Using an interactive website to disseminate participatory ergonomics research findings: an exploratory study

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Introduction: Researchers traditionally present the results of their research in academic journals and through conference presentations. Typically, individuals working outside of academia do not have access to traditional journal indexes; the use of electronic archives has been shown to assist in disseminating research findings to potential users outside of the research community.

Typically the results of participatory ergonomics research are published in peer reviewed articles or presented at conferences. Some health and safety associations have developed and published (in print or on their website) participatory ergonomics literature reviews and participatory ergonomics program implementation manuals with industry specific examples for their members. The Participative Ergonomics Blueprint and Ontario's MSD Prevention Guideline are non-industry specific documents that can be used as resources for a participative ergonomics program.

Currently, there is not an all-in-one resource for workplace parties containing all of the information to consider when determining if a participatory approach to ergonomics is appropriate for a specific workplace, or when implementing a participatory ergonomics program. Workplace parties would have to consult several sources (such as health and safety association publications, academic literature, books, magazines, corporate resources, safety groups, newsgroups, etc.) to gather and synthesize the information and resources required to develop and implement a participatory ergonomics program.

The purpose of this thesis was to evaluate the responses to and effectiveness of an interactive website for knowledge dissemination to industry stakeholders.

Methods: I developed an interactive wiki-style website with content based on my lay language synthesis of the participatory ergonomics literature. Relevant case-study examples, drawn from

participatory ergonomics intervention studies, were used to illustrate concepts from the literature review.

Website visitors were asked to complete a short questionnaire and were encouraged to contribute experiences, tools, links and comments on each web page in the "visitor contributed content" area. The purpose of the questionnaire was to learn more about website visitors and to gather feedback about the effectiveness of using an interactive website to disseminate participatory ergonomics research findings to industry stakeholders. Data were collected to allow computation of total duration of website visit, page order, total number of pages viewed, and the average time spent viewing each page. A qualitative analysis of all visitor contributed content and questionnaire responses was completed. The data were reviewed, grouped into themes and key messages were summarized. T-tests and chi-square analyses were completed to analyze the quantitative questionnaire responses.

Results: During the data collection period (October 23, 2006 to May 31, 2007), there were 2214 website visits. With "short duration" and search engine indexing software visitors removed, 256 people came to the website, who browsed the content for more than one minute and viewed more than one page. During this time 54 questionnaires were submitted.

All questionnaire respondents reported that the website content did not contradict their previous knowledge of participatory ergonomics. Several respondents stated they would need additional resources in order to determine if a participatory approach to ergonomics was right for their workplace or to implement a participatory ergonomics program. Suggested topics for a participatory ergonomics "tool box" included: timeline for program implementation, a timeline to demonstrate improvements in measurable outcomes of success, guidelines for ergonomics training, guidelines for assessment tools, methods and equipment, and an ergonomics policy/procedure template. Overall, with the exception of the expert's rating of the visitor contributed content, the respondents found the

case study examples and the visitor contributed content helpful. The source credibility of the literature review, visitor contributed and ergonomics content on the Internet were rated the same on all dimensions of credibility by questionnaire respondents.

Eight unique website visitors made 13 contributions to the website. Website visitors were more likely to contribute to the website content if they visited the website for more than 10 minutes (chi-square 20.9038, df=1, prob <0.0001). The majority of contributions were added to the "successful and sustainable participatory ergonomics programs" and "participatory ergonomics" pages. Most of the comments were sharing "tips, tricks, and traps" from past experiences with participatory ergonomics (or similar) programs and sharing links to additional participatory ergonomics resources.

The most common reason for not contributing to the website content was lack of time and not realizing that it was possible to contribute to the website. In addition to "not realizing that it is possible to contribute", three people reported they were unable to figure out how to contribute to the website. This implies that prior to expanding this approach to knowledge transfer; there are user interface issues that should be addressed.

Conclusions: The most significant limitation of this project was the small number of questionnaire respondents and the sparse visitor contributions to the website content which is likely due to not allowing a sufficiently long data collection period. Feedback from website visitors suggests that additional case study examples and a participatory ergonomics "toolbox" should be added to future iterations of the website.

It was surprising that there were no statistically significant differences for the source credibility of the website content based on the literature review, the visitor contributed content and other health, safety and ergonomics information on the Internet.

Most website visitors did not share their experiences due to a reported lack of time and user interface issues. To increase the number and frequency of visitor contributions, the user interface issues need to be resolved. An alternative method to engage website visitors (e.g. moderated commenting system) may be more successful than the wiki website created for this project.

I believe that it is worthwhile to continue to invest time and resources to further develop this interactive participatory ergonomics resource. With additional time, continued recruitment and promotion efforts and changes to address user's concerns (moderated commenting system, authority of contributions, addition of a 'tool box', etc.) there is the potential to fill an information niche that is currently missing online.

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Ruth Gooding, thank you for all your assistance and guidance during my time at Waterloo.

Dedication

To Cam, Owen, Mom, Dad, and my family and friends. Thank you for your unconditional love, support and encouragement throughout this journey. I could not have done it without you!

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Chapter 1
Introduction

1.1 Introduction

Researchers traditionally present the results of their research in academic journals and through conference presentations. Individuals working outside of academia may not have access to traditional journal indexes (May and Barnard, 1996), and therefore may not be aware of the latest research findings in their area. May and Barnard (1996) found that the use of electronic archives assisted in rapid dissemination of research findings to potential users outside of the research group.

Typically, the results of participatory ergonomics research are published in peer review articles or presented at conferences. Some health and safety associations[1] have developed and published (in print or on their website) participatory ergonomics literature reviews and participatory ergonomics program implementation manuals with industry specific examples for their members. The Participative Ergonomics Blueprint (Wells et al., 2003) and Ontario's MSD Prevention Guideline are non-industry specific documents that can be used as resources for a participative ergonomics program. The 'blueprint' lays out a plan for starting and maintaining an effective ergonomics program. The purpose of the MSD Prevention Guideline is to "provide Ontario employers and workers with information and advice on a recommended generic framework for preventing musculoskeletal disorders" (OHSCO, 2007). Although the prevention guideline advocates worker involvement during risk assessments and implementing MSD hazard controls, it does not recommend a full participatory ergonomics program.

[1] For example: Institute for Work and Health, Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST), Occupational Health and Safety Agency for Healthcare in British Columbia, Ontario Safety Association for Community and Healthcare

Currently, there is not an all-in-one resource for workplace parties containing all of the information to consider when determining if a participatory approach to ergonomics is appropriate for a specific workplace, or when implementing a participatory ergonomics program. Workplace parties would have to consult several sources (such as health and safety association publications, academic literature, books, magazines, corporate resources, safety groups, newsgroups, etc.) to gather and synthesize the information and resources required to develop and implement a participatory ergonomics program.

1.2 Purpose

The purpose of this exploratory study is to investigate the feasibility of using an interactive website to disseminate participatory ergonomics research findings, filling an information niche that is currently missing online.

- The purpose of the first phase of the study is to synthesize the participatory ergonomics peer-reviewed literature into a lay-language summary and to synthesize data from five case-control participatory ergonomics intervention studies to include relevant case-study examples to illustrate concepts from the literature review.
- The purpose of the second phase of this study is to assess the limitations and strengths of an interactive website for the purpose of knowledge dissemination to industry stakeholders. The results of the evaluation will be used to determine if this method of knowledge dissemination looks promising and if additional time and resources should be invested in developing the website further.

1.3 Hypotheses

The hypotheses for this thesis are:

- Electronic resources assist in dissemination of research findings to potential users outside of the research group. Website visitors may identify limitations with the website, but the strengths of the website will outweigh the limitations and it will be worthwhile to continue to invest time and resources to further develop this project.
- Internet users want to know that information on the Internet is authoritative and coming from a trusted source before they will consider applying it. The website's "core content" (based on the literature review) will be rated higher on measures of source credibility than the website's visitor contributed content or other health, safety and ergonomics Internet resources.
- Knowledge evolves when it is applied in the world of practice. If website visitors are given an opportunity to share their experiences, they will. "Experts" (who are aware of the PE literature and have implemented PE programs) are willing to share their experiences and will contribute to website content.

Chapter 2
Literature review

2.1 Ergonomics

Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance (IEA, 2000). A participative ergonomics (PE) approach in the workplace relies on the active involvement of workers in implementing ergonomics knowledge and procedures in their workplace in order to improve working conditions and product quality (Wilson, 1995).

2.1.1 Benefits of a participative approach

> "We must give ergonomics away…transfer our knowledge and methods to others who are closer to the places where changes have to be made, so that they do much of the ergonomics for themselves" (Cortlett, 1991 in Wilson, 1995).

Organizations cannot rely on hiring professional ergonomists for their every need because there are not enough professional ergonomists to meet every organizations need and this approach is not cost effective for many organizations (Haines et al, 2002; Wilson, 1995). The advantages of a participative approach are numerous and are well documented by many authors:

1. The facility gains an **increased awareness of ergonomics** that stays after the "expert" leaves (St-Vincent et al, 1998). In the consultant model, the facility receives a report which answers the question the consultant was asked to look at. The participative approach aids in the spread of interest and ergonomic expertise within the organization; ideally the ergonomics perspective becomes embedded in the organization (Wilson, 1995).

2. When **key stakeholders are involved in solution building**, the recommendations to address the ergonomics concern(s) are typically practical, economically and technically feasible, and respect the culture of the plant (Haines et al, 2002; St-Vincent et al, 1998; Wilson, 1995). When key stakeholders are involved in developing solutions, the implementation of changes is smoother and changes have higher worker acceptance and compliance than without key stakeholder involvement (Haines et al, 2002; Nagamachi, 1995; St-Vincent et al, 1998; Wilson, 1995)

3. The PE approach has been associated with **improved workplace climate** including improved productivity, quality, communication within the workplace, quality of working life and reduction of stress and 'health problems' (Carayon and Smith, 2000; Nagamachi, 1995; St-Vincent et al, 1998; Wells, 2007).

2.1.2 Issues to consider when implementing a participative ergonomics program

Despite the advantages of implementing a PE program, there are several issues that need to be considered prior to implementing a PE program in order to improve chances for a successful, sustainable program.

The participative approach is not easy (Wilson, 1995). There are two aspects of participation that need to be considered prior to implementing a PE program to determine if a participative approach is right for a workplace. Ask:

- Are there volunteers who would be willing to participate in the PE program either as ergo committee members or workers providing feedback and input on ergonomics committee projects (Wilson, 1995)?

- What is the best way to involve the workforce members who are not directly active in the ergonomics committee (Haines et al, 2002)?

The objective of a PE program is to increase ergonomics awareness and skills within a facility. Even with a highly skilled, educated and motivated ergonomics committee, there are instances where the analysis required will exceed the skills of the ergonomics committee and should be completed by a professional ergonomist. The PE program should focus on allowing the company and ergonomics committee to understand what can be done internally and which problems require the input of a professional ergonomist (Wilson, 1995). As the program evolves and the ergo committee gains experience, one would expect that the committee could take on more challenging projects, but there will always be a limit to the committee's level of expertise, and they should always work within their skill level.

In some environments, a new participative program may be viewed with suspicion by union and workers (Wilson, 1995). Setting up the program should be a collaborative effort by management and workers. The anticipated benefits of the program should be promoted to the workforce early in the process to generate motivation, interest and support for the program and to mitigate any worker or union suspicion of the program (Wilson, 1995).

In some facilities the introduction of a new PE programs is viewed by some as the "treat of the week" due to negative experiences with past ergonomics and other programs. Effort is required to develop a collection of individual interventions into a sustainable continuous improvement program (Nagamachi, 1995).

Developing a successful, sustainable PE program causes increased workload for a few people in the organization and requires time and financial resources (Caryon and Smith, 2000; Nagamachi, 1995). Management needs to be ready to respond to employee concerns about increased workload and the perceived time and cost involved in a participatory approach.

2.1.3 Factors for success

A review of the PE literature revealed five broad categories that need to be considered in order to maximize the changes for a successful, sustainable PE program: providing adequate resources and support, selecting the ideal membership for the ergonomics committee, providing training for the ergonomics committee and the workforce, considering the impact of organizational factors and involving the workforce in the PE program.

2.1.3.1 Support for participative ergonomics program

In order to have a successful, sustainable PE intervention, the organization must support and prepare for it. Sustainable PE programs require initial and continuing support which must come for the top level of management (Wilson and Haines, 1997). The program must have sufficient resources which include: involving the right mix of people, adequate financial resources to make meaningful changes and time. If the required resources are not provided, ergo committee members will become frustrated and de-motivated (de Looze et al, 2001; Nagamachi, 1995; St-Vincent et al, 1998; Wilson, 1995; Wilson and Haines 1997).

The lack of adequate funding for the PE program can limit or halt entirely the work of the ergonomics committee. A lack of funding slows the rate at which changes are implemented, which is frustrating to committee members and the workforce (de Looze et al, 2001; Nagamachi, 1995; St-Vincent et al, 1998; Wilson, 1995). There is evidence that ergonomics committees are mindful of company finances, are conscious of the cost of their solutions and do the best to find the most economical solution to resolve the ergonomics concerns identified (St-Vincent et al, 1998).

Ergonomics committee members must be given adequate time away from their regular duties to participate in the process (de Looze et al, 2001; Nagamachi, 1995; St-Vincent et al, 1998; Wilson, 1995). Time conflicts and pressures of production process can negatively affect efforts to achieve

meaningful participation. With time, the relative priority of the PE program may need to be adjusted in response to changes in operational and market constraints (Wilson and Haines, 1997). At one facility, management members of the ergonomics committee were often called out of meetings to deal with issues on the production floor and night shift committee members had to come to work during the day to attend ergo committee meetings (Cole et al, 2003; Granzow et al, 2002; Theberge et al, 2006).

The PE program itself must not be unduly time constrained (Wilson and Haines, 1997). Adequate time must be allowed for the program to get established so meaningful changes can be implemented.

Another factor for success is ensuring that the right groups of people are involved in, and aware of the PE program. All parts of the organization that will be involved in or affected by the PE process must be made aware of its existence (Wilson and Haines, 1997). It's essential to ensure that:

- the ergonomics committee has people with the right mix of skills,
- that key decision makers within the organization are directly involved in the process, and
- efforts are made to gain support from workers and the union (Wilson and Haines, 1997).

As an example, an ergonomics committee in a manufacturing facility had little authority to make changes on the plant floor. To address this issue, the maintenance and continuous improvement managers were recruited to join the ergonomics committee. Both had high technical knowledge of plant operations, the authority to make changes, and provided funds for changes through budgets they controlled (Dixon et al, 2005).

2.1.3.2 Training

Training principles and methods are central to the success of the PE process (Kuorinka and Patry, 1995). The ergonomics committee requires initial training in ergonomics and the “how to” of a

participatory process (Kuorinka and Patry, 1995). In order to improve support for the PE process it is important for the workforce to gain an understanding of basic ergonomics (Wilson, 1995).

To have a competent ergonomics committee, members require a knowledge of general problem solving skills, job design concepts, and ergonomics concepts, methods and tools (Kuorinka and Patry, 1995; Nagamachi, 1995; Wilson, 1995). Initial training should provide the committee with the skills necessary to:

- identify and assess risk factors present in the workplace
- generate solutions to address ergonomic concerns, and
- assess or evaluate the ergonomic changes that are implemented (Laing et al., 2005).

As committee members gain knowledge and practice applying their ergonomic knowledge, they will gain confidence in their contributions to the PE process and see that their efforts are making a difference (Wilson and Haines, 1997). Periodic updates and refresher training on the use of ergonomics assessment tools will likely be required (Theberge et al, 2006).

It is important for the committee to recognize when a problem exceeds their skill set and a professional ergonomist is required to complete a more complex analysis (Kuorinka and Patry, 1995; St-Vincent et al, 1998; Wilson, 1995). When this occurs, the ergonomics committee would review the ergonomist's report and implement changes to address the concerns identified.

Depending on the ergonomics committee's members previous exposure to committee work, in addition to ergonomics training, additional training on "non-ergonomic" topics including the social aspects of project management, the "how to" of a participatory process and meeting management may be required (Cole et al, 2003; Granzow et al, 2002; Kourinka and Patry, 1995; Theberge et al, 2006) . Training on project management will assist the ergonomics committee to manage the projects in the

committee is working on. This will help the committee to create a list of action items and work activities for committee members and supporting staff (i.e. maintenance or engineering) for the next meeting. If there is going to be an effort to rotate responsibility of meeting management duties among committee members, training should be provided on how to chair meetings, writing meeting agendas and taking meeting minutes (Theberge et al, 2006). When training on meeting management is not provided, it has a disproportionately negative effect on worker members of the ergonomics committee (Granzow et al, 2002; Theberge et al, 2006).

Relevant ergonomic skills and knowledge need to be spread throughout the organization to maximize the effectiveness of the ergonomics process (Wilson, 1995). The objective should be to train all employees to an appropriate level in the consequences of poor ergonomic quality, identification of risk factors and their place in the ergonomics process (Wells et al., 2000; Wells et al., 2003). In addition, all engineering or technical staff who are not members of the ergonomics committee should be educated on the role of ergonomics in the design process and corporate design criteria (Wells et al., 2000; Wells et al., 2003).

There are several benefits to educating the workforce in ergonomics. Individuals are more aware of ergonomics and are able to identify ergonomic concerns. It enables individuals (workers, supervisors, engineering or technical personnel) who are not on the ergonomics committee to better communicate with the ergonomics committee. Ergonomics awareness enables individuals who are not on the ergonomics committee to better understand the purpose of the ergonomics committee's work.

2.1.3.3 Ergonomics committee composition

The recommendation for group work is eight to twelve people (Wells et al, 2003). As the committee progresses, there may be need to involve additional people with specific knowledge for

some projects. This can either lead to the formation of a "sub-group" or temporarily increase the size of the ergonomics committee to upwards of 10 people.

In selecting who will be on the ergonomics committee, it is important to have the correct balance of skills on the committee. Generation of solutions relies heavily on the everyday experiences of the committee members (Kuorinka and Patry, 1995). Workers' knowledge and input is equally important as technical or engineering input (Haines et al, 2002; St-Vincent et al, 1998).

To maximize chances for success, participation on the ECT should be voluntary (Haines et al, 2002; St-Vincent et al, 1998; Wilson, 1995; Wilson and Haines, 1997). A successful PE program requires that committee members are committed to the process and should be prepared to invest the time and energy required to actively participate in committee activities (both during meetings and time outside of meetings investigating possible ergonomics changes) (St-Vincent et al, 1998; Wilson, 1995; Wilson and Haines, 1997).

Early in the process, the "ergonomics expert" or "facilitator's" role is to provide training, to guide the ergonomics committee and to ensure the group is kept on task (Wilson and Haines, 1997). The facilitator should be unbiased, knowledgeable, flexible and adaptable (Wilson, 1995; Wilson and Haines, 1997). If the facilitator is an insider, a corporate ergonomist for example, they may not be viewed as unbiased. If the facilitator is from outside the organization, they may not be viewed as knowledgeable about the industrial processes (Wilson and Haines, 1997). If an outside facilitator is involved early in the process, then the timing of their withdraw needs to be considered; the facilitator must be aware of when it's most appropriate to withdraw from the process (Wilson, 1995; Wilson and Haines, 1997). If the facilitator withdraws too early in the process then there may not be ownership of the process at the facility and the ergonomics program may leave with the facilitator. If the facilitator's withdraw is later than optimal, then full participation may be stifled (Wilson, 1995).

Even after the facilitator withdraws from the daily activities of the ergonomics committee, the committee should have contact with an ergonomics expert to respond to specific complex situations that exceed the committee's expertise (St-Vincent et al, 1998). Most of the ergonomics projects should be completed internally (Wilson and Haines, 1997), but in the instance where an assessment is completed by a professional ergonomist, the ergonomics committee should only deal with implementing changes to address concerns identified by the ergonomist (Kuorinka and Patry, 1995).

Successful, sustainable PE programs have an ergonomics program "leader" or "champion" of the ergonomics program. The ergonomics champion's role is to coordinate the committee's activities. It is very important to ensure that the responsibility for daily activities (meeting agenda and minutes, chairing meetings, etc) does not fall to only one person (St-Vincent et al, 1998). The three workplaces that the Centre of Research Expertise for the Prevention of Musculoskeletal Disorders (CRE-MSD) has worked with who implemented sustainable PE programs (meaning the ergonomics committee continued once the ergonomics expert withdrew from daily activities) all had one person who took on a leadership role. In each facility, the "ergonomics champion" ensured that people were given time away from their regular duties to attend meetings, and work on ergonomics committee projects outside of meetings. These leaders also kept track of projects the ergonomics committee was working on and made sure that key decision makers in their workplace and all employees were aware of the ergonomics committee, its purpose and recent activities.

The absence of leadership was a contributing factor to the lack of sustainability of the PE program at one facility. The ergonomics committee had good attendance from both management and worker representative over several months at the beginning of the program. Unfortunately, several months into the intervention, workers were not being relieved by management of their regular duties in order to attend committee meetings. The worker representatives on the committee who were not being relieved of their regular work duties were frustrated as were those workers who were able to attend

meetings. Worker representatives saw the inability of management to ensure they could attend committee meetings as a lack of management support for the intervention. Not only were worker representatives frustrated that they could not attend the meetings, the committee's work was slowed because members who typically carried out tasks such as assessing and addressing these hazards were absent. (Personal communication with Shane Dixon, October 23, 2006)

2.1.3.4 Involving the workforce in the ergonomics program

When the ergonomics committee is investigating changes to workstations or lines, it is very important to involve as many workers as possible, as well as supervisors and technical staff (i.e. engineering, maintenance) who may be affected by the change. Participation of all stakeholders leads to a shared understanding of the problem, to committee building and to feelings of involvement in the decision making process (Caryon and Smith, 2000; de Looze et al, 2002; Nagamachi, 1995). Often workers are more likely to accept the changes if they were involved in improving the job. With inadequate worker participation, it is more likely that the solutions implemented will be less than optimal (Caryon and Smith, 2000; de Looze et al, 2002; Nagamachi, 1995).

Shift meetings and suggestion boxes were met with limited success in PE programs in several industries (Cole et al, 2003; Granzow et al, 2002; Theberge et al, 2006). In these facilities, the ergonomics committees found a "one minute survey" was a good way to get broad input (Laing et al., 2005). In a foam manufacturing facility, committee members emphasized the importance of consulting with workers in making changes; the one minute survey had strong endorsement from committee members and workers as a useful way to gather information, and one that reflected the participatory nature of the project (Cole et al, 2003; Granzow et al, 2002; Theberge et al, 2006). In a garment manufacturing facility, the ergonomics committee found that doing a "walkthrough" of one department as part of each meeting was the best way to gather information from workers. After each

meeting the committee asked each worker in the department they were experiencing any pain or discomfort, if they have any ergonomics concerns about their jobs and if they have any suggestions for improvement. During the "walkthrough" committee members also observe working postures to identify jobs that may benefit from ergonomics improvements even if workers did not report pain or discomfort.

Strong communication with the workforce is essential to gaining support or buy-in from management and workers who are not directly involved in the ergonomics committee and who are affected by the projects the ergonomics committee is investigating (Dixon et al, 2005; St-Vincent et al, 1998). The timing of notifying people who are not directly involved in the ergonomics committee must be considered (Wilson and Haines, 1997). If workers are not notified of a change soon enough then rumors will circulate, and opinions about the upcoming change will be formed based on the rumors, not facts. If people are notified of upcoming changes too early and delays occur, then they may become frustrated with the lack of progress as they wait for a change to be implemented. Communication is the key to avoiding these potential obstacles and increasing support for the program.

Once the ergonomics committee has set goals, they should be communicated to all people in the organization who need to be aware of the existence of the ergonomics program (workers, local and corporate management) (Wilson and Haines, 1997). In order to gain support or buy in from those who are not directly involved in the ergonomics committee, the committee needs to initially focus on making changes that are visible or tangible to the rest of the organization (Wilson, 1995). Working on "quick fix" changes or "fast tracked" projects that do not go though the full analysis process are one way to provide committee members with a positive experience working together and to provide tangible evidence to the rest of the organization of the impact of the ergonomics committee (Theberge

et al, 2006). Often individuals who are initially skeptical about the PE process become supporters once they see results of the ergonomics committee's efforts (St-Vincent et al, 1998).

Additionally, the rate of change needs to be considered when the ergonomics committee works on projects. If the rate of change is "too slow" then the PE program may fall into disrepute within the organization. If changes occur too fast, it is likely that worker will feel "not involved" and "left behind" (Wilson and Haines, 1997).

2.1.3.5 Organizational factors to consider

There is limited discussion in the research literature of the effect of the organization's characteristics on the success of a PE intervention. The following discussion of the influence of organizational factors is based on the limited information available in the literature and experience with implementing PE programs in different industries.

The climate of the organization has a large impact on the outcome of a PE program and is one of the organizational factors that must be considered when deciding if it is appropriate to introduce a PE program. "Common-sense" dictates that it is likely counter productive to introduce a new program in times of conflict, unrest or great uncertainty (Wilson and Haines, 1997). PE programs place additional demands and responsibilities on individuals. It is not advisable to introduce a PE program when the survival of the organization is at stake because there is a need to concentrate on the normal operational activities to promote the survival of the organization (Wilson and Haines, 1997).

A PE program can be best sustained if it's embedded in the approaches and practices within the organization and promoted within the organization as complementary to the existing health and safety practices (Wilson, 1995). Allowing people to make a genuine contribution can also help to embed an ergonomics perspective within the organization (Wilson, 1995). In a manufacturing facility, the ergonomics committee was presented to the organization as a viable, effective group to manage risk

and injuries that affected production. The ergonomics committee was involved in modified work when the injuries were related to ergonomics (Dixon et al, 2005). This approach helped to increase the visibility of the ergonomics committee within the facility and contributed to the long-term sustainability of the PE program.

2.2 Other forms of workplace participation

A participative approach to ergonomics is one method to achieve participation from key stakeholders in the workplace. Other methods to achieve participation discussed in the literature include Kaizen and Kaizen events, quality circles and teams. These methods all aim to increase worker participation compared to a "traditional work group" where workers perform core production activities, and other groups are responsible for support activities (receiving, quality control, maintenance, etc) (Banker et al., 1996).

2.2.1 Kaizen

Kaizen is a Japanese word that is translated to "continuous improvement" and Kaizen is one tool of lean manufacturing. Originally Kaizen referred to "subtle, gradual improvements made over time" (Manos, 2007), but many facilities hold kaizen 'events', 'blitzes' or 'rapid improvement projects' (Manos, 2007). Kaizen events are organized team efforts to improve reliability of a process, reduce the setup/lead time, streamline a process or rapidly implement a work area (Harms, 2007). Although there are differences in the primary focus of Kaizen events and participatory ergonomics programs, there is overlap between the benefits of these approaches. Manos (2007) reports there are three major advantages to using the kaizen "event" approach instead of other continuous improvement methods. Kaizen events are scheduled time with the purpose of making improvements to a work area. By scheduling a kaizen event instead time is set aside for team members to make proactive improvements to a work area. Secondly, a kaizen event brings people together who would not normally work

together. At the end of a kaizen event, participants will often report "how much s/he enjoyed working as a team" where these same individuals may have preferred to work alone at the beginning of the kaizen event (Manos, 2007). Lastly, kaizen events provide tangible proof that "lean does indeed work". Workers see immediate results from a kaizen event which may lead to an increase in perceived control over one's work (Manos, 2007).

The quantitative benefits of successful kaizen or kaizen events may include: cost savings, time savings, reduced distance traveled, reduced staffing requirements, shorter cycle time, increase in value added and reduction in non-value added content, reduced steps in a process, reduced inventory or improved first pass yield (Manos, 2007). Qualitative benefits to this continuous improvement approach may include reduced stress, and increase in employee's perceived control over his/her work (Manos, 2007).

2.2.2 Quality circles

Kaoru Ishikaway, an originator of Japanese quality circles, maintains the purpose of the circles is to develop oneself, encourage creativity and develop the management ability of circle members (Yager, 1979 in Buch and Spangler, 1990). Quality circles are a form of participative management, a problem solving forum and a human resources development tool (Buch and Spangler, 1990). The basic format of most quality circle programs is small groups of people who perform similar work voluntarily meet on a regular basis to discuss, analyze and propose solutions to work related problems (Marks et al, 1986; Banker et al., 1996). Circle participants focus on quality problems, improving productivity and reducing costs (Marks et al., 1986; Banker et al., 1996). The quality circle problem solving process involves sequential stages of problem identification, analysis, solution and cumulates in the management presentation. With this approach to participation, quality circle participants are responsible for managing suggestions, but do not have the authority to make decisions (Buch and

Spangler, 1990; Banker et al., 1996). Benefits of quality circles include increased productivity, cost savings and improved quality of working life (Buch and Spangler, 1990).

2.2.3 Self managing work teams

A self managing work team is a group of individuals who can self-regulate work. This approach to participation empowers employees to take on more responsibility and make decisions that are typically made by management in other approaches (Schilder, 1992; Banker et al., 1996). In addition to being responsible for core production activities, the work team has control over the management and execution of support activities (quality control, maintenance, receiving, etc.) (Banker et al, 1996). Typically the work team employees are responsible for ordering materials, scheduling and tracking overtime, calculating productivity, reviewing budgets, and interviewing prospective team members (Schilder, 1992).

2.3 Knowledge transfer and exchange

Research on the implementation of research findings into the 'world of practice' spans many disciplines and is studied from authors from many fields: communication, political science, sociology, social psychology, philosophy and others (Huberman and Ben-Peretz, 1994). The majority of literature reviewed focused on the medical field (implementation of clinical practice guidelines, continuing medical education) (Berner et al, 2003; Bero et al, 1998; Davis et al, 1999, 2003; Davis and Taylor-Vaisey, 1997; Freeman and Sweeny, 2001; Green and Johnson, 1996; Grimshaw et al 2001; Grybowski et al, 2000; van Tulder et al 2002; Walshe and Rundall, 2001), education (school improvement, teacher education) (Ben-Peretz, 1994; Cousins and Leithwood, 1993; Huberman, 1983, 1990; Hutchinson and Huberman, 1994) and program evaluation (Strang and Pearson, 1995). The literature review did not identify any references examining knowledge transfer and exchange in ergonomics or kinesiology. Research utilization is the study of the transfer of theories, constructs and

findings from a universe of inquiry to the universe of practice. (Huberman and Ben-Peretz, 1994). There is agreement in the literature that a gap exists between knowledge and practice (Davis et al, 2003; Huberman, 1994; Grimshaw et al, 2001; van Tulder et al, 2002) and the study of research utilization addresses this gap (Huberman and Ben Peretz, 1994).

There are four major assumptions underlying the field of knowledge transfer and exchange according to Green and Johnson (1996): subjectivity thesis, corrigibility thesis, sociality thesis and the complexity thesis. The consumption of knowledge is subjective; individuals and organizations consume knowledge according to their own experiences and circumstances. The corrigibility thesis assumes that knowledge always leaves room for refinement. The production, transfer and utilization of knowledge is a complex social process which is affected by social arrangements (society, organization, etc.). Lastly, the development, dissemination and utilization of knowledge is complex and difficult to study because of the interdependence between the causes and effects of knowledge development, dissemination and utilization (Green and Johnson, 1996).

2.3.1 Knowledge transformation

"People do not utilize research in the way that they utilize a hammer" (Weiss, 1981); users of research findings must transform or adapt the research findings before incorporating it to professional practice. Ben-Peretz (1994) reports that in a study of school improvement conducted by Louis and Miles (1990), the schools that had the most success, "adapted their plan as they went along to improve the fit between the change and conditions in the school to take advantage of unexpected developments and opportunities". This kind of evolutionary and adaptive planning of change is considered to be the most effective and empowering mode for the process of dissemination and use of research based knowledge (Ben-Peretz, 1994).

It is not likely that research knowledge will be used in an instrumental way (like a hammer). Research provides a wider knowledge base, which in turn provides alternative perspectives to ponder and inform policies and opinions (Huberman and Ben-Peretz, 1994). There are many models that describe the different ways in which research findings are used. In the political model of research utilization, research conclusions are used to support a predetermined position, even if conclusions "have to be ripped out of context" (Weiss, 1979). In this model, research findings find "ready made partisans" who will support its implementation. In the enlightenment model of research utilization, it is not a single study or body of research that informs a particular policy decision, rather it is social science concepts and theoretical perspectives that inform and provide a backdrop for policy decision making (Weiss, 1979).

2.3.2 Whose responsibility is it to disseminate research findings?

There is agreement that a gap exists between research and the dissemination and implementation of research findings in practice in many disciplines (van Tulder et al, 2002). However different groups have different beliefs about the role of researchers in trying to close the gap. The Research Advisory Committee of the WSIB has identified "transfer of scientific knowledge to the workplace" as one of their five research priorities (WSIB, 2004). Knowledge translation is a "prominent and innovative feature of the CHIR mandate" (CIHR, 2004). The knowledge translation vision at CIHR is to "develop a systematic integrated approach to accelerate optimal use of the best available research evidence in the interest of the health of Canadians" (CIHR, 2004). van Tulder et al (2002) report on the findings of a workshop about the implementation and dissemination of low back pain research findings into practice. This group concluded that health care providers and professional bodies involved in patient care should be responsible for implementing low back pain research findings. They felt that researchers should not be primarily responsible for implementing their results. Instead it is critical for researchers to provide an adequate evidence base for experts, systematic reviews and

guideline development. This conclusion is not in agreement with the WSIB research advisory council's research priorities, CIHR's vision of knowledge transfer or with the objective of this thesis.

2.3.3 Barriers to implementing research findings

In the literature, authors have reported on reasons for not implementing research evidence in health care, medical education, education and in policy planning and decision making. Across all disciplines there were three common barriers to implementing findings:

- research findings are not readily accessible to potential users
- resistance to deviating from the status quo
- difficulty in applying research findings to practice

In some cases, research evidence is not readily accessible to decision makers. Huberman and Ben-Peretz (1994) state that "important decisions are being made everyday without consideration of the most valid and recent information". In their literature review of professional education and quality assurance interventions to improve patient care, Grimshaw and colleagues (2001) found that the body of primary research about the effectiveness of different interventions was dispersed primarily across the medical literature and is therefore not readily accessible to policy makers and individuals responsible for continuing education and quality improvement initiatives. May and Barnard (1996) found that electronic (FTP) archives originally intended to facilitate collaborative work for a long-term research project were frequently accessed by users outside of the research group. The potential users of the research findings were often not from academia and would therefore have limited access to traditional journal indexes. The authors felt that electronic archives supported their efforts to disseminate findings to potential users. Strang and Person (1995) found that clear and sustained

dissemination of evaluation research findings to all relevant stakeholders in an agency was required in order for utilization to occur.

Resistance to change is another factor that impedes the implementation of research findings. Individual and organizational characteristics and past experiences have a large impact on attempts to introduce change (Ben-Peretz, 1994). An "overall facilitating atmosphere for research" encourages utilization of evaluation research findings (Strang and Person, 1995). In a study of changes in schools, Fullan and Steigelbauer (1991 in Ben-Peretz 1994) found that in some schools the "status quo is so fixed that it leaves little room for change". Freeeman and Sweeney (2001) found that general practitioner's personal and professional experience affected their readiness to implement clinical evidence. Doctors' past "accidents, mishaps or spectacular clinical successes" have a direct influence over subsequent practice.

Depending on the type of research conducted, even if findings are disseminated to potential users of the research knowledge, it may be too difficult to translate and implement the findings. Some family physicians are not enthusiastic about implementing clinical evidence or clinical practice guidelines because of "tricky logistical problems" of general practice that the research evidence does not take into account (Freeman and Sweeny, 2001). In education, research findings constitute a regular part of teacher education courses; however student teachers find it difficult, if not impossible to translate the findings to the classroom setting (Ben-Peretz, 1994).

2.3.3.1 Disseminating participatory ergonomics knowledge

Typically the results of participatory ergonomics research are published in peer review articles or presented at conferences. Some health and safety associations have developed and published (in print or on their website) participatory ergonomics literature reviews and participatory ergonomics program implementation manuals with industry specific examples for their members. The Participative

Ergonomics Blueprint (Wells et al., 2003) and Ontario's MSD Prevention Guideline are non-industry specific documents that can be used as resources for a participative ergonomics program. The 'blueprint' lays out a plan for starting and maintaining an effective ergonomics program. The purpose of the MSD Prevention Guideline is to "provide Ontario employers and workers with information and advice on a recommended generic framework for preventing musculoskeletal disorders" (OHSCO, 2007). Although the prevention guideline advocates worker involvement during risk assessments and implementing MSD hazard controls, it does not recommend a full participatory ergonomics program.

Table 1 below summarizes the results of an Internet search for "participatory ergonomics case study" and "ergonomics case study conducted in 2004 and in 2007 and an Internet search for "participatory ergonomics" completed in 2007. All searches were completed on google.com.

Table 1: Summary of Internet search for 'ergonomics' and 'participatory ergonomics'

	'Participatory ergonomics' 'case study' *	'Participatory ergonomics' 'case study'^	Ergonomics 'case study' *	Ergonomics 'case study' ^	'Participatory ergonomics' ^
Total results	451	634	86500	732000	580000
Categorized top 50 results					
Publications (theses, journals, conference publications)	19	25	4	14	31
Project descriptions (individual workstation changes: problem, intervention, impact)	3	3	15	12	5
University programs (course syllabus, CV, grant applications, academic appointments)	8	1	4	1	

	'Participatory ergonomics' 'case study' *	'Participatory ergonomics' 'case study'^	Ergonomics 'case study' *	Ergonomics 'case study' ^	'Participatory ergonomics' ^
Marketing/success stories	1	2	9	8	
Conference website, conference program	4	3	3	3	
Reference lists	4	8			2
Presentations	3	2			2
Workshop summary, "how to" information, ergo quizzes	2	2	1	2	1
Corporate ergonomics programs			3	2	
Newsletter	2	1		1	2
Book sales			2	1	3
Ergonomics case studies specifically for teaching purposes			2	2	
Cognitive ergonomics case study (usability)			1	2	
Wikipedia					2
Unavailable (missing, password protected)	4	3	2	1	
Not related to ergonomics			3	2	2

* search completed in 2004
^ search completed in July 2007

2.4 Source credibility and Internet sources

Credibility is typically defined in terms of worthiness of being believed (West 1994 in Johnson and Kaye, 1998). Credibility is a critical issue for this thesis since research suggests that "people are less likely to pay attention to media they do not perceive as credible" (Gaziano, 1988, cited in Johnson

and Kaye, 1998). Website visitors are less likely to pay attention to the media and the message if it is perceived to be not credible.

Message credibility is a multi-dimensional construct (Johnson and Kaye, 1998). Believability, accuracy, bias and completeness of message are the 4 measures that have "consistently emerged from several studies that have examined how media credibility should be gauged" (Johnson and Kaye, 1998; Flanagin and Metzger, 2003). A medium's credibility is strongly related to the degree to which people rely on it. In their study of "politically interested Internet users", Johnson and Kaye (1998) found that "reliance" (average number of hours per week on political websites and degree of reliance on the web) is a much stronger measure of credibility than "general use" indicators (average number of hours per week spent on the web, and number of times the Internet has been accessed).

2.5 Wiki

The term wiki comes from the Hawaiian language and means "fast, speedy; to hurry, hasten; quick, fast, swift." (Leuf and Cunningham, 2001, page 14). The word has also been interpreted as an acronym for "what I know is" which describes the knowledge contribution, storage and exchange function of a wiki (Wikipedia, 2007). The "wiki" web concept which originated by Ward Cunningham, it is an expandable collection of linked pages, similar to a "hypertext system" for storing and modifying information where each page is easily editable by any user (Leuf and Cunningham, 2001).

The most well known wiki is the online encyclopedia "wikipedia", launched in 2001 (Butler, 2005). Its purpose is to create and distribute a free international encyclopedia in as many languages as possible (Scowen, 2005). An example of an academic wiki is The Biomechanics Knowledge Repository, Biomech-W, (www.biomch-w.org), launched in February 2005 which serves as a platform to disseminate biomechanics related information (Biomchw.org, 2007).

2.5.1 Key features of wiki

The key feature of a wiki is open editing which allows users to create and edit web page content. It promotes an interactive exchange of ideas and knowledge by allowing synchronous or asynchronous collaboration, typically without having to deal with accounts and passwords (Leuf and Cunningham, 2000; Aronsson, 2002). Wikis are a powerful tool to facilitate collaboration in closed work groups, but it can also be used effectively for the general public on the Internet (Aronsson, 2002). The wiki seeks to involve website visitors in an on-going process of creation and collaboration (Leuf and Cunningham, 2000). The frequent use of cross-links promotes meaningful knowledge organization and topic association between different pages (Leuf and Cunningham, 2000).

The wiki concept typically works well because the pages are kept under version control and the content can be restored to a previous version if one user makes an inappropriate contribution (Aronsson, 2002). An advantage of using a wiki is that it leaves a permanent archived record of the evolving consensus about a topic over time and accumulates the experience of the community of users rather than providing a forum for discussion, like a blog (Aronsson, 2002).

2.5.2 Wiki concerns

Due to the open nature of wiki websites, the most common concerns about using this style of website, relate to vandalism and editing "wars". A common fear about wiki websites is that different opinions on a topic would lead to editing wars. Editing "wars" occur due to a difference in opinion on a topic. Most wiki contributors learn to take a neutral point of view when discussing controversial topics to avoid conflicts (Aronsson, 2002).

Arosson (2002) reports "that a more real threat to a wiki website is that nobody wants to edit anything". Based on his experience with the first nine months of operation with a "large scale,

general purpose wiki" Anderson (2002) reports that the first few individuals must be very determined to get the process started.

2.5.3 Measuring wiki "success"

Typically, the wiki-specific metrics of success are the total number of pages in the wiki and the number of contributions per time unit (Aronsson, 2002). Other website statistics such as number of page views, number of unique visitors, and increase in traffic over time can also be used to quantify the success of a wiki.

2.5.4 Wiki page structure

The choice to write several short pages instead of fewer longer pages improves readability and user friendliness. A wiki with many short pages encourages linkage between pages and "it also dramatically enriches the linkage space with new relationships that others can link to and build on" (Leuf and Cunningham, 2001). Seeding a new wiki with a core set of pages and "content template" is a good idea for multi-user wikis; seeding is usually more effective for task oriented wikis (Leuf and Cunningham, 2001).

2.5.5 Wikis in academia

In academia, the traditional published paper is accepted as the "undisputed information of record" (Butler, 2005). Collaborative technologies (such as a wiki or blog) could serve as a forum for broader discussion to complement peer-reviewed publications (Butler, 2005). Wikis could be used in academia to enhance science communication before publication, when generating ideas, and after publication when discussing the results (Butler, 2005).

Chapter 3
Methods

3.1 Website content

I completed a review of the participatory ergonomics literature. The literature review included peer-reviewed journal publications, conference publications, non-peer reviewed publications (for example: OHSCO, 2007; St-Vincent et al, 1998; Wells et al., 2003), Internet sources (Wells, 2007), and transcripts of interviews with ergonomics committee members from a participatory ergonomics intervention research project. After writing the participatory ergonomics literature review (section 2.1 of this thesis), the key messages were grouped into themes, summarized and a lay-language summary was written. The lay-language summary formed the website's core content (Appendix A).

The thesis website[2] was created in Summer 2005. The top of each page contained the content from the lay-language summary of the literature review ("core content") followed by visitor contributed content at the bottom of each page. The website was organized into a parent–child–sibling tree (a portion of the website is illustrated in Figure 1). Figure 2 is a screen shot of the website home page.

[2] www.cre-msd.uwaterloo.ca/participatoryergonomics

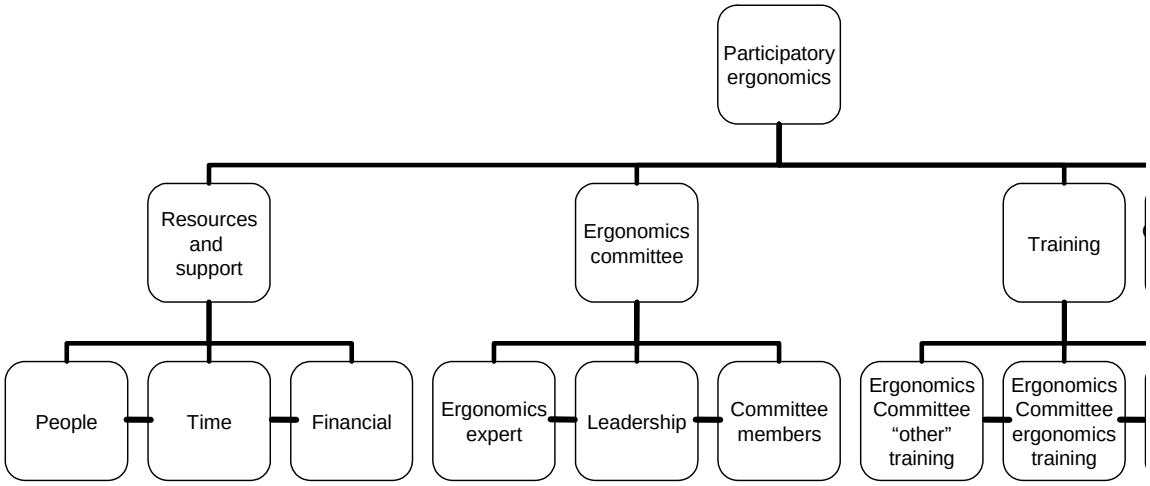

Figure 1: Layout of website topics

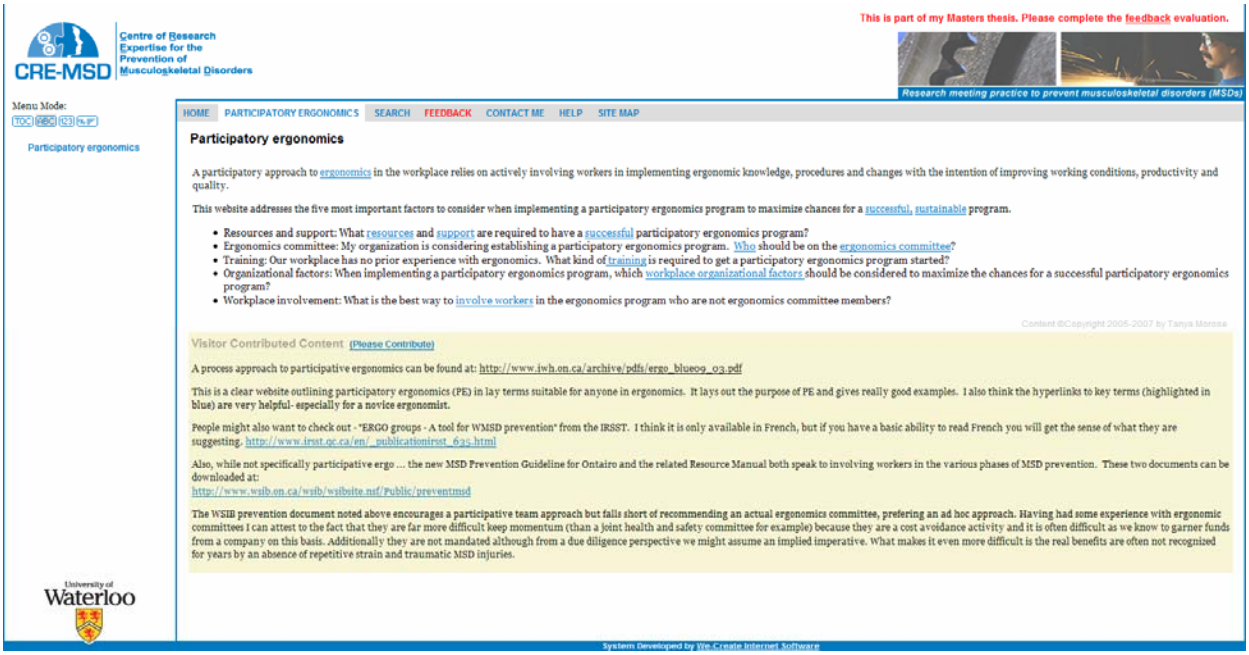

Figure 2: Website home page

3.2 Recruitment

The recruitment efforts (described below) over time are summarized in Table 2.

Table 2: Recruitment efforts

	October November 2007	December 2006	January 2007	February 2007	March 2007	April 2007	May 2007
Recruitment efforts	Launch website ACE Letter HSAs contacted	Direct mailings Google Adwords Submit to wikipedia ergonomics page (link removed) Submit to google for indexing	Create participatory ergonomics wikipedia page Google Adwords	Email colleagues and clients Google Adwords	Email colleagues and clients Google Adwords	Link from CRE-MSD webpage	Post on H&S Canada List-serv

3.2.1 Direct recruitment

Approximately 250 direct recruitment letters were distributed to individuals who attended CRE-MSD's job rotation workshop and delegates of the Association of Canadian Ergonomist's annual conference (October 2006). The letter explained the purpose of the project and invited recipients to visit the website, share there experiences with ergonomics and complete the questionnaire to provide feedback on the website.

In February and March 2006 emails with the content from the direct recruitment letter were sent to colleagues and clients who were thought to be potentially interested in visiting the website and participating in this thesis.

3.2.2 Health and safety association newsletters

In November (2006) the editors of nine Ontario's Health and Safety Association's newsletters were contacted (EUSA, OHCOW, IAPA, OSSA, MHSAO, THSAO, CSAO, MASHSO, PPHSA) about including information from the press release in their next publication. The press release was sent to seven of the HSA newsletter editors for their consideration (EUSA, OHCOW, OSSA, MHSAO, CSAO, MASHA, and PPHSA). One editor provided confirmation that she intended to publish the press release in the next newsletter (PPHSA – January 2007). Confirmation was not received from the other newsletter editors, despite follow-up. In discussion with the newsletter editors, the reasons for not agreeing to publish "on the spot" included, needing to review the website, ensuring that the website would meet their members' needs and space considerations on what they'd have room to publish next edition.

3.2.3 Wikipedia

In December 2006 a link to the website was submitted to the "ergonomics" page on wikipedia under the heading "research". Within 12 hours the link was removed since it was identified as "link spam". In January 2007, to combat this misinterpretation of my motives, I created a dedicated page about participatory ergonomics inside wikipedia that summarized the content from my research site and also provided a direct link to the thesis website "for more information". This new page in Wikipedia was linked under the "See Also" heading from the main ergonomics page, as well as pages about occupational health and safety, worker safety, job satisfaction, the WSIB, and similar topics.

3.2.4 Search engines

In December 2006, an electronic, computer-readable site map was submitted through Google's webmaster toolkit[3]. Shortly after the site map was submitted Google indexed the website and it started showing up in the search engine result pages for searches relating to "participatory ergonomics". Several search engines (google, yahoo, msn, and others) then repeatedly re-indexed the content and visitor contributions throughout the data collection period. This re-indexing ensured that the latest content of the website was available to interested search engine users.

3.2.5 AdWords

To increase traffic to the website, a "Google AdWords" advertising account was created. The advertisement was associated with the following search terms in Google: ergonomics, workplace ergonomics, industrial ergonomics, participatory ergonomics, ergonomics team, ergo team, ergo committee, and ergonomics committee. The ad showed as a "sponsored link" on the right-hand side of the Google search results pages when users searched on the above keywords. The ad was shown 23196 times and 100 users clicked the link to the website (an approximately 0.5% click-through rate). The content of the ad is shown below.

> Participatory Ergonomics
> Setup an Ergo Change Team at work.
> Case studies. Examples. Information
> www.ahs.uwaterloo.ca

3.3 Data collected

Three sources of data were collected and analyzed for this study. With each visit, website data was automatically collected. The other data sources relied on website visitors contributing to the website content and/or completing an online questionnaire at the end of their visit to the website.

[3] http://www.google.com/webmasters/

3.3.1 Website data

A “cookie” is a piece of data that a website is permitted to store on a visitor’s computer. Temporary cookies were placed on the visitor’s computer and unique identification numbers were assigned to each visitor. The temporary cookie was deleted when the user closed his/her web browser or manually cleared their cookies. If they returned to the website for a second visit after doing either of the above, they were assigned a new identification number. A database was used to track information (web pages viewed, duration of visit, questionnaire responses, contributions made, etc.) and associate that information with each visitor’s identification number. Since neither the cookie nor the database contained any personally identifying information, it was impossible to personally identify any visitors. This process guaranteed anonymity.

All available, non-personal, browser-related information (such as the browser signature, date and ip address) were recorded to facilitate differentiating between humans and search engine indexing software. Additionally, with each page view the identifier, date, time and page number were logged. This allowed the computation of the overall visit length, and page order. Also with this data the time spent viewing each page could be inferred as well as average time per page.

If a questionnaire was completed, the same visitor identification number was recorded to allow correlation of questionnaire responses with the web pages viewed, time spent on the site, and average time spent reading each page.

Unfortunately, several visitors left their web browsers open for extended period of time and in some cases the duration of visit recorded (difference between the time the first page request and last page request) was weeks or months. It was assumed that no website visitor would spend weeks or months actively looking at the website, and that an average reader could read the entire content of any one webpage in less than ten minutes. When the periods between page requests were longer than ten minutes, it was also assumed that the reader was not actively looking at the website and instead was

attending to other matters, completing other computer tasks or away from the workstation (i.e. overnight, on weekends). To correct for long periods of inactivity a computer script identified any page-to-page interval greater than ten minutes, deleted this interval from the total website visit duration and replaced the 'inactive interval' with the average page–to-page interval for the rest of that person's visit.

From the tracking database data the following variables were calculated:

- total number of web pages viewed
- the total duration of website visit (the time difference between the first and last page requests with inactive periods removed)
- the average time spent viewing each page (duration of website visit divided by number of pages viewed)

Lastly, the "Google Analytics" web statistics service was used to track the number of website visits over time, the source of website visitors (from a search engine, referral link, or directly entering url), and the "bounce rate" or percentage of visitors that leave the website after viewing only one page.

3.3.2 Questionnaire

Website visitors were asked to voluntarily complete a short questionnaire (16 questions). The purpose of the questionnaire was to learn more about website visitors and to gather feedback about using the wiki approach to disseminate participatory ergonomics research findings to industry stakeholders. The questionnaire was divided into 5 sections: Participatory ergonomics and me, Implementing a participatory ergonomics program, Visitor contributed content, My Internet use, and About me. The full questionnaire can be found in Appendix B and the rationale for each of the questions is summarized below.

The purpose of the "participatory ergonomics and me" section was to gain a better understanding of who are the website visitors and what their experiences are. Visitors were asked to rate their knowledge of participatory ergonomics prior to visiting the website. Cousins and Leithwood (1993) refer to a user's personal characteristics as one factor that influences the extent and type of use of new knowledge. The second question asked respondents to identify their planned use of knowledge after visiting the website. Since it was not possible to evaluate the website as a dissemination tool by observing changes in behaviour or professional practice, this data was collected to gain an understanding of anticipated knowledge utilization. The responses were ordered on a continuum of increasing involvement from "no action" to "implementing a PE program". The third question asked users if they had learned something new about participatory ergonomics after visiting the website in an attempt to gain an understanding of user's conceptual knowledge of participatory ergonomics. The fourth question asked about compatibility of the website content with user's prior knowledge of participatory ergonomics (Rogers, 1995). The comparison of the relevance to the visitor's situation or intended application to the case study examples was the focus of the fifth question. The last question of this section focuses on the credibility of the message delivered via the website. Users rated the website content on four constructs (believability, accuracy, bias and depth of content on a 5 point scale (e.g. not very believable to very believable with a "no opinion" option) (Johnson and Kaye, 1998; Flanagin and Metzger, 2003).

The second section of the questionnaire focused on implementing a participatory ergonomics program. Respondents were asked if they would require any additional information to 1) determine if a participatory ergonomics program is right for their facility, and 2) implement a participatory ergonomics program in their workplace. For both questions, if the answer was "yes I would require additional information", respondents were asked to elaborate and provide additional details on what kind of additional information they would require. Both questions were asked to gain an

understanding of the comprehensiveness of the website content. It was the goal of this thesis to provide enough information to allow website visitors to determine if the participatory approach to ergonomics was something worth investigating further, it was not the intention of this thesis to provide all website visitors with all the information they would require in order to implement a participatory ergonomics program.

The third section of the questionnaire asked website visitors for feedback on the visitor contributed content in the website. Respondents were asked if they contributed to the website content or not. For those who did not contribute, they were asked to select all the reasons they chose not to add to the visitor contributed section of the website. All visitors were asked to provide any suggestions for improving the process for adding visitor contributed content. The second and third questions in this section were similar to the questions in the "participatory ergonomics and me" section. Respondents were asked to rate the relevance of the case study examples contributed by website visitors and to rate the credibility of the visitor contributed content (believability, accuracy, bias and depth). Again, this rating used a five point scale with a "no opinion" option.

The fourth section was "My Internet use" and focused on respondents' reliance on the Internet to obtain ergonomics information and their perceptions of the credibility of health, safety and ergonomics content on the Internet in general (believability, accuracy, bias and depth). Again, this rating used a five point scale with a "no opinion" option.

The final section asked respondents to identify their role in their organization and to select the industry they work in. The purpose of collecting respondent demographics was to determine if the visitors conformed to the intended target group for this study.

3.3.3 Visitor contributions

Visitors were encouraged to contribute experiences, tools, links and comments on each page in the "visitor contributed content" area. Whenever a contribution was made the visitor identification number, date of contribution, time of contribution, and the page content before and after each contribution was recorded for later analysis.

3.4 Quantitative data analysis

SAS 9.1.3 was used to complete the data analysis. Cross tabulations, chi-squares and t-tests were used to analyze the data. A significance level of 0.05 was selected due to the exploratory nature of this study (personal communication with Richard Wells, July 23, 2007). T-tests were used to analyze the source credibility data.

Chi square analyses were completed to determine if there is an association between average time spent viewing each page (minutes), total number of website pages viewed or total duration of website visit and contributing to the website or completing a questionnaire. In many analyses, the observations were collapsed across levels to increase the number of observations in each cell. Table 3 summarizes the chi-square analyses that were completed.

Table 3: Chi-square analyses completed

	Duration of visit	Number of pages viewed	Average time/page	Starting knowledge of participatory ergonomics
Complete questionnaire	x	x	x	
Contribute to content	x	x	x	x
Increase in knowledge				x
Anticipated knowledge use				x

3.5 Qualitative data analysis

Qualitative analyses of the visitor contributed website content, barriers to contributing to the website and questionnaire responses to the “would you require additional information in order to implement a participatory ergonomics program?” question were completed. For each analysis, the data was reviewed, grouped into themes and key messages were summarized. For qualitative analysis of questionnaire responses, the effect of the respondent’s starting knowledge of participatory ergonomics was considered during the analysis.

Chapter 4
Results

4.1 Description of population

During the data collection period (October 23, 2006 to May 31, 2007), there were 2214 website visits The website logs were reviewed and after removing visits from search engines (1331) and the researcher (17), 866 people visited the website during the data collection period. The majority of the 866 visitors (66%) were from Canada[4] and 16% were located in the United States. Website visitors were located in all continents. The percentage of website visitors from each continent were: North America 82.6%, Asia 8.5%, Europe 4.7%, Australia 2.5%, South America 0.8%, and Africa 0.7%.

610 of the 866 visitors (70.4%) visited the website for less than one minute ("short duration" visitors). Most of the short duration visitors (550, 90.1%) only viewed one page from the website. Forty-five viewed two pages, eight viewed three pages, four viewed four pages and two viewed six pages. With the "short duration" visitors removed, the number of people who came to the website and browsed the content for more than one minute and viewed more than one page is 256.

During this time 54 questionnaires were submitted. After 4 blank questionnaires were removed from the pool, 50 usable (partially complete) questionnaires remained. This resulted in an overall questionnaire completion rate of 19.5% (50/256). Of the 50 questionnaires submitted 35 or 70% were completed fully.

Thirty-seven respondents reported which industry they primarily worked in; this is summarized in Table 4.

[4] Website visitors' physical location was determined based on their IP address and Google Analytics software.

Table 4: Industries represented by questionnaire respondents

Industry	Number of responses
Electrical Utilities	3
Manufacturing	12
Construction	2
Pulp and Paper	5
Service	1
Health Care	6
Consultant	2
Education/Academia	4
Government	2

Respondents were also asked to select the titles which best described their role in their organization. Most respondents were in a management or professional role, no questionnaire respondents selected "worker" as one of their roles in the organization. The responses are summarized in Table 5.

Table 5: Questionnaire respondents' job roles

Role in organization	Number of responses
Health and Safety Manager	3
Ergonomist	16
Heath and Safety Association Consultant	3
JHSC Member	4
Plant Manager	1
Occupational Nurse	1
Human Resources	1
Graduate Student	3
Industrial Engineering/Ergonomics coordinator	1
Industrial Hygienist	1
Consultant, Trainer	4

Nine website visitors (including researcher) made 16 contributions to the website (this includes 3 comments added by the researcher in response to questions raised by questionnaire respondents). All contributions were added to the most appropriate website pages.

Table 6 summarizes the website traffic, questionnaire completion, and visitor contributed content over time.

Table 6: Website trends over time

	October November 2006	December 2006	January 2007	February 2007	March 2007	April 2007	May 2007
Total website visitors	74	83	68	141	194	125	187
Website visitors >1 minute	43	24	26	41	50	26	46
Questionnaires completed	7	3	1	8	18	4	7
Visitor contributed content	2			7	1	1	2

Figure 3 illustrates the number of website visitors (all) over time. The peaks in website traffic on February 20, March 19, and April 30, 2007 coincide with specific recruitment efforts.

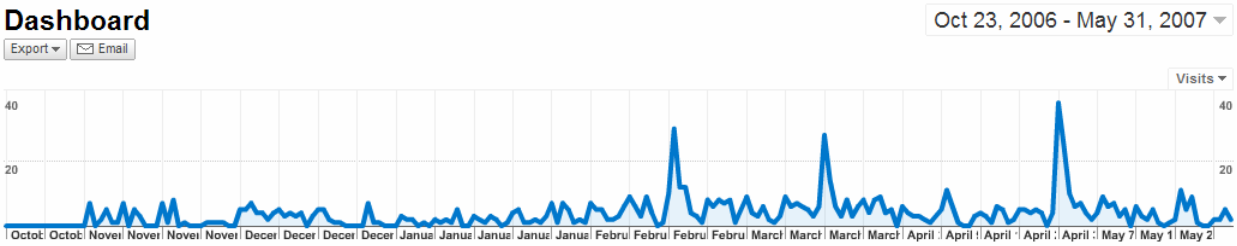

Figure 3: Website traffic during data collection period

The sources of website traffic are illustrated in Figure 4 below. Direct traffic (typing the url directly into an Internet browser or clicking on a link in an email message) accounted for the largest portion of website traffic. Search engines accounted for 36% of website visitors, while 26% of website visitors arrived by clicking links in 'referring' websites. Not surprisingly, the bounce rate, or percentage of visitors that leave the website after viewing the first page, was highest for referring sites (59.6% bounce rate), followed by search engine traffic (53.7% bounce rate) and direct traffic had the lowest bounce rate (34.3%).

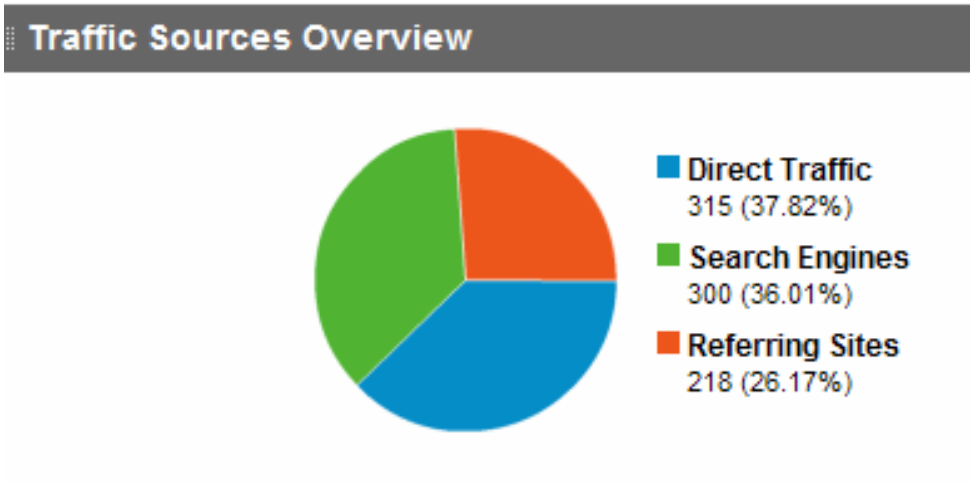

Figure 4: Website traffic sources

4.2 Questionnaire Results

Chi square analyses were completed to determine if there is an association between completing a questionnaire and duration of visit, depth of visit and average time per page. A qualitative analysis of open-ended questionnaire responses was also completed. The questionnaire is included in Appendix B.

4.2.1 Predictors of completing a questionnaire

Table 7 below summarizes the number of website pages viewed by questionnaire respondents and non-respondents whose duration of website visit is greater than one minute (deviation, or number of cell observations minus expected number of observations is in brackets). Number of pages viewed is associated with questionnaire completion (chi square= 11.9869, df=2, prob 0.0025). A website visitor is more likely to complete a questionnaire if s/he views more pages.

Table 7: Chi-square of number of pages viewed and questionnaire completion (all visits >1minute)

	Questionnaire completed	No questionnaire completed
2 to 10 pages	21 (-8.482)	164 (8.4821)
11 to 20 pages	11 (4.1474)	32 (-4.147)
More than 21 pages	8 (4.3347)	15 (-4.335)

Table 8 below summarized the average viewing length per page for questionnaire respondents and non respondents. This analysis does not include "short duration" website visitors (visits less than1 minute). There is not an association between the average time spent viewing each page and questionnaire completion (chi-square=0.4431, df = 2, prob=0.8031)

Table 8: Chi-square of average time per page and questionnaire completion

	Questionnaire completed	No questionnaire completed
>0.5 min/page	24	106
0.6-1.0 min/page	13	64
<1.1 min/page	7	42

Duration of visit is reported in minutes, and is the difference between the date and time of the first and last page requests, with periods of inactivity greater than ten minutes normalized to account for distraction[5]. Duration of website visit does not include the time taken to complete the questionnaire. Table 9 summarizes the duration of website visit for questionnaire respondents and non respondents. Duration of website visit is associated with questionnaire completion (chi-square=17.4926, df=2, prob 0.0002). Participants with longer duration of website visits are more likely to complete a questionnaire than those with shorter visit durations.

Table 9: Duration of website visit and questionnaire completion

	Questionnaire completed	No questionnaire completed
1 to 10 minutes	29	188
11 to 20 minutes	8	19
More than 21 minutes	7	6

4.2.2 Comprehensiveness of website

A chi-square analysis was completed to determine if there is a relationship between a respondent's starting knowledge of participatory ergonomics and learning something new after visiting the website (Table 10). As a person's starting knowledge of participatory ergonomics increases s/he is less likely to learn something new from visiting the website. Most 'experts' (who have implemented participatory ergonomics programs) did not learn anything new about participatory ergonomics after

[5] It is assumed that average reader would be able to read the entire content of any page in less than ten minutes. Periods between page requests longer than ten minutes, the reader is assumed to be distracted by their surroundings or other computer tasks and not actively looking at the website content. To correct for long periods of inactivity, any page to page interval greater than ten minutes was replaced with the average page to page interval for rest of that person's visit. This corrected for visits that lasted months with several days between subsequent page requests.

visiting the website. Individuals who rated their starting knowledge of participatory ergonomics as none, novice or intermediate were more likely to learn something knew after visiting the website (chi-square=12.1503, df=2, prob=0.0023). Due to the small number of responses 33% of cells had expected values less than 5.

Table 10: Chi-square of starting level of knowledge and new knowledge after visiting website

		Starting knowledge of participatory ergonomics		
		None/Novice	Intermediate	Expert
Know more about PE after visiting website?	Yes	11	15	6
	No	1	3	10

Questionnaire respondents were asked if they would require any additional information in order to decide if a participatory approach is right for their facility and if they would require any additional information to implement a participatory ergonomics program. Respondent's verbatim comments are in Appendix C.

Three respondents reported they would require additional information from their workplace prior to determining if a participatory approach is right. One respondent stated s/he would require additional information on the "extent to which management supports [the ergonomics program] with money and time…and the workplace expectations and goals for the ergonomics program". Another indicated that s/he would need to survey the workforce to determine the level of interest for a participatory ergonomics program.

Two respondents reported they would like to see more case study examples prior to proceeding with implementing an ergonomics program. Suggested topics for case study examples included illustrating "who would benefit from a participatory ergonomics program" by highlighting firms with higher rates of ergonomics-related WSIB claims.

The cost-benefit justification of a participatory ergonomics program was also mentioned by questionnaire respondents. Certainly there is a cost to implementing a program and there are cost-savings. In the research literature there are several papers that summarize the economic justification of an ergonomics program, but these are specific to an ergonomics program in a particular workplace. A crude estimate of the cost of a participatory ergonomics program for the first year ($27000 to $53000) was calculated based on one case study and added to the visitor contributed content by the researcher. In their full economic evaluation of the first year of a participatory ergonomics intervention in an automotive parts manufacturer, Tompa et al. (2007) found the first year of the program cost $21578.66. This evaluation included costs for a 6 person ergonomics team, an external facilitator and implementing 10 changes. The benefit side of the cost-benefit justification depends on the changes the ergonomics committee implements, the cost of these changes, the impact of the ergonomics changes on risk of injury, productivity and quality and worker's compliance with the changes implemented. Supplementing the website content with additional case study examples that include cost-benefit information could address this concern, but the pay-off period for the program would be specific to each facility.

One respondent felt the inclusion of sector specific injury statistics could be provided and would help to make an economic case for implementing an ergonomics program.

One respondent reported s/he would require additional information on the disadvantages of implementing a participatory ergonomics program in a unionized environment. Typically there is a positive publication bias in the peer reviewed literature; the literature reviewed for this thesis reported the benefits of successful participatory ergonomics programs and the pre-requisites for a successful program. The website content from the literature review alluded to when it is not appropriate to implement a participatory ergonomics program. Ideally I was hoping that disadvantages or challenges with implementing a participatory ergonomics program would come from website visitors

who shared their experiences from the world of practice. Due to the lack of visitor contributions, the primary information on the website was based on the literature review. If this project is continued, increased efforts to solicit visitor contributed content may result in additional content added to the discussion of this topic through visitor contributions.

Several respondents stated they would need additional resources in order to determine if a participatory approach to ergonomics was right for their workplace and to implement a participatory ergonomics program. Based on feedback from respondents, if a "participatory ergonomics tool box" is developed, it should include the following topics:

- A "readiness" checklist to determine if a facility has "what it takes to be successful".
- Tools to "measure the success" of the participatory ergonomics program (i.e. measurable outcomes)[6]
- A practical timeline for program implementation
- Estimated timeline to demonstrate improvement (how long for injury statistics to "turn around")
- Templates for policies and procedures required (i.e. provide advice, working examples, a list of topics that may be included, etc.)
- Guidelines for ergonomics training
- Guidelines for assessment tools and equipment
- Guidelines for assessment methods

[6] A summary of leading and lagging "measurable" outcomes was added to the website content in January 2007

- Types of assessments that could be completed, when they should be conducted, by whom and suggestions of additional resources that are available
- More detailed information on the process (steps and stages)

4.2.3 Anticipated use of knowledge

The relationship between respondent's starting knowledge of participatory ergonomics and anticipated use of knowledge to gain an understanding of knowledge utilization. Response options are on a continuum from "no action" to "implementing a PE program". With the exception of one person, all questionnaire respondents plan to take some action on participatory ergonomics in their workplaces. Table 11 summarizes the responses to the "anticipated instrumental use of PE knowledge" question.

Table 11: Anticipated instrumental use of knowledge and starting knowledge of participatory ergonomics

		Self reported starting knowledge level of PE			
		None	Novice	Intermediate	Expert
Anticipated knowledge use	I do not plan to tell anyone about this website.				
	I do not plan to talk to anyone about participatory ergonomics.		1		
	I plan to refer a colleague/client to this website.	1	4	7	5
	I plan to talk to a colleague/peer/client about participatory ergonomics.		1	9	4
	I plan to discuss/review the information on participatory ergonomics with my co-workers/colleagues/manager/clients.		2	9	5
	I am planning on taking steps to determine if a implementing a participatory ergonomics program is suitable for my (clients') workplace.		2	3	2
	I am planning on implementing a participatory ergonomics program in my (clients') workplace.		1	4	3
	I already use a participatory approach in my (clients') workplace.			4	14

The majority of experts are already doing participatory ergonomics, while the majority of 'novices' are planning to refer colleagues/clients to this website. The majority of 'intermediates' are planning on discussing participatory ergonomics with colleagues or clients, only a few 'intermediates' are planning to determine if a participatory approach is right for their facility or planning to implement a participatory ergonomics program at their workplace.

4.2.4 Compatibility with existing knowledge

All questionnaire respondents reported that the website content did not contradict their previous knowledge of participatory ergonomics.

4.2.5 Relevance of examples

Questionnaire respondents were asked if they found the case study examples from the literature review and those submitted by website visitors helpful. Figure 5 and 6 illustrate the distribution of response for the literature review and visitor contributed content, respectively. Overall, respondents rated both the examples from the literature review and the visitor contributed content 3.4 on a 5 point scale, however the distributions were different for respondents of different experience levels for the two sets of examples (Table 12). Overall, with the exception of the "expert's" rating of the visitor contributed content, the respondents found the case study examples and the visitor contributed content helpful.

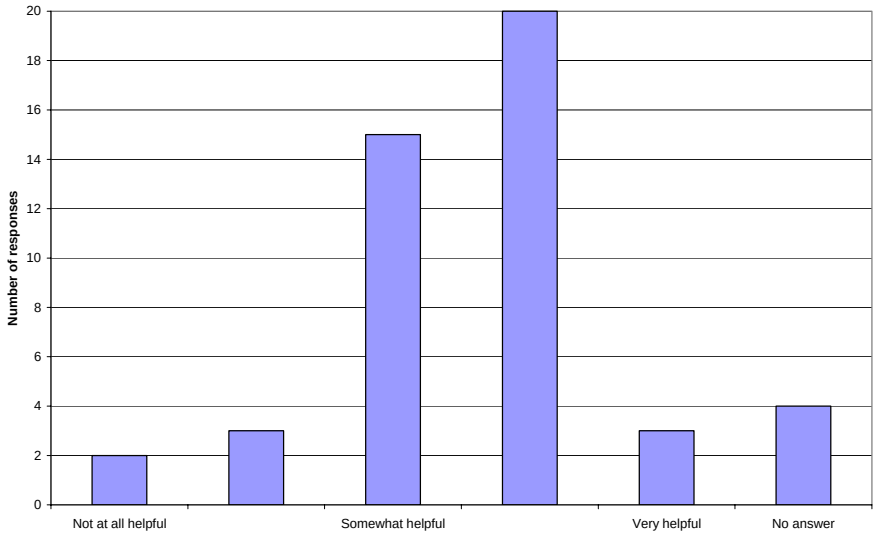

Figure 5: Were case study examples from literature review helpful?

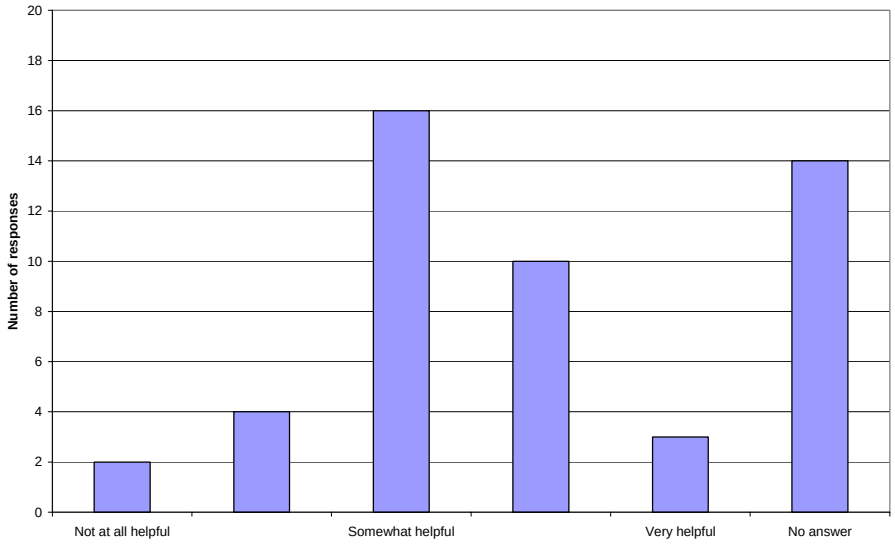

Figure 6: Was visitor contributed content helpful?

Table 12: Ratings of relevance for examples from literature review and visitor contributed content

	All respondents	Level of knowledge			
		None	Novice	Intermediate	Expert
Examples from literature review	3.4	3	3.4	3.6	3.3
Visitor contribute content	3.4	5	3.6	3.5	2.8

4.2.6 Credibility of literature review, visitor contributed and Internet content

Mean and standard deviation (in brackets) were calculated for each of the four source credibility criterion for the literature review content, visitor contributed content and ergonomics content on the Internet in general (summarized in Table 13). Student's t-test was used to determine if there is a statistically significant difference between the source credibility ratings for the 3 sources of information.

Table 13: Mean and standard deviation of source credibility measures for literature review, visitor contributed content and ergonomics on the Internet

	Believable	Fair	Accurate	In depth	Average all credibility scales
Literature review content	4.1 (0.6)	4.1 (0.8)	4.1 (0.6)	3.3 (0.9)	3.9 (0.8)
Visitor contributed content	4 (0.7)	3.9 (0.7)	4 (0.6)	3.6 (1.0)	3.9 (0.7)
Health, safety & ergonomics on the Internet	3.3 (0.9)	3.1 (0.9)	3.2 (0.9)	3.1 (1.0)	3.2 (0.9)

Due to the small difference between means and large deviations, none of the t-tests between means on believability, fairness, accuracy, depth or overall credibility scores between literature reviewed, visitor contributed and general Internet content were significant (tobs 0-0.4, tcrit=1.658-1.740, prob=0.05, df=17-152). The source credibility of the literature review, visitor contributed and ergonomics content on the Internet were therefore rated the same on all dimensions of credibility by questionnaire respondents.

4.3 Contributing to website content

Nine website visitors (including researcher) made 16 contributions to the website (this includes 3 comments added by the researcher in response to questions raised by questionnaire respondents). All contributions were added to appropriate pages. The visitors contributed to the following web pages: Time, Financial Resources, Workforce Ergonomics Training, Ergonomics Team formation, Resources and Support, Ergonomics Expert, Integrating Ergonomics into the organization, and Successful Sustainable PE programs. Table 14 summarizes the webpages that visitors contributed to over time. This includes the content was added on January 29, 2007 by Tanya Morose in response to

questions raised and requests for additional information in the open-ended comments by questionnaire respondents (indicated by * in the table).

Table 14: Visitor contribution to topics over time

Web page content added to	Number of visitor (researcher) contributions	Date of visitor contributions						
		10/23/06	10/24/06	*01/29/07**	2/20/07	3/19/07	4/30/07	5/1/07
Resources and support	2				X			X
Time	0 (1)			*X*				
Financial Resources	0 (1)			*X*				
Ergonomics team formation	1							X
Participatory ergonomics	4		X		X	X	X	
Successful and sustainable PE programs	3 (1)	X		*X*	X			
Workforce ergonomics training	1				X			
Ergonomics expert	1				X			
Integrating ergonomics into the workplace	1				X			

4.3.1 Predictors of adding to website content

Due to the limited number of visitors who contributed to the website content all the chi-square analyses were completed with 25 to 50% of cells having less than 5 expected observations after collapsing across levels. The results of the analysis are included, but are interpreted with caution due to the small N.

The results of the chi-square analysis of number of pages viewed and website contribution are summarized in Table 15 for website visitors who spent more than one minute visiting the website. The analysis indicated that there is not an association between contributing to website content and number of web pages viewed (chi-square=0.1581, df=1, prob=0.6910).

Table 15: Chi-square of total number of pages viewed and website contribution

	Contribute	No contribution
Less than 10 pages viewed	4	184
More than 11 pages viewed	2	65

The results of the chi-square analysis of average time spent viewing each page and website contribution are summarized in Table 16 for website visitors who spent more than one minute (total) visiting the website. The analysis indicates that there is not an association between the average time spent viewing each page and a respondent contributing to the website (chi-square 0.7996, df=1, prob=0.3712).

Table 16: Chi-square of average time spent viewing each page and website contribution

	Contribute	No contribution
>1.0 min/page	4	203
<1.1 min/page	2	47

The results of the chi-square analysis of total duration of website visit and contributing to website content are summarized in Table 17 for website visitors with visits greater than one minute. The analysis indicates that there is a relationship between these two variables, people are more likely to contribute to the website content if they visit the website for more than 10 minutes (chi-square 20.9038, df=1, prob <0.0001).

Table 17: Chi-square of duration of visit and website contribution

	Contributed	No contribution
Less than 10 minute website visit	1	216
More than 10 minute website visit	5	36

Website visitors could contribute to the website content independently of completing the questionnaire. Table 18 summarizes the self-reported knowledge level for all questionnaire respondents who did and did not contribute to the website content.

Table 18: Self-reported knowledge of participatory ergonomics for website contributors and non-contributors

Starting knowledge of PE	Contributed	No contribution
None	0	3
Novice	2	7
Intermediate	3	17
Expert	1	16

A chi-square analysis was completed to determine if there is a relationship between knowledge level and contributing to the website content. Due to the small number of people who contributed to the website content and completed a questionnaire, even after collapsing across levels of knowledge, 50% of cells had expected values less than five (Table 19). There is no relationship between contributing to the website content and starting knowledge of PE (chi-square 0.2892, df=1, prob=0.5908).

Table 19: Chi-square analysis of knowledge of participatory ergonomics and contributing to website content

Starting knowledge of PE	Contributed	No contribution
None/Novice	2	10
Intermediate/Expert	4	33

4.3.2 Analysis of visitor contributed content

The content of the visitor contributions (Appendix D) were analyzed for themes. The majority of comments were added to the "successful and sustainable participatory ergonomics programs" (N=4) and "participatory ergonomics" (N=4) pages. Most of the comments were sharing "tips, tricks, and traps" from past experiences with participatory ergonomics (or similar) programs (N=7) and sharing links to additional participatory ergonomics resources (N=3).

One contributor reported that s/he has had positive experience implementing an ergonomics team by adding responsibility for ergonomics to an existing joint health and safety committee. The JHSC became the "joint health, safety and ergonomics committee". In this particular example, the JHSC was functioning effectively at the facility and workers and management were already familiar with the JHSC process, and adding ergonomics to their portfolio was attributed to the success of the ergonomics program. The visitor also cautioned that adding responsibility for ergonomics to a JHSC that is not functioning effectively will more than likely result in an ineffective ergonomics program.

Two visitors validated the information from the literature review about starting with small and easy to implement solutions to increase the visibility of the ergonomics program and to prove the effectiveness of the ergonomics program to workers and management. This contributor cautioned that if an ergonomics team starts with a "big, complex problem", there is a higher chance that the ergonomics team would need several opportunities to make it "right" which would lead to a loss of support from the workforce. Another visitor validated the information from the literature review about involving the workforce. It is easy to ask for input from the workforce, but if the recommendations from the workforce are not included in the solution development, problems will exist and the team will cease to function effectively.

Two visitors commented on the different roles represented in case management for injured workers and the role of ergonomics in this process of encouraging an early and safe return to work.

Two visitors cautioned website visitors about the role of the ergonomics expert and 'flexibility of solutions' as potential barriers to successful participatory ergonomics programs.

One visitor validated the message from the literature review about the role of the facilitator in the ergonomics program. S/he reported that it is a fine balance between ensuring the facilitator is not overused for projects that the ergonomics committee could complete on their own and that the ergonomist is used to his/her full capabilities to maximize the impact on the ergonomics program.

Another visitor cautioned that 'flexibility' of solutions can become an issue when some workers are not involved in the design of an ergonomic solution. For these workers, the solution may not address their concerns. During the solution generation phase of the process, the team needs to be aware of differences between similar workstations or processes to ensure that "one person's (or team's) improvement [does not become] another's burden".

One contributor stated that maintaining momentum for the ergonomics program is often a challenge. S/he felt that it can be difficult to maintain program momentum because it is a "cost avoidance" strategy whose impact is often "not recognized for years by an absence of musculoskeletal injuries". Additionally, "Ontario MSD Prevention Guideline encourages a participative approach but it falls short of recommending their adoption and ergonomics committee and ergonomics programs are not mandated even if they are implied from a due diligence perspective".

The comments on the "participatory ergonomics" page showed the most evolution over time. Visitors shared links to related web resources: Ontario's MSD Prevention Guideline[7], IRSST's "Ergo Groups - A tool for WMSD prevention"[8], IWH's process approach to participative ergonomics[9] and a

[7] http://www.wsib.on.ca/wsib/wsibsite.nsf/Public/preventmsd

[8] http://www.irsst.qc.ca/en/_publicationirsst_635.html

systematic review of the PE literature conducted at IWH. The first visitor shared a link to the IWH process approach to participative ergonomics and a subsequent visitor validated the resource as "a clear website outlining PE in lay terms suitable for anyone in ergonomics. It lays out the purpose of PE and gives really good examples." The third visitor suggested additional resources from Ontario's WSIB and Quebec's IRSST while the fourth commented that the MSD prevention guideline promoted a "participative team approach but falls short of recommending and actual ergonomics committee, preferring an ad hoc approach".

One visitor posed a question on the "workforce ergonomics training" page on February 20, 2007 that remained unanswered by other website visitors.

4.3.3 Barriers to contributing to website content

Questionnaire respondents were given the opportunity to provide reasons for not contributing to the website. Twenty-five respondents (58%) provided a reason for not contributing to the website content and 18 respondents did not complete this question.

Table 20: Knowledge level of participatory ergonomics and reason for not contributing to website content

	Reason provided for not contributing	No reason provided
None	1	2
Novice	4	3
Intermediate	9	8
Expert	11	5

The most common reason for not contributing to the website content was a stated lack of time (reported by 3 "intermediates" and 5 "experts") and not realizing that it was possible to contribute to

[9] http://www.iwh.on.ca/archive/pdfs/ergo_blue09_03.pdf

the website (reported by 3 “novices”, two “intermediates” and 3 “experts”). In addition to “not realizing that it is possible to contribute, three people reported they were unable to figure out how to contribute to the website (2 “intermediates” and 1 “expert”). This implies that prior to expanding this approach to knowledge transfer; there are user interface issues that should be addressed.

Three respondents (one with no ergonomics experience and two with intermediate knowledge of participatory ergonomics) reported they did not have any experiences with ergonomics to share with website visitors and one respondent reported that s/he did not want to share his/her experiences with website visitors.

Two “experts” reported they were unable to contribute to the website content due to concerns about client confidentiality. One person reported that s/he would need to discuss what information could be shared with clients prior to posting to the website.

Three people expressed concerns about the anonymity of contributions and the authority of the contributors. One respondent found “it troubling to take advice from someone who may not be an expert.

Other concerns were fundamental to the design of the website and the approach to knowledge dissemination; concerns about the website turning into a ‘blog’ where information may not be accurate and the “intent” of visitor contributed content.

Chapter 5
Discussion and conclusions

The discussion and conclusions are organized around each of the hypotheses:

1. Electronic resources assist in dissemination of research findings to potential users outside of the research group. Website visitors may identify limitations with the website, but the strengths of the website will outweigh the limitations and it will be worthwhile to continue to invest time and resources to further develop this project.

2. Internet users want to know that information on the Internet is authoritative and coming from a trusted source before they will consider applying it. The website's "core content" (based on the literature review) will be rated higher on measures of source credibility than the website's visitor contributed content or other health, safety and ergonomics Internet resources.

3. Knowledge evolves when it is applied in the world of practice. If website visitors are given an opportunity to share their experiences, they will. "Experts" are willing to share their experiences and will also contribute to website content.

5.1 Hypothesis 1: Strengths and limitations

With a few exceptions overall, the ratings of the website were generally positive. All questionnaire respondents reported they intended to take some action on participatory ergonomics in their workplace. Most experts report they are planning to (or already have) implemented participatory ergonomics programs; visitors with intermediate knowledge were planning on discussing and reviewing the participatory ergonomics information with colleagues and coworkers while most visitors with lower knowledge were planning on referring a coworker or colleague to the website. All

questionnaire respondents reported the website content did not contradict their existing knowledge of participatory ergonomics.

5.1.1 Duration of data collection

The number of website visitors, questionnaires completed and visitor contributions did not accelerate with time; rather the frequencies appear to be tied to specific one-time recruitment efforts. This implies that the seven month data collection period wasn't long enough and the recruitment efforts did not form a cohesive traffic generation plan.

A longer data collection period may have helped to increase the total number of questionnaires, and visitor contributions. This is because it takes time for the website to be indexed and become trusted by search engines, both of which are required before a site can be listed in response to a search for a specific keyword. A longer data collection period would have also provided additional time for recruitment efforts by "word of mouth" and repetition. Several individuals who had intended to forward the recruitment information to their clients and colleagues were unable to make time during their busy schedules to complete this task during the data collection period. And a longer data collection period would have allowed for a longer time to increase the number of referral links from other websites, thus improving a search engine's trust in the content of the site.

Website traffic generation was not explicitly planned from the start of this project. Instead, we hoped that "if we build it, they will come and participate"; this assumption was incorrect. If a successful traffic generation strategy was planned and implemented up front, we likely would have seen sustained and continued daily growth over time (number of visitors, contributions and completed questionnaires per day). If this or a similar project is implemented in the future, there would be a potential opportunity to work with the Computer Science department to develop and implement a

traffic generation plan. The purpose of the traffic generation plan would be to drive interested people who would participate in and who would benefit to the website.

5.1.2 Case study examples

Overall, with the exception of the expert's rating of the visitor contributed content, the respondents found the case study examples and the visitor contributed content helpful. The definition of expert for the purpose of this study is a person who is aware of the literature and who has implemented participatory ergonomics programs. These individuals have a relatively high starting knowledge from both the literature and the world of practice; the examples were not rated highly because they likely didn't add to the experts' understanding of participatory ergonomics because they already have a lot of experiences to draw from. If experts were to learn something new, I anticipate that it would have come from another visitor sharing his/her tips and tricks from the world of practice rather than the literature review content.

Although the mean rating is the same for the case study examples and visitor contributed content, the distribution of responses suggests that more people found the literature review examples more helpful than the visitor contributed examples. 8.5% and 28.6% of questionnaire respondents did not answer this question for the case study examples and visitor contributed content respectively. Due to the small number of visitor contributions, it is likely that some visitors did not view any visitor contributed content prior to completing the questionnaire.

Originally, I hoped that the case study library would be built by visitor contributed content. This did not turn out as expected. Additionally, questionnaire respondents clearly indicated they felt the website would benefit from additional examples. Suggestions for additional examples included: gaining top management support, cost justification, and using injury stats to illustrate which companies benefit from an ergonomics program.

5.1.3 Additional topics

When this project started, it was never the intention to provide all the information needed to implement a participatory ergonomics program from scratch. Instead, the objective was to provide website visitors with the basic information needed to determine if a participatory approach to ergonomics could be suitable for a workplace and to direct visitors to additional resources (IWH ergonomics blueprint, Ontario's MSD prevention guideline, etc.). Feedback from questionnaire respondents indicates that visitors felt the purpose of the website was to provide the resources (or templates) required to develop and implement a participatory ergonomics program. To bring the website content more inline with visitor's expectations, in the future a "toolbox" component could be added to the website. The "toolbox" should include templates and checklists summarized in the results (section 4.2.2) and an expanded resources section. The purpose of the resources section would be to direct visitors to appropriate resources if they require additional information or professional ergonomics support to develop and implement their program (for example, links to Ontario's health and safety associations, and the Association of Canadian Ergonomists directory of consultants, etc.).

5.2 Hypothesis 2: Source credibility

Due to a small number of responses and large standard deviations, there were no statistically significant difference between source credibility ratings of the website content based on the literature review, visitor contributed content and health, safety and ergonomics information on the Internet. The source credibility scores for the Internet are slightly lower (but not statistically significant) than the website content (literature review and visitor contributed). This is surprising; I anticipated that the source credibility rating for "health safety and ergonomics information on the Internet" would be significantly lower than the website content rating. Potentially, with a longer data collection period and a larger N, statistically significant differences between the three sources of information may have emerged.

It is encouraging that overall the website content was perceived as credible (3.9/5). The scores for believability, fairness and accuracy were 4.1 out of 5 while the depth of the website was rated much lower (3.3/5). My intended purpose for the website did not match up with visitors' perceived website purpose (to provide the resources (or templates) required to develop and implement a participatory ergonomics program) and this is reflected in the low rating for the depth of the website. Based on visitor's expectations, the website is "missing" significant sections of information.

5.2.1 Target versus actual audience

When this project started, the target audience was representatives from Ontario workplaces. The website content was written in lay-language intended for workplace representatives. Due to the recruitment efforts, the majority of website visitors self-identified as professionals (Ergonomists, Health and Safety managers, Health and Safety Association Consultants, etc.) and no website visitors identified themselves as workers or worker representatives. As a result there was a disconnect between the audience the content was intended for and those who visited the website. Had the original target audience been professionals, the website content would have been written differently, in a style closer to the literature review in chapter two of this thesis (the ideas would be the same, but the style and tone would be different). Had there been a better match between the writing style and visitor's expectations and information needs, the ratings of website credibility may have improved.

5.3 Hypothesis 3: Sharing experiences and contributing to the website

Data collection for this thesis ran for approximately 7 months (October 23, 2006 to May 31, 2007). The number of questionnaires completed and lack of visitor contributions was disappointing. Arosson (2002) reports "that a more real threat to a wiki website [than editing wars or vandalism] is that nobody wants to edit anything" which is in agreement with the experience of working on this thesis. Based on his experience with the first nine months of operation with a "large scale, general

purpose wiki" Aronsson (2002) reports that the first few individuals must be very determined to get the process started. Perhaps, the seven months of data collection was not long enough to reach a critical mass required for a wiki-style website to become a success. For the purpose of comparison, I tried to contact the administrator of biomch-w, a biomechanics wiki, to compare my experiences with this thesis to their experiences with a researched-based wiki, but did not receive a reply to my repeated inquiries.

With only one reference to compare to (Aronsson, 2002), I suspect that having only one person writing content and examples, and responding to visitor questions (from questionnaire responses) was not enough to get the wiki off to sufficient start required for a 7 month data collection period. In hindsight an additional recruitment opportunity would have been to contact professional ergonomists and members of kinesiology departments who conduct applied workplace research to share their experiences by adding to the visitor contributed content prior to recruiting from the target population. If the visitor content on all pages had been 'seeded' with several examples, visitors may have been more willing to contribute to the website content because they wouldn't be the first person to add to a blank page, and each page would have an example to illustrate the intended purpose of the visitor contributed content.

5.3.1 Addressing barriers to contributing to website content

Lack of time and user interface issues were the most common reasons cited for not contributing to the website content. Lack of time is an issue in many people's work life. The only thing we can do to address this barrier is to make it as quick and easy as possible to contribute the website content. This was the rationale for the current anonymous contribution system. During the early development of the website a decision was made to not require visitors to create an account and log in to contribute to the website content which was intended to facilitate the rapid submission of contributions.

Additionally a wiki was chosen for the visitor contribution section over a methodology centered around the more traditional “comments system”. The wiki style allows contributors to edit any content provided by previous visitors. The hope was that by allowing contributors to fire off rapid thoughts and experiences they would be free of the burden of being “perfect” because others could refine the content over time, and thus more contributions would occur overall.

“Not realizing it was possible to contribute” and not “figuring out how to contribute” were the other major reasons provided for not contributing to the website. This clearly suggests that prior to continuing with this approach to knowledge transfer, some user interface issues need to be resolved. The addition of a clearer, more prominent explanation of the purpose of the visitor contributed content may encourage additional contributions. Increasing the emphasis on visitor contributions may resolve the user interface issues identified by questionnaire respondents.

Alternatively, maybe a wiki is not the ideal approach to engage website visitors. A traditional commenting system instead of the wiki contributions would likely be more familiar to website visitors and people may be more likely to realize that commenting is possible and more likely to take action (personal communication with Cameron Turner, We-Create Inc., July 27, 2007).

5.3.2 Authority of website and visitor contributed content

To address concerns about the “level of authority” of the website content, the difference between the content from the literature review and the content submitted by visitors needs to be made more clear, or the contributors professional credentials need to be recorded and displayed to future visitors.

The feasibility of implementing a moderated commenting system may be worth investigating. If all visitor comments are approved by a moderator, this would address concerns about “the level of authority” of visitor contributions. Visitors would either have to create an account to submit a comment or the comment submission form could include fields to enter name, contact information,

affiliations, etc. The challenge with this approach would be getting an “ergonomics expert” to commit to moderating all visitor submissions in a timely manner.

5.3.3 Advantages and disadvantages of anonymous visitor contributions

An anonymous visor contribution system was selected primarily to make it as quick and easy as possible for visitors to add content to the website. There are several benefits to keeping an anonymous visitor contribution system. Firstly, ergonomics is a relatively small community of practice. If ergonomists are going to be the primary visitors to the website, it is likely that visitors would know of each other. If a contribution is made and only a person’s name and credentials are affiliated with the comment, it is likely that other visitors will know where the contributor is employed and it would be possible to link visitor contributions with physical location and employers. This is a greater concern if visitors are sharing anecdotes about “obstacles encountered” or “failures” of participatory ergonomics programs they have been involved in.

Secondly, I would expect that worker representatives would be more inclined to share their experiences in an anonymous contribution system. If worker representatives are asked to provide their name and affiliation prior to making a contribution, this may discourage some people from voicing their opinions or sharing their experiences for fear of potential negative consequences in the workplace (particularly if their contribution does not reflect well on their employer, supervisor or management team).

Changing to a non-anonymous system does have advantages. Attributing comments to individuals may provide incentive for some website visitors to share their experiences; which may ultimately benefit their professional reputation. It may also make the website more personal and move towards a more interactive “community of practice” where practitioners can share their experiences and seek advice from their peers. If contact information is included with the contributor’s name and

credentials, there would be an opportunity for future website visitors (and the website administrator) to contact the contributor for clarification or additional information. The non-anonymous system would address visitors concerns about the authority of visitor contributed content and may improve the perceived credibility of the visitor contributed content, especially if the new system requires contributors to state their credentials (i.e. Certified Professional Ergonomist, Canadian Certified Professional Ergonomist, etc.).

A potential compromise between the benefits anonymous and non-anonymous systems would be that all visitors are required to state their name and credentials when submitting their contributions. Visitors could choose to have the name and credentials associated with the contributions or have their contributions remain anonymous and only the website administrator would know their identity. To address concerns about authority of contributions the website administrator could review all contributions prior to posting on the public website (with an emphasis on more thorough review of anonymous contributions).

5.4 Lessons learned

This section summarizes the lessons learned from this thesis and provides some guidance for further web-based projects at CRE-MSD.

The target audience was different from the actual visitors who came to the website. For future projects, in the early stages of development (prior to writing the website content) more emphasis should be placed on the recruitment strategy to ensure that the target audience is made aware of, and encouraged to visit the website. During the data collection period, where possible, efforts should be made to ensure that the website visitors are representative of the target audience. If there is a mismatch between the actual and target audience, changes to the recruitment efforts should be made to ensure that the target audience is aware of and encouraged to visitor the website, or changes to the

content may be required so it meets the needs and expectations of those who are actually visiting the website.

The website content was written in lay-language and references were not included in text. Instead, links to selected resources were included on a reference page of the website. To increase the authority and source credibility of the website, unobtrusive references should be cited on each page for those readers who would like additional information. Parenthetical references are difficult to read and may detract from the message for those readers who are not used to reading academic literature. Footnotes are a possible method to include references in an unobtrusive way.

To address visitor's concerns about the visitor contributed content in an interactive website, the intent and purpose of the visitor interaction must be stated clearly and conspicuously to website visitors. Additionally, all website pages where it is possible for visitors to contribute should be seeded with at least one sample contribution from CRE-MSD.

CRE-MSD has a network of researchers and students in a wide variety of fields investigating different aspects of the prevention of musculoskeletal disorders. If an interactive website on another topic related to MSD prevention if developed, content should be solicited from CRE-MSD researchers when the website's 'core content' is developed and when the website is seeded with visitor contributions. Ideally, in addition to providing information published in journals and presented at conferences, CRE-MSD researchers could also provide content that would focus on how the knowledge could be incorporated into professional practice or applied in a workplace setting.

5.5 Future research

The literature review identified several important factors for success and sustainability that should be considered when implementing a participatory ergonomics program (support and resources, training, selecting ergonomics committee members, organizational factors and workforce

involvement). I was unable to find a document that summarized the relative importance of each of these factors. Reitzel (2006) identified nine factors for success and concluded that "the inclusion of ergonomics expertise in ergonomics programs or workplace ergonomics activities is associated with program success and sustainability". I believe there is an opportunity for a systematic literature review to inform a research project that aims to determine the relative importance of each of the 'factors for success' identified in the literature review. The results of this study could be transferred to industry by creating a 'readiness checklist'. Workplaces could complete the 'readiness checklist' to determine in they have the required programs and supports in place to implement a successful participatory ergonomics program. Ideally the checklist would include 'need to have' and 'nice to have' factors for success.

The experience of this thesis is that it is difficult to get a wiki started when one person is writing the content and the timeline from launch date to the end of data collection is 7 months. It would be interesting to retrospectively or prospectively study the growth and development of a wiki to determine the amount of time required to reach a 'critical mass', and the amount of content necessary to start a wiki. It would be interesting to evaluate the differences between private and public wikis and the effect of the wiki purpose (i.e. knowledge dissemination, knowledge generation, social networking) on its growth and development.

Although wikis are very popular, and are often discussed in the popular press, there is limited information on the use of wikis in the peer-reviewed literature. I believe there is an opportunity to conduct scholarly research on the use of this communication tool for the purposes of: knowledge dissemination from academia to the end users of research findings, planning and discussion of research projects in progress and communication within an organization (i.e. a business or health and safety association) or interest group (i.e. safety group, Ergonomists).

5.6 Conclusions

The most significant limitation of this project was the small number of visitors, completed questionnaires, and visitor contributions which is likely due to not allowing a sufficiently long data collection period. Feedback from website visitors suggests that additional case study examples and a participatory ergonomics "toolbox" should be added to future iterations of the website.

The website content based on the literature review, visitor contributed content and health, safety and ergonomics information on the Internet did not differ on measures of source credibility.

Most website visitors did not share their experiences due to a stated lack of time and user interface issues. To increase the number and frequency of visitor contributions, user interface issues such as improving the process for adding visitor contributions need to be resolved. An alternative method to engage website visitors (moderated commenting system) may be more successful than the interactive wiki-style website created for this project.

I believe that it is worthwhile to continue to invest time and resources to further develop this interactive participatory ergonomics resource. With additional time, continued recruitment and promotion efforts and changes to address user's concerns (moderated commenting system, authority of contributions, addition of a 'tool box', etc.) there is the potential to fill an information niche that is currently missing online.

Appendix A: Website content

This is a verbatim export of the final version of the "core" content of the research website. As mentioned it represents a literature review of academic participatory ergonomics articles and case studies written in lay language. The format of this Appendix is an approximation of the hyperlinked nature of a wiki-based site. The links within pages of the site are represented as follows:

- All text that formed a link is underlined.
- Internal links to other portions of the site are followed by a "page number" in parentheses.
- Footnotes are used to provide link URLs that went off-site.
- Headings in this Appendix prefixed with numbers in parentheses indicate the start of a "page".

(1) Welcome: Interactive Participatory Ergonomics Resource

Welcome and thank you for taking the time to visit this interactive participatory ergonomics(2) resource. This research project is being conducted by Tanya Morose(28) as part of her Master's thesis under the supervision of Dr. Richard Wells(28), of the Department of Kinesiology[10] at the University of Waterloo[11].

We are trying to determine if an interactive website is a good way to let people know about the latest participatory ergonomics(2) research findings. Please click here(2), or on the navigation bar at the top to start browsing(2). Browse the website as long as you wish and add to the content on web pages(29) as you wish. We hope that before you leave the website you choose to complete the

[10] http://www.ahs.uwaterloo.ca/kin/

[11] http://www.uwaterloo.ca/

questionnaire[12] in the feedback section[3] so we can evaluate the usefulness of the website. If you do not want to complete the questionnaire[3], feel free to browse the website and add to the content(29) if you wish. It is important that you know that all information you provide will be held in strict confidence, and it is not possible to associate any of your answers with any personal identifying information.

This study has been reviewed and received ethics clearance through the Office of Research Ethics at the University of Waterloo. If you have any concerns about participating in this study, please feel free to contact us(28).

Thank you for your time. We really appreciate your input!
Tanya Morose(28)

(2) Participatory ergonomics

A participatory approach to ergonomics(25) in the workplace relies on actively involving workers in implementing ergonomic knowledge, procedures and changes with the intention of improving working conditions, productivity and quality.

This website addresses the five most important factors to consider when implementing a participatory ergonomics program to maximize chances for a successful,(24) sustainable(24) program.

- Resources and support: What resources(3) and support(3) are required to have a successful(24) participatory ergonomics program?
- Ergonomics committee: My organization is considering establishing a participatory ergonomics program. Who(7) should be on the ergonomics committee(7)?

[12] Questionnaire is in Appendix B

- Training: Our workplace has no prior experience with ergonomics. What kind of training(11) is required to get a participatory ergonomics program started?
- Organizational factors: When implementing a participatory ergonomics program, which workplace organizational factors (15) should be considered to maximize the chances for a successful participatory ergonomics program?
- Workplace involvement: What is the best way to involve workers(18) in the ergonomics program who are not ergonomics committee members?

(3) Resources and support

"What resources and support are required to have a successful participatory ergonomics program?"

If the PE(2) intervention is going to be successful, the organization must support and prepare for it. Sustainable participatory ergonomics(2) programs require initial and continuing support which must come from the top level of management. The program must have sufficient resources which include: involving the right mix of people(4), adequate financial resources(5) to make meaningful changes, and time(6). If there are not adequate resources for the PE(2) program, then ergonomics committee(22) members may become frustrated and de-motivated.

(4) People

The first resource(3) necessary for a successful participatory ergonomics(2) program is ensuring that the right people are involved. You need to ensure that all parts of the organization that will be involved in, or affected by the process are aware of its existence. It's important to ensure that the ergonomics committee has people with the right mix of skills(7) and that key decision makers(7) within the organization are directly involved in the process. It is also essential to gain support from workers(18) and the union (where applicable).

Case study example:

In a manufacturing facility, the ergonomics team(22) found it had little authority to make changes on the plant floor. Production supervisors often discounted the ergo team's recommendations which meant that changes were often under-used or used incorrectly. To improve this situation, the ergo team recruited the maintenance and continuous improvement managers to the team. Both were powerful members of the plant, who had high technical knowledge of plant operations and the authority to make change.

(5) Financial resources

The second resource(3) to consider when implementing a participatory ergonomics program is funding. The lack of adequate funding can limit or halt the progress of the ergonomics committee(22). A lack of funding slows the rate at which changes are implemented, which is frustrating to committee members as well as workers. The ergonomics committee needs resources to be effective, but they do not spend money carelessly. Based on several case studies in many different industries, there is evidence that ergonomics committees(22) are mindful of company finances, are conscious of the cost of their solutions and they do the best to find the most economical solution.

Case study example:

In a manufacturing facility the ergonomics committee did not have a budget designated for implementing ergonomics changes. The lack of financial resources meant that for each change the team wanted to make, they had to get money from a budget controlled by individuals who were not directly involved in the ergonomics committee. This limited the team's progress in making changes. The ergonomics committee recruited the maintenance and continuous improvement managers to the team. Both could provide funds for ergonomic changes through budgets that they controlled. With the continuous improvement manager,

the ergonomics committee could "piggy-back" on changes that were already being undertaken independently of ergonomics.

(6) Time

The third resource(3) required for a successful participatory ergonomics(2) program is time. There must be adequate time give to the program itself to get established, and individuals involved in the participatory ergonomics(2) program must be given adequate time to participate in the process. The participatory ergonomics program itself must not be unduly time constrained. Adequate time must be allowed for the program to get established so that ergonomics team can identify opportunities for improvement, assess ergonomics risk factors, develop and implement solutions. Team members need to be given adequate time away from their regular duties to fully participate in ergonomics committee activities (attend meetings and work on ergonomics committee projects between meetings).

Case study examples:

In a foam manufacturing facility, members of the ergonomics change team (ECT)(22) found it challenging to balance production demands with the demands of committee work. Night shift team members had to come in for meetings during the day and management team members were often called out of ECT meetings to deal with issues on the production floor.

The issue of providing adequate time to participate in ergonomics committee activities becomes more important and difficult to schedule for workplaces where team members regularly work off-site. In our work with a courier company, most of the ergonomics committee members regularly worked off-site. It was difficult to schedule relief from regular job duties so that committee members could return to the workplace and attend meetings or work on ergonomics committee projects. Over the course of our involvement with this facility, this challenge was always present; team members were often absent from meetings and meetings were often cancelled due to lack of attendance.

(7) Ergonomics team formation

"My organization is considering establishing a participatory ergonomics program(2). Who should be on the ergonomics committee?"

The ergonomics committee should be composed of 4 to 8 people (depending on the size of the company) with the right mix of skills(8); technical(8) or engineering(8) knowledge, workers'(8) knowledge, and input from an ergonomics expert(9). Successful(24), sustainable(24) participatory ergonomics(2) programs have an individual on the committee who takes on a leadership(10) or "ergonomics champion(10)" role.

(8) Selecting ergo team members

The recommendation for group work is four to eight people. As the team progresses, there may be need to involve additional people with specific knowledge for some projects. This can either lead to the formation of a “sub-group” or temporarily increase the size of the ergonomics committee to upwards of 10 people.

In selecting who will be on the ergonomics committee, it is important to have the correct balance of skills on the team. The generation of solutions relies heavily on the everyday experiences of the committee members. Workers’ knowledge and input is equally important as technical or engineering input.

To maximize chances for success, participation on the ergonomics committee should be voluntary. A successful(24) participatory ergonomics program requires that team members are committed to the process and should be prepared to invest the time and energy required to actively participate in team activities (both during meetings and time outside of meetings investigating, implementing and following-up on ergonomics changes).

Case study example:

In a garment manufacturing facility, participation on the ergonomics team wasn't truly voluntary. Membership on the ergonomics team was often a function of a person's role in the workplace. People were asked if they wanted to be on the ergonomics team, but it was often a rhetorical question instead of a true choice. One of the obstacles this ergo team encountered was a lack of full participation in all ergo team activities by all team members.

(9) Ergonomics expert

If you chose to involve an “ergonomics expert” or “facilitator” in your participatory ergonomics(2) program, there are several things that should be considered in order to maximize chances for success. The facilitator's role is to provide training(11) and guide the ergonomics committee. The facilitator should be unbiased, knowledgeable, flexible and adaptable. If the facilitator is an insider, a corporate ergonomist for example, they may not be viewed as unbiased. If you select a facilitator from outside your organization, they may not be viewed as knowledgeable about your industrial processes. If an outside facilitator is involved early in the process, then the timing of their withdrawal from daily ergo team activities needs to be considered. If the facilitator withdraws too early in the process then there may not be ownership of the process at the facility and the ergonomics program may cease to exist when the facilitator leaves the workplace. If the facilitator's withdraw is later than optimal, then true participation may be stifled.

Case study example:

Initially, the ergonomics committee at an automotive parts manufacturing facility was driven almost entirely by the outside facilitator. For the most part, committee members attended monthly meetings, but did not participate in any assessments, solution development or implementation activities[13] outside of meetings. Over a period of approximately a year the ergonomics committee

[13] http://www.escs.uwaterloo.ca/bprint.html

took ownership of the team and now relies on the ergonomics expert to assess and identify solutions for ergonomics concerns only when the problem exceeds the team's capabilities(12). In addition to attending monthly meetings, most team members participate in assessment, solution development and implementation activities outside meetings.

(10) Leadership

There needs to be a leader or "champion" of the participatory ergonomics (2)program. This individual's role is to coordinate the team's activities. However it is very important to ensure that the responsibility for daily activities (meeting agenda(13) and minutes(13), chairing(13) meetings, etc.) does not fall to only one person.

Case study example:

The three workplaces that we've worked with who have implemented sustainable(24) ergonomics programs (meaning the ergonomics committee continued when the ergonomics expert(9) withdrew from daily team activities) all had one person who took on a leadership role. In each facility, the "ergonomics champion" ensured that people were given time away from their regular duties to attend meetings, and work on ergonomics committee projects outside of meetings. These leaders also kept track of the status of the projects the ergonomics committee was working on and made sure that key decision makers in the workplace and all employees were aware of the ergonomics committee, it's purpose and recent activities.

One of the reasons the ergonomics program was not sustainable(24) at the courier depot, is that no one took a leadership role. As a result, more often than not, meetings were canceled because people were not able to attend meetings. Workers, especially courier drivers who were scheduled to be on the road, were not provided with time away from their regular duties to attend the meeting or work on ergonomics committee projects between meetings.

(11) Training

"Our workplace has no prior experience with ergonomics. What kind of training is required to start a participatory ergonomics(2) program?"

Training principles and methods are central to the success(24) of the participatory ergonomics process. There are three major aspects to training that should be considered in the early stages of planning and implementing a participatory ergonomics program.

- Obviously the ergonomics committee needs initial training in ergonomics(12) which should include, but is not limited to ergonomics concepts and tools.
- Depending on who is selected to be on the ergonomics committee and their past experiences with committee work and implementing workplace changes, it is likely that the ergonomics committee will need some informal training on other(13) "non-ergonomic(13)" topics(13) such as meeting management and project management.
- In order to improve support for the participatory ergonomics process, it is important for the workforce(14) to gain an understating of ergonomics.

(12) Ergonomics training

To have a competent ergonomics committee, team members need knowledge of general problem-solving skills, job design concepts, ergonomics concepts, methods and tools. Initial training(11) should provide the team with the skills necessary to:

- identify and assess risk factors present in the workplace,
- generate solutions to address ergonomic concerns, and
- assess or evaluate the ergonomic changes that are implemented.

As committee members gain knowledge and practice applying their ergonomic knowledge, they will gain confidence in their contributions to the ergonomics process(2) and see their efforts are make

a difference. Periodic refresher training will likely be required. It is also important for the committee to understand when a problem exceeds their skill set and they need to call in an ergonomics expert to complete a more complex analysis and assessment. In this case, the committee would review the consultant's report and implement changes to address the concerns identified in the report.

Case study example:

The initial training for the ergonomics team at the auto parts manufacturing facility included problem identification, ergonomic assessment tools, solution building and implementation[4]. At the end of our involvement with this workplace, ergonomics team members reported that they felt ongoing training in the use of ergonomic tools would have been beneficial.

(13) Non-ergonomics training

Depending on the previous exposure to committee work that ergo team members have had, it is likely, in addition to ergonomics training(12), additional training on "non-ergonomic" topics may be required. It has been our experience that many ergonomics committees benefit from informal training on the social aspects of project management, the "how to" of a participatory process, and meeting management. Training on project management will assist the ergonomics committee to manage the projects the team is working on; identifying action items and work activities for team members and supporting staff (i.e. maintenance or engineering) for the next meeting. If there is going to be an effort to rotate responsibility of meeting management duties(10) among committee members, training should be provided on how to chair meetings, writing meeting agendas and taking meeting minutes.

Case study examples:

Initial training(11) for the ergo team at the auto parts manufacturing plant focused only on ergonomics (concepts, methods and tools(12)); it did not include any information on project management, change management or managing meetings (preparing agendas, minutes and chairing

meetings). This lack of training on meeting management had a disproportionate effect on worker ergo team members. When responsibility for managing the meetings was transferred from the facilitator(9) to the team, an effort was made to rotate responsibility for preparing agendas, minutes and chairing the meetings among all team members. This resulted in only one agenda being prepared for the following seven meetings. To address this challenge, the ergo team decided to alternate the responsibility for chairing meetings between two team members who had the skills to chair a meeting. At the conclusion of our involvement with the auto parts manufacturing plant, the ergo team members reported they felt they needed training on the social aspects of change management.

In a garment manufacturing facility, our first attempt to rotate responsibility for taking meeting minutes was a failure. The individual who was selected to do the first minutes did not have the required skills. At the following meeting the facilitator briefly explained how to take meeting minutes and asked if team members felt they had enough knowledge to complete this task. Subsequent efforts to rotate responsibility for meeting minutes were more successful.

(14) Workforce ergonomics training

Relevant ergonomics skills, knowledge and awareness need to be spread throughout the workplace to maximize the effectiveness of the ergonomics process. The objective should be to educate all employees to an appropriate level in the consequences of poor ergonomic quality, identification of risk factors, and their place in the ergonomics process. This should include:

1. Educate all employees on:
    - the identification of symptoms of musculoskeletal disorders and other consequences of poor ergonomic quality,
    - the identification of risk factors, and
    - their place in the ergonomics process.

2. Educate the engineering or technical staff on ergonomics in the design process and on the corporate ergonomics design criteria (where applicable).

There are several benefits to educating the workforce in ergonomics:

- Individuals are more aware of ergonomics and are able to identify ergonomic concerns
- It enables individuals (workers, supervisors, engineering or technical personnel) to better communicate with the ergonomics committee
- It enables individuals who are not on the ergo team to better understand the purpose of the participatory ergonomics process and the ergo committee's work

(15) Workplace organizational factors

"What workplace organizational factors should be considered when deciding to implement a participatory ergonomics(2) program to maximize the chance for success(24)?"

There is limited discussion in the research literature of the effect of the organization's characteristics on the success of a participatory ergonomics intervention(2). Based on our experiences and the limited information available in the literature, this section discusses the following topics:

- The effect of the workplace climate (16)and the timing of the introduction (16)of the participatory ergonomics program, and
- Integrating(17) the participatory ergonomics program into the existing health and safety programs(17)

(16) Workplace climate

The workplace climate has a large impact on the outcome of a participatory ergonomics program and is one of the organizational factors (15)that must be considered(15) when deciding if it is

appropriate to introduce a participatory ergonomics program. "Common-sense" dictates that it may be counter productive to introduce a new program in times of conflict, unrest or great uncertainty. Participatory ergonomics programs place additional demands and responsibilities on individuals; it is not advisable to introduce a participatory ergonomics(2) program when the survival of the organization is at stake because there is an increased need to concentrate on the normal operational activities to promote survival.

(17) Integrating ergonomics into the workplace

A participatory ergonomics(2) program can be best sustained(24) if it's embedded in the approaches and practices within the workplace and promoted as complementary to the existing health and safety practices. Enabling non-ergo team members to make a genuine contribution(18) can help to embed the ergonomics perspective within the workplace.

Case study examples:

To maximize the visibility of the ergonomics team within a manufacturing facility, the Health and Safety manager presented the team as a viable, effective group to manage risk and injuries that affected production. The ergonomics team was involved in modified work when the injuries were related to ergonomics.

The same people were on both the JHSC and ergonomics committee at one garment manufacturing facility. At the time of our involvement, the committees were separate, but the Health and Safety coordinator felt the ergonomics committee would cease to be a separate entity, and the JHSC would be responsible for addressing health, safety and ergonomics concerns.

(18) Involving the workforce

"What is the best way to involve people in the ergonomics program who are not on the ergonomics committee?"

The ergonomics committee needs to respond to expectations about the participatory ergonomics(2) project. It is important to gain support or "buy in" from people within the organization who are not directly involved in the participatory ergonomics project. The ergonomics program needs to be visible within the workplace(19); this can be accomplished by ensuring that there is a focused effort to communicate with workers(20) and by involving key stakeholders(21) in all changes that are investigated and implemented.

A discomfort survey[14] (page A10-A11 in PDF document) can be used to gain input from workers when the ECT is identifying projects to work on. After a change has been implemented, a 'one minute survey'(23) can be used to follow up with those affected by the change to ensure that the problem or ergo concern has been resolved.

(19) Visibility of the ergonomics team

Once the ergonomics committee has set goals, they should be communicated to all people(20) in the organization who should be aware of the existence of the ergonomics program (workers, local management, corporate management). In order to gain support or buy in from those who are not directly involved in the ergonomics committee, the team needs to initially focus on making changes that are visible or tangible to the rest of the organization. Often, individuals who are initially skeptical about the participatory ergonomic process become supporters once they see results of the ergonomics committee's efforts. In making initial changes, the rate of change needs to be considered. If the rate of change is "too slow" then the ergonomics program may fall into disrepute within the workplace. If changes occur too fast, it is likely that workers will feel "not involved" and "left behind".

[14] http://www.escs.uwaterloo.ca/library/blueprinta.pdf

Case study examples:

At the start of the participatory ergonomics project in an auto parts manufacturing facility, "quick fix" or "fast tracked" changes were made in order to give the ergo team members a positive experience of working together and to provide tangible evidence to the rest of the workforce that the ergo team was making a difference.

Early on in the ergonomics program at a manufacturing facility, influential (production) managers were not aware of what the ergo team was trying to accomplish or what changes it had made in the plant. The ergonomics champion(10) found the following activities increased the visibility of the team within the organization:

- provide ergonomics training for engineers and supervisors
- report the ergo team's activities in an issue of the health and safety bulletin
- present ergo team activities during the annual "safety week"
- circulate a detailed list of ergo team accomplishments and plans to managers as a regular update
- speak about the ergo team in safety committee and return to work committee meetings

(20) Communication with workplace

The timing of notifying people who are not directly involved in the ergo team(18) must be considered. If workers are not notified of a change soon enough rumors will circulate, and opinions about the upcoming ergonomics change will be formed based on the rumors, not facts. If people are notified of upcoming changes too early and delays occur, then they may become frustrated with the lack of process as they wait for a change to be implemented. Communication is the key to avoiding these potential obstacles.

Case study example:

In an auto parts manufacturing facility, workers knew a layout change was coming, but management didn't provide workers with details on the planned changes. Workers felt "stressed out" when the new layout was introduced because workers felt the change made their jobs more physically demanding and the new layout made the work areas more crowded.

Go back to involving the workforce.(18)

(21) Worker input

When the ergonomics committee(22) is investigating changes to workstations or lines, it is very important to involve as many workers as possible, as well as supervisors and other technical staff (i.e. engineering, maintenance) who may be affected by the change. Participation of all stakeholders leads to a shared understanding of the problem, to team building and to feelings of involvement in the decision making process. Often workers are more likely to accept the changes if they were involved in improving the job. With inadequate worker participation, it is more likely that the solutions implemented will be less than optimal

Case study examples:

In working with several different workplaces (auto parts manufacturing, garment manufacturing and courier) it has been our experience that shift meetings and suggestion boxes are met with limited success at best.

We have found that a "one minute survey(23)" is a good way to get broad input. In the auto parts manufacturing facility, ergo team members emphasized the importance of consulting with workers in making changes. The one minute survey(23) had strong endorsement from the ergo team and workers as a useful way to gather information, and one that reflected the participatory nature of the project.

In a garment manufacturing facility, the ergonomics committee found that doing a "walkthrough" of one department at a time as part of each meeting was the best way to gather information from workers. After each meeting the team asked each worker in the department whether they were experiencing any pain or discomfort[5], if they have any ergonomics concerns about their jobs and if they have any suggestions for improvements. Team members also observed working postures to identify jobs that may benefit from ergonomics improvements even if workers are not currently reporting pain or discomfort.

* Discomfort survey is on page A10 and A11 of the PDF document

(22) Ergonomics team

Depending on your workplace, an ergonomics change team (ECT) may also be referred to as an ergonomics committee or ergonomics team. The ergonomics team is the essence of a participatory ergonomics program. The committee is responsible for identifying areas for improvement, developing solutions to address ergonomics concerns, implementing and evaluating changes[4].

(23) One minute survey

A one minute survey (OMS) is a method to get input about ergonomics changes from a large number of people who are affected by the change. It is a short (5 questions) survey that solicits worker perceptions of an ergonomic change. It usually includes a photo of the change that has been implemented. We have found that a OMS is a very effective method to involve people(18) who are not on the ergo team(22) in the participatory ergonomics(2) process. Typically one or two members of the team interview workers about an intervention currently underway. Ideally, the OMS is completed when the intervention is in the prototype stages.

The survey[4] asks the following questions:

- Have you used this improvement?
    - No, haven't even seen it
    - No, have seen it but not used it
    - Yes, once or twice
    - Yes, a few times
    - Yes, regularly
- If you answered yes, how would you rate this improvement? (on a scale of 1 to 7 where 1 is "Hate it, worse than before!" and 7 is "Love it - huge improvement!")
- What are some advantages of this improvement?
- What are some disadvantages of this improvement?
- Do you have any suggestions for improvement?

(24) Successful, sustainable programs

We often refer to implementing a "successful and sustainable" participatory ergonomics program. By "successful" we are referring to the ergonomics committee's ability to make meaningful changes to the workplace that reduce the risk of musculoskeletal injuries, improve product quality, improve efficiency or improve operator comfort. A participatory ergonomics program is "sustainable" if it is able to continue to implement changes despite turnover on the ergonomics committee, changes in personnel within the workplace and other challenges (contract negotiations, layoffs, restructuring, budget reductions, etc.).

(25) Ergonomics

Ergonomics is human-centered design. It is the process of designing or modifying tools, materials, equipment, work spaces, tasks, jobs, products, systems and environments to match the mental and physical abilities and limitations and social needs of all people affected (Wells et al., 2000[15]).

(26) Further reading

UNITE (2001) Ergonomic Handbook for the Clothing Industry[16]

UNITE HERE (2004) Handbook on Participatory Ergonomics

Wells, R., Norman, R., Frazer, M., Laing, A., Cole, D., and Kerr, M. (2003). Participative Ergonomic Blueprint[17].

(27) Search

This page presented a standard search feature allowing the visitor to search all of the page content, just within the "core" content, or just within the "visitor" content.

(28) Contact me

If you have any general comments or questions related to this study please contact either:

Tanya Morose

MSc Candidate

Department of Kinesiology

Email: temorose@uwaterloo.ca

Or

Dr. Richard Wells

Director, CRE-MSD

Department of Kinesiology

Phone: (519) 888 4567 x33069

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[15] http://www.escs.uwaterloo.ca/bprint.html

[16] http://www.iwh.on.ca/archive/pdfs/ergohandbook.pdf

[17] http://www.iwh.on.ca/archive/pdfs/ergo_blue09_03.pdf

Email: wells@uwaterloo.ca

If you have any concerns regarding your participation in this study please contact

Dr. Susan Sykes,

Director, Office of Research Ethics

Phone: (519) 888 4567 x36005

Email: ssykes@uwaterloo.ca

(29) Help

This website is a wiki[18]; it is a dynamic resource that solicits visitor contributions for the benefit of the community.

Navigation

The left menu shows the pages that you've visited and can be sorted in one of four ways:

- [ABC] alphabetically by page title (like an index)
- [123] numerically in the order pages were visited, with the most recent page at the top of the list
- [%] frequency of page visit, with the most frequently viewed page at the top
- [TOC] A traditional menu showing all pages, even if you haven't visited them.

As you browse you will find words that are 'clickable'. These hyperlinks will take you to additional pages of information (don't worry, your browser's back button will still work).

If you find the wiki-style navigation frustrating, we suggest that you navigate the website using the site map(30).

Searching

[18] http://en.wikipedia.org/wiki/Wiki

There is a search function(27) built into this website. You can chose to search all site content, just the core content written by Tanya Morose, or just the visitor-contributed content.

Visitor-contributed content

Since this is a wiki style website, we are seeking visitor contributed content. To share your experiences with participatory ergonomics or to respond to content on the website or posted visitor contributed content, click the "please contribute" link at the top of the yellow section on each page and add your comments to the visitor contributed content that has already been posted and click 'save' when you've finished. **You'll be able to edit what others have written. Please take care to not completely delete their ideas, but instead insert or add your views to create a balanced point of view for future readers.** Tanya Morose is notified of ALL modifications to each page and all versions of the visitor contributions are backed up to prevent abuse. Excessive bias-inducing changes may be deemed as vandalism and deleted or modified by Tanya Morose.

Feel free to contact us(28) if you have any questions that we haven't answered.

Tanya Morose(28)

(30) Site Map

Appendix B: Questionnaire

Participatory ergo and me

1. How would you rate your knowledge of participatory ergonomics prior to visiting this website?

   □ None
   □ Novice: I have heard of participatory ergonomics.
   □ Intermediate: I have read about participatory ergonomics.
   □ Expert: I am aware of the literature and have implemented participatory ergonomics.

2. Which of the following statements applies to you? Please check all that apply.

   □ I do not plan to tell anyone about this website.
   □ I do not plan to talk to anyone about participatory ergonomics.
   □ I plan to refer a colleague/client to this website.
   □ I plan to talk to a colleague/peer/client about participatory ergonomics.
   □ I am planning to discuss/review the information on participatory ergonomics with my co-workers/colleagues/manager/clients.
   □ I am planning on taking steps to determine if a implementing a participatory ergonomics program is suitable for my (clients') workplace.
   □ I am planning on implementing a participatory ergonomics program in my (clients') workplace.
   □ I already use a participatory approach in my (clients') workplace.

3. Do you know more about participatory ergonomics after visiting this website?

   □ Yes
   □ No
   □ Not applicable

4. Did any of the information on this website contradict to what you already knew about participatory ergonomics?

   □ The content of the website did not contradict my prior knowledge about participatory ergonomics.
   □ Some of the website content contradicts my knowledge of participatory ergonomics. Please elaborate on the disagreement(s) between the website content and your knowledge. <Big text box>

5. Did you find the examples from different industries helpful?

   X X X X X

   Not at all helpful very helpful

6. Please tell us what you think about the core content on this website (the black text on white background in the top half of the screen).

X	X	X	X	X	X
Not very believable		Somewhat		Very believable	No opinion
X	X	X	X	X	X
Not very fair (biased)		Somewhat		Very fair (unbiased)	No opinion
X	X	X	X	X	X
Not very accurate		Somewhat		Very accurate	No opinion
X	X	X	X	X	X
Not very in depth		Somewhat		Very in depth	No opinion

Implementing a participatory ergonomics program

7. Would you require any additional information to help decide if a participatory ergonomics approach is right for your (clients') workplace?

□ No
□ Yes (Please elaborate) <big text box>

8. Would you require any additional information to implement a participatory ergonomics program in your (clients') workplace?

□ No
□ Yes (please elaborate) <big text box>

User comments The following questions refer to the user contributed content (the shaded area at the bottom of each screen).

9. Did you contribute to the content of the website?

□ Yes
□ No

If you answered no, please check all the reasons why you chose to not add to the website content.

- □ I don't have any experience with ergonomics
- □ I don't want to share my experiences
- □ I didn't know I could add to the content of the website
- □ I couldn't figure out how to add to the content
- □ Other – Please specify _____

Do you have any suggestions for improving the process for contributing to the website content?

<big text box>

10. Did you find the user contributed content was helpful in understanding participatory ergonomics?

	X	X	X	X	X
Not at all helpful					very helpful

11. Please tell us what you think about the user submitted content on this website

X	X	X	X	X	X
Not very believable		Somewhat		Very believable	No opinion

X	X	X	X	X	X
Not very fair (biased)		Somewhat		Very fair (unbiased)	No opinion

X	X	X	X	X	X
Not very accurate		Somewhat		Very accurate	No opinion

X	X	X	X	X	X
Not very in depth		Somewhat		Very in depth	No opinion

Your Internet use

12. Please tell us what you think about the health, safety and ergonomics content on the Internet in general

X	X	X	X	X	X
Not very believable		Somewhat		Very believable	No opinion
X	X	X	X	X	X
Not very fair (biased)		Somewhat		Very fair (unbiased)	No opinion
X	X	X	X	X	X
Not very accurate		Somewhat		Very accurate	No opinion
X	X	X	X	X	X
Not very in depth		Somewhat		Very in depth	No opinion

13. To what extent do you agree or disagree with this statement: "I rely heavily on the Internet to obtain information about ergonomics."

- ☐ Strongly agree
- ☐ Somewhat agree
- ☐ Neither agree nor disagree
- ☐ Somewhat disagree
- ☐ Strongly disagree
- ☐ No opinion

About me

14 What is your role in your workplace? Please check all that apply.

- ☐ Health and safety manager
- ☐ Ergonomist
- ☐ HSA consultant
- ☐ JHSC member
- ☐ Plant manager
- ☐ Occupational nurse
- ☐ Worker
- ☐ Floor supervisor
- ☐ Human resources
- ☐ Other. Please specify _____

15. What industry best describes your workplace?

    - ☐ Electrical utilities
    - ☐ Manufacturing
    - ☐ Construction
    - ☐ Pulp and paper
    - ☐ Service (tourism, hospitality, etc.)
    - ☐ Health care
    - ☐ Other _____

****

Please provide your contact information if you would like to be notified of the results of this study or if you would be interested in being notified of other CRE MSD research activities. All identifying information is stored separately from the feedback provided above. It is not possible to associate the answers given to any person.

☐ Please notify me of the results of this study
- ☐ By email
- ☐ By post

☐ I would be interested in being notified of other CRE MSD research activities

Name:
Title:
Company:
Address:
Phone:
Fax:
Email:

Appendix C: Additional information required to proceed with implementing a participatory ergonomics program

The following are verbatim responses to the questions “would you require any additional information to help decide if a participatory ergonomics approach is right for your (clients’) workplace?” and “Would you require any additional information to implement a participatory ergonomics program in your (clients’) workplace?” on the questionnaire.

“Would you require any additional information to help decide if a participatory ergonomics approach is right for your (clients’) workplace?

- What are the disadvantages of implementing such a program? I'm particularly concerned in a unionized environment.
- What's the pay off?
- I can appreciate the amount of work it has taken to set up this site and am very glad you have taken the effort. Understanding this is part of a thesis, I think this is an excellent foundation to start from. I would not expect you to add a lot more content for your thesis. What I would like are case examples of "Who would benefit from a participatory ergonomics program" You may want to highlight firms with higher rates of ergonomics-related WSIB claims.
- What existing health and safety programs must be in place? How much time is required? How much money is required to pay the employees to be on the committee, to do the assessments and to do the necessary changes? A checklist to determine if the client has what it takes to be successful?
- Extent to which management supports it with money and time. The workplace goals/expectations for ergonomics.

- difficult to find information on the website. more examples of studies similar to NIOSH website:
- I don't think it's additional information that I would need, it's more needing to know if my workers would respond positively or negatively towards such a program. I would need to survey my workplace before to determine the interest for such a program.

Would you require any additional information to implement a participatory ergonomics program in your (clients') workplace?

- One thought I had was what statistics from industry could we provide to our clients that support their financial ergo commitment reduced MSI
- tools/methods to measure success of program
- Further information on how to gain top management drive is essential. How does one gain that?
- As a full-time occupational health and safety professional, I have a hard time dedicating a lot of time to writing up the various policies and procedures required as part of an ergonomics participatory program. I don't believe this site should actually write them for the end user, however, providing advice and working examples would be beneficial...I can work from a table of contents of things to consider while implementing such a program.
- Estimates of costs of successful programs, and what kind of measurable outcomes are used to determine success, and best techniques for transfer information to others to sustain programs.
- Guidelines for program Guidelines for training program Guidelines for assessment tools and equipment Guidelines for assessment

- More research findings/case examples from companies similar to client's company re implementation & successes to help promote/"sell" to management & workers
- more detailed information on the process (steps/stages) more information on types of assessments that may be conducted, when they should be conducted, by whom and resources available, (both consultants and assessment tools)
- I would need to determine level of interest from my workers before implementing PE.
- This site directs to appropriate references with which I would use to implement participatory ergonomics
- a practical timeline for implementation and turn around of stats to show improvements
- About technical applied participatory ergonomy
- I don’t think it’s additional information that I would need, it’s more needing to know if my workers would respond positively or negatively towards such a program. I would need to survey my workplace before to determine the interest for such a program.

Appendix D: Verbatim Visitor Comments from Website

The following are verbatim website content contributed by visitors. The comments in italics were added by Tanya Morose in response to requests for additional information in the open-ended section of the questionnaire.

Financial Resources

How much money is required to pay the employees to be on the committee, to do the assessments and to do the necessary changes?

That depends on the size of your team (and their hourly wages), the frequency of ergo team meetings, and the types of changes that the team wants to implement. To determine the labour costs for ergo team members, you can use the following rough estimate of the time commitment required:

- *Initial training: 18 to 24 hours*
- *Monthly ergo team activities: 4 - 8 hours per team member for meetings and working on projects outside of meetings (8 hours is a relatively high estimate for monthly time commitment required)*
- *Ergonomist's time: approximately 300 hours for 1 year of involvement*

Assuming an average hourly rate of $25/hour for all team members (professionals and workers), an 8 member ergonomics team and 300 hours of a corporate ergonomist's time, the labour costs to provide relief time to allow team members to participate in training, meetings and project work outside meetings for the first year of the project is approximately $27 000 to $38 000. If an external ergonomics consultant is hired to facilitate the project, the labour costs would increase to approximately $42 000 or $53 000 for the first year of the project.

I have personally been involved in some other ergonomics teams that only met for one hour once per month, and where only a few team members worked on activities outside of meetings. Obviously, the total labour costs for this participatory ergonomics program would be much lower, but the team's progress, and therefore the overall impact of the PE program, was much less than "more active" teams who met more frequently and participated more fully in team activities.

Based on our experience we would recommend an ergo team budget of $10 000/year to implement "small changes" and larger expenditures would go through the "normal" expenditure approval process at your facility (added January 29, 2007).

Time

How much time is required?

During a 10 moth intervention, the 9 member ergonomics committee met 24 times (every 2 weeks).

The team members collectively spent 870 hours in training, in ergonomics committee meetings and working on ergo team projects outside of meetings. During the first month, each team member participated in 18 hours of training. Once the ergonomics team was set-up, each team member spent approximately 7-8 hours/month in team meetings, and working on ergo projects outside of meetings (this amount of monthly involvement is high relative to other PE teams that I have been involved in).

During the same intervention, the ergonomist spent approximately 300 hours facilitating the process. This time commitment provides a rough estimate of the time that would be required of a corporate ergonomist to implement a participatory ergonomics program in a new worksite (added January 29, 2007).

Workforce ergonomics training

How much, if any, focus should be placed on training an understanding of the anatomy of the most at-risk joints? (added February 20, 2007)

Ergonomics team formation

We have a selection of staff that form that support group. Physiotherapist, nurse case manager (OH&S), specific union rep, manager/delegate, labour relations as needed (added May 1, 2007).

Resources and Support

In addition to financial resources and time - the team using a PE approach must ensure recommendations and comments from all persons are well received. If a team takes comments or recommendations from its worker resources but never included their ideas in the final intervention problems will exist and the team will cease to function effectively (added February 20, 2007).

I can only contribute what seems currently to work at our site. We are a health care site and OH&S does all of the case management of STD, LTD, & WSIB cases. We employ and outside physiotherapy firm to assist us in managing the ergonomics and MSD issues. They provide us with a kiniesologist and a physiotherapist. The physio and the Nurse case manager in OH&S work with the staff member in making the adjustment from illness/injury to resume duties in the workplace. Weekly meetings with staff, union, nurse, manager/delegate physio ensure a safe transition.

In addition a current physical/ and sometimes cognitive demands analysis of all of the positions should be available on an ongoing basis. If it is not possible to do all then at least do the main positions that cause most of the injuries (added May 1, 2007).

Ergonomics Expert

I agree and think that often ergonomics experts are not used to their capabilities or are overused for actions that a committee could complete on their own. Finding that line is sometimes difficult (added February 20, 2007).

Integrating Ergo into the workplace

In my experience of forming ergonomic teams - I have found that implementing the process with one already familiar has worked extremely well. I now know of teams that have rename themselves the Joint Health, safety and ergo committee. However, it should be noted that if the JHSC is dysfunctional in its current form this will not be effective (added February 20, 2007).

Successful Sustainable PE Programs

I have found that when teams start - a good way to achieve early success is to work on small easy to implement but highly visible interventions. This helps both workers and managers to see the effectiveness of the implementation of changes. If you start with a big problem that is complex the chance of needing several opportunities to make it “right” may result in a loss of support from the workplace (added February 20, 2007).

I have also seen in larger industrial settings that flexibility is an issue in that when one team of workers have input into the design and production processes, these modifications should be “personalized” to that team. Another group of individuals in the same or similar work station should have the flexibility to design alternate approaches. However, changes implemented by one group become “law” for all and may thereby lose their effectiveness. One person's (or team's) improvement may be another's burden (added February 20, 2007).

A systematic review of the effectiveness of participatory ergonomic interventions is on the Institute for Work and Health\'s website at http://www.iwh.on.ca/SR/wi_part_ergo.php (added October 24, 2006).

What kind of measurable outcomes are used to determine success?

The following "measurables" are based on work by Cole et al (2002) and personal experience with ergonomics programs in a variety of industries. The health indicators at the top of the list are "leading" health indicators and "lagging" health indicators (i.e. may take months or years to demonstrate the impact of the PE program) are towards the bottom of the list.

- *Management awareness of ergonomics program*
- *Commitment to change (management and employees)*
- *Resources for the ergonomics program*
- *Number of changes implemented*
- *Number of workers affected by the change*
- *Utilization of the change (what percentage of workforce is using the intervention a few weeks after implementation?)*
- *"Quality" of ergo changes (What is the impact of the ergo change(s) on the exposure to risk factors? Can be evaluated by risk factor screening tools or full ergonomics assessments before and after the implementation of ergonomics changes)*
- *Changes in pain or discomfort (comparison of discomfort survey results before and after ergo changes)*
- *Changes in reported pain/discomfort (first-aids, medical centre visits)*
- *Absenteeism and turnover rates*
- *Frequency and severity of work related (WSIB) and non-work related injuries (claim costs, claim duration, number of claims)*

Other non-health "measurables" may include

- *Productivity*
- *Efficiency*
- *Scrap or number of "seconds" produced (added January 29 2007).*

Participatory Ergonomics

A process approach to participative ergonomics can be found at: http://www.iwh.on.ca/archive/pdfs/ergo_blue09_03.pdf (added October 24, 2007)

This is a clear website outlining participatory ergonomics (PE) in lay terms suitable for anyone in ergonomics. It lays out the purpose of PE and gives really good examples. I also think the hyperlinks to key terms (highlighted in blue) are very helpful- especially for a novice Ergonomist (added February 20, 2007).

People might also want to check out – "ERGO groups - A tool for WMSD prevention" from the IRSST. I think it is only available in French, but if you have a basic ability to read French you will get the sense of what they are suggesting. http://www.irsst.qc.ca/en/_publicationirsst_635.html Also, while not specifically participative ergo ... the new MSD Prevention Guideline for Ontario and the related Resource Manual both speak to involving workers in the various phases of MSD prevention. These two documents can be downloaded at: http://www.wsib.on.ca/wsib/wsibsite.nsf/Public/preventmsd (added March 19, 2007).

The WSIB prevention document noted above encourages a participative team approach but falls short of recommending an actual ergonomics committee, preferring an ad hoc approach. Having had some experience with ergonomic committees I can attest to the fact that they are far more difficult keep momentum (than a joint health and safety committee for example) because they are a cost

avoidance activity and it is often difficult as we know to garner funds from a company on this basis. Additionally they are not mandated although from a due diligence perspective we might assume an implied imperative. What makes it even more difficult is the real benefits are often not recognized for years by an absence of repetitive strain and traumatic MSD injuries (added April 30, 2007).

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