigation should be performed to determine alternative techniques of providing ergonomics training. In
order to entirely understand the effects of ergonomics education on the workforce, it is crucial to continue each aspect of this research and obtain a larger population sample and employ a greater array of ergonomics educational techniques. Delving further into why full time employees have a greater understanding of ergonomics and why part time employees are lacking should be considered. Demographic statistics including age and gender were not considered in this study and may need further contemplation in future studies. Typically, my experience dictates that females have a propensity to report ergonomics injuries more frequently than males and have a greater interest in the subject. Without this being considered a potentially major factor is not being accounted for. In addition, the delivery of the course, although reported to be satisfactory in this study, was mainly didactic. A participatory approach increasing employee involvement in the class and incorporating hands on learning techniques would also be useful with the end results being quite interesting. To achieve further desired results, a longitudinal study taking these issues into account, along with many others not mentioned, may be extremely beneficial and would offer more detail as to whether or not work related injuries decrease and if ergonomics techniques taught are actually used on the job after attendance at an ergonomics course. However beneficial these results seem, without more detailed investigation, we may not have a complete understanding of the impact of ergonomics training and will not know with certainty that employees will actually follow through with they had reported in this study.
Appendices

Appendix A

Table 1.1

Employees Reporting They Will Use Ergonomic Skills Taught

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>1</td>
<td>6.2%</td>
</tr>
<tr>
<td>Disagree</td>
<td>10</td>
<td>62.5%</td>
</tr>
<tr>
<td>Neutral</td>
<td>1</td>
<td>6.2%</td>
</tr>
<tr>
<td>Agree</td>
<td>10</td>
<td>62.5%</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>5</td>
<td>31.3%</td>
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<tr>
<td>Total</td>
<td>16</td>
<td>100%</td>
</tr>
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</table>

Table 1.2

Employee Knowledge Prior to Attending Ergonomics Course

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Low</td>
<td>2</td>
<td>12.5%</td>
</tr>
<tr>
<td>Low</td>
<td>3</td>
<td>18.8%</td>
</tr>
<tr>
<td>Neutral</td>
<td>2</td>
<td>12.5%</td>
</tr>
<tr>
<td>High</td>
<td>9</td>
<td>56.2%</td>
</tr>
<tr>
<td>Very High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 1.3

Employee Knowledge After Attending Ergonomics Course

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
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<tr>
<td>Very Low</td>
<td>7</td>
<td>43.8%</td>
</tr>
<tr>
<td>Low</td>
<td>7</td>
<td>43.8%</td>
</tr>
<tr>
<td>Neutral</td>
<td>2</td>
<td>12.5%</td>
</tr>
<tr>
<td>High</td>
<td>9</td>
<td>56.2%</td>
</tr>
<tr>
<td>Very High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>100%</td>
</tr>
</tbody>
</table>
Table 1.4

Comparison between Full Time and Part Time Employees Perception of Course

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>p</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of Ergonomics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before Taking Course</td>
<td>3.55</td>
<td>10.0</td>
<td>.005</td>
<td>-2.13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part Time</td>
<td>11</td>
<td>2.73</td>
<td>1.19</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Full Time</td>
<td>5</td>
<td>4.00</td>
<td>.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I Feel Ergonomics is Important to Co-workers</td>
<td>4.12</td>
<td>13.2</td>
<td>.001</td>
<td>-2.06</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part Time</td>
<td>11</td>
<td>3.00</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Time</td>
<td>5</td>
<td>4.60</td>
<td>.548</td>
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Appendix B

Course Survey

Ergonomics Awareness Training Course
Class Evaluation/Questionnaire

Class Title____________________________________ Date ________________

Please give us your opinion of today’s course.

Employment Status: Hours Worked Per Week on Average:
□ Full time  □ Part time  □ 5-10  □ 11-25  □ 25 or more

1. I attended today’s ergonomics course because?
□ It was mandatory  □ I was interested in the topic
□ Other: ______________________________________

2. I have had discomfort/pain while working in a job before?
□ Yes  □ No

3. I have had some sort of ergonomics training in the past?
□ Yes  □ No

4. How many of your coworkers do you feel know what ergonomics is?
□ 0-10%  □ 11-25%  □ 26-50%  □ 51-75%  □ 76-100%

5. How many of your coworkers feel ergonomics is important?
□ 0-10%  □ 11-25%  □ 26-50%  □ 51-75%  □ 76-100%

Please use the following scale when answering the below questions (6 –12):
1 – strongly disagree
2 – disagree
3 – neutral
4 – agree
5 – strongly agree

6. Ergonomics in general is important to know about.  1  2  3  4  5

7. There are sufficient ergonomics education courses being offered to employees at CSU.  1  2  3  4  5
8. I plan to use the ergonomics techniques and skills taught in this workshop. 1 2 3 4 5

9. The method of delivery for this course was appropriate. 1 2 3 4 5

10. This course is necessary given the tasks performed on the job. 1 2 3 4 5

11. I feel comfortable reporting hazards in the workplace. 1 2 3 4 5

12. This course kept my interest while teaching me about ergonomics. 1 2 3 4 5

Please use the following scale when answering the below questions (13 – 13):

1 – very low
2 – low
3 – neutral
4 – high
5 – very high

13. Before taking this course my knowledge of ergonomics was: 1 2 3 4 5

14. After taking this course my knowledge of ergonomics is: 1 2 3 4 5

As a result of this course, to what extent do you feel you understand the below (circle answer)?

<table>
<thead>
<tr>
<th></th>
<th>Not Well</th>
<th>Somewhat</th>
<th>Pretty Well</th>
<th>Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. Injury risk factors</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>16. Ergonomic Techniques</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
References


