ATHABASCA UNIVERSITY

EFFICACY OF EFFICIENT REMOTE OFFICE ERGONOMICS EDUCATION

BY

RANDALL TRESIDDER

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF EDUCATION IN DISTANCE EDUCATION

FACULTY OF HUMANITIES AND SOCIAL SCIENCES

ATHABASCA, ALBERTA

JANUARY, 2021

Athabasca University
FACULTY OF GRADUATE STUDIES

The future of learning.

Approval of Thesis

The undersigned certify that they have read the thesis entitled

EFFICACY OF EFFICIENT REMOTE OFFICE ERGONOMICS EDUCATION

Submitted by

Randall Tresidder

In partial fulfillment of the requirements for the degree of

Master of Education in Distance Education

The thesis examination committee certifies that the thesis
and the oral examination is approved

Co-Supervisors:
Dr. Mohamed Ally
Athabasca University

Dr. Cynthia Blodgett-Griffin
Athabasca University

External Examiner:
Dr. Terra Murray
Athabasca University

January 25, 2021

1 University Drive, Athabasca, AB, T9S 3A3 Canada
P: 780.675-6821 | Toll-free (CAN/U.S.) 1.800.788.9041 6821
fgs@athabascau.ca | fgs.athabascau.ca | athabascau.ca

Dedication

This thesis is dedicated to my loving wife, Dr. Shailini Sarwal. She taught me patience and to continually learn. She also taught me how to let the inner child out every once in a while to lighten up. May she rest in peace.

Acknowledgement

I would like to express my gratitude to the individuals who participated in this study to the end. They took on the added workload required during these busy times so that this study could move forward.

I would also like to express my appreciation to my co-supervisors, Dr. Mohamed Ally and Dr. Cynthia Blodgett-Griffin. Their guidance during this journey was extremely helpful. I would like to give a special thanks to Dr. Blodgett-Griffin who spent several hours to help guide a group of us through the abyss of the master's thesis every two weeks. This helped to keep me on track and move forward instead of slowing down after my last formal course.

I would also like to say thank you to Dr. Terra Murray for being the external examiner and taking an interest in this topic.

Abstract

Many employees have makeshift areas within their homes to conduct their work during the current pandemic, increasing their risk for discomfort and injury. This study looked at the ability of a distance education office ergonomics course for participants in Canada who normally work in an office and are now working from home because of the global pandemic where physical distancing limits the ability to obtain a face-to-face ergonomic assessment. Using an explanatory sequential mixed methods design, the distance education course was assessed to determine its effectiveness in addressing knowledge and behaviour of office ergonomics. There was evidence of increasing knowledge after participants completed the eLearning program and adoption of this knowledge after the provision of feedback from the participant photos submitted for review. In future, a larger group should be identified to recreate this study using a randomized-cluster design.

Keywords: office ergonomics, distance education, photo-based assessments, ergonomics assessment, ergonomics training, eLearning

Table of Contents

List of Tables

List of Figures and Illustrations

Chapter 1. Introduction

Due to the current global pandemic, many employees have makeshift areas within their homes to conduct their work which increases the chance of poor posture and increases the risk of discomfort and injury (Kline, 2020). This can include using the kitchen table or sitting on a couch with a laptop computer. There are currently limited choices for employees to remotely address their ergonomic needs during a time of physical distancing and working at home during this global pandemic. There are options available, but they are either expensive, have limited effectiveness, or take a good length of time.

Although there are not many studies available regarding the use of web-based training for office ergonomics, there are enough that warrant a look at an abbreviated distance education course to determine its effectiveness (Dalkilinç & Kayihan, 2014; IWH, 2015; Rucker, 2004; Sonne & Andrews, 2012; Work Safe Alberta, n.d).

This study will provide insight into the effectiveness of an abbreviated office ergonomics program offered through a distance education course.

Introduction

At present, ergonomic assessments are provided through self-assessment checklists, participatory ergonomics, instructor-led education, and some online programs (Bohr, 2000, 2002; Dalkilinç & Kayihan, 2014; IWH, 2015; Kirk et al., 2013; Sonne & Andrews, 2012; Work Safe Alberta, n.d.). With the current global pandemic and the increased need for employees to work from home, there needs to be an option to access an abbreviated office ergonomics program that provides input from someone with advanced knowledge of ergonomics.

Background

With increasing computer use over the years, there is an increase in workplace musculoskeletal disorders (WMSD) that cause employees discomfort (Dalkilinç & Kayihan, 2014; Kirk et al., 2013; Meinert, et al., 2013; Robertson et al., 2009, 2017; Swinton et al., 2017). The causes of these injuries have been shown to be related to physical and psychosocial risk factors (Bohr, 2000, 2002; Meinert et al., 2013; Robertson et al., 2017). The main physical risk factors are caseload, repetitive work, static and/or awkward postures, and amount of time spent at the computer (Berner & Jacobs, 2002; Meinert et al., 2013; Robertson et al., 2017). Psychosocial risk factors include high mental loads, high job demands, low job control, lack of supervisory support, and low job security (Bongers et al., 2002; Christensen & Knardahl, 2010). As stated by Blatter and Bongers (2002), "physical factors seem to be responsible for the adverse effect of computer work…[and although] psychosocial factors in itself are associated with the presence of symptoms, they are not related with duration of computer work" (p. 304).

Office ergonomic education is meant to provide the client with knowledge on identifying risk factors for WMSD, understanding the importance of dynamic movement and varying work postures, knowing how to set up the workstation, recognizing visual concerns and being able to address them, and using good computer use habits (Bohr, 2000, 2002; Dalkilinç & Kayihan, 2014; Robertson et al., 2009; Rucker, 2004). The client is then expected to apply this knowledge by setting up their workstations and changing habits to reduce the risk of injury and discomfort in the workplace. Although Berner and Jacobs (2002) discuss ergonomic training as common in many settings, including home and workplace, Yazdani and Wells (2018) indicate that there are

industries and situations that lack an easily accessible training program. Some of the reasons for decreased accessibility include:

(i) Lack of time;

(ii) Lack of resources;

(iii) Lack of communication;

(iv) Lack of management support, commitment, and participation;

(v) Lack of knowledge and training;

(vi) Resistance to change;

(vii) Changing work environment;

(viii) Scope of activities;

(ix) Lack of trust, fear of job loss, or loss of authority;

(x) Process deficiencies; and

(xi) Difficulty of implement controls. (p. 122)

Personal Interest

As an example, this author currently works in a publicly funded institution and is required to provide ergonomic assessments for approximately 12,000 employees within a geographical area that is nearly 150 kms by 50 kms. Taking into account that an in-person ergonomic assessment can take 45 to 60 minutes and writing the report can take 30-60 minutes, it would take approximately 11 years to provide assessments for all employees excluding travel time and staff turnover. The current reality is that there are 100 direct employee assessment requests per year which equates into 0.1 years, or 10 percent of this author's annual caseload. The current management expectation to conduct

individual office ergonomic assessments represents only two to five percent of this author's annual caseload (personal communication, A. Keenan, May 27, 2013).

Another example of access relates to clinical provision of treatment. As a physiotherapist, this author has treated clients in the past and has recommended an ergonomic assessment. If this is not addressed, it could pose a barrier to treating musculoskeletal disorders such as neck, shoulder, or low back pain. Due to the lack of budget or resources listed above, some employers find it difficult to pay for an assessment, which can cost a few hundred dollars (Yazdani & Wells, 2018). This then places the responsibility of payment on the client and can delay treatment effects if the client is unable or unwilling to cover the cost.

One more example of access has been brought to light during the recent global pandemic related to COVID-19 (Ducharme, 2020). The Public Health Agency of Canada has advised the public to minimize exposure to each other through physical distancing, frequent proper hand washing, using coughing and sneezing etiquette, disinfecting high use areas such as door handles and toys, and to stay at home as much as possible (Government of Canada, 2020). For workplaces, this may mean "changing hours of operation, closing for a period of time or working from home" if the workplace is not considered an essential service (Government of Canada, 2020). These steps make it difficult for the average worker to be able to access an ergonomic expert to provide a face-to-face assessment and it is inefficient for an ergonomic expert to conduct individual assessments in separate houses.

The internet provides increasing access to information (Dalkilinç & Kayihan, 2014; Meinert et al., 2013; Rucker, 2004). Providing ergonomic online resources through

distance education would transcend these barriers by teaching best practices for the client or employee to set up their own workspaces, assess results, and change behaviours. If feedback is desired, one possible option is for the treating physiotherapist or ergonomic consultant to use photo analysis of the setup (Covalla, 2003; Liebregts et al., 2016).

Statement of the Problem

Currently office ergonomics training is conducted through checklists, instructor-led education, and some online programs (Bohr, 2000; Dalkilinç & Kayihan, 2014; IWH, 2015; Kirk et al., 2013; Sonne & Andrews, 2012; Work Safe Alberta, n.d.). This can be expensive and time-consuming when using face-to-face methods including consultant reviews or instructor-led courses (Meinert et al., 2013; Sasson & Austin, 2005; Sonne & Andrews, 2012). This would be the cost of the consultant, the instructor, and the employee time required to conduct the education or review. Many of these methods provide education to increase knowledge, but they may or may not address behaviours (Bohr, 2002; Dalkilinç & Kayihan, 2014; Robertson et al., 2009; Rucker, 2004). These methods are especially difficult to use when employees are being asked to work from home and maintain physical distancing (Government of Canada, 2020).

Some authors have identified that psychosocial stress can affect the physical discomfort felt by employees and believe that participatory ergonomics can help the employee by addressing one or more components of psychosocial stress (Bohr, 2000; Kirk et al., 2013; Robertson et al., 2009; Swinton et al., 2017). This can include having the "end-users as active participants in the identification and analysis of ergonomic risk factors, as well as the design and implementation of ergonomic solutions" (Kirk et al., 2013, p. 287). Components of psychosocial stress include the employee perception of

ergonomics climate, corporate culture, and workplace design satisfaction (Robertson et al., 2017).

With the current global pandemic, access to many of these resources is difficult because of the cost and inefficiency for someone with advanced knowledge of ergonomics to conduct in-person assessments.

Self-Assessment Checklists

One method of addressing the need to access ergonomic information at home is through the use of a self-assessment checklist (Baker et al., 2013; Janowitz et al., 2002; Sonne & Andrews, 2012). This would allow the employee to conduct their own assessment, but literature has shown that employees have a difficult time correctly identifying the problematic areas of the workstation (Baker et al., 2013). But if someone with advanced knowledge of ergonomics is included when using the checklist, problem areas are identified and appropriately addressed (Janowitz et al., 2002; Sonne & Andrews, 2012).

One example of a checklist that is reliable and has construct validity is the Rapid Office Strain Assessment (ROSA) that requires approximately 15 minutes of observation and specific just-in-time education to address any concerns with setup (Sonne & Andrews, 2012). This checklist has also been shown that when "remotely performed, photo-based ergonomic assessments showed potential as a valid assessment method; however, improvements must be made before an intervention program is implemented in the workplace" (Liebregts et al., 2016, p. 320).

Alternative to Checklist

With the barrier of physical distancing introduced by the COVID-19 pandemic, is there a way to provide education that the employee can access from home and implement on their own? There are free resources on the internet such as eOfficeErgo: Ergonomics e-learning for office workers provided by the Institute for Work and Health (IWH, 2015). The concern is that this program takes 90 minutes to complete and it is recommended that there should be a "follow up with in-person sessions designed to increase the confidence of workers and supervisors in their ability to successfully identify problems and implement solutions" (IWH, 2015). This author was also advised that many ergonomists have requested training shorter than the online program provided by the Institute for Work and Health (D. Van Eerd, personal communication, November 19, 2019). Mr. Van Eerd mentioned that he was also unaware of any shorter resources.

Remote Accessibility as a Requirement

With the current pandemic, employees need to be able to access resources remotely and be confident in their ability to identify problems and implement appropriate strategies to address these problems. A self-assessment checklist can be used, but as identified, employees often miss the problematic areas (Baker et al., 2013). The use of the checklist would require follow-up from someone with advanced ergonomic knowledge (Baker et al., 2013; Janowitz et al., 2002; Sonne & Andrews, 2012). An eLearning program can be used that guides the employee through various steps and provides guidance on some solutions, but again this requires input from someone with advanced ergonomic knowledge (IWH, 2015).

Telehealth can be another option for remote access. Telehealth uses the premise of two-way communication through the use of photos or video and tries to replicate the ergonomic expert being on location (Baker & Jacobs, 2014; Ritchie et al., 2017). A limitation to this approach is the cost for the time for the ergonomic expert and in some cases the equipment and bandwidth for communication (Ritchie et al., 2017). There is a requirement to provide an abbreviated office ergonomic education program that provides feedback from someone with advanced knowledge of ergonomics.

Purpose Statement

The purpose of this study was to evaluate the effectiveness of an abbreviated office ergonomics course offered through distance education for employees working from home during the current global pandemic.

Research Question

The primary research question is: how effective will an abbreviated distance education course for office ergonomics training be to address behaviour and employee discomfort for employees working from home during the current global pandemic?

Subquestions to be explored included:

1. What was the effectiveness of providing advanced ergonomic advice after completing the eLearning course?
2. What are the drivers and the barriers that allow the employee to enable changes in their behaviour towards the use of proper office ergonomics for employees working from home?

Delimitations

As noted by Mauch and Park (2003), the "two words delimitations and limitations are often confused. A *limitation* is a factor that may or will affect the study but *is not under control* of the researcher; a *delimitation* differs, principally, in that it *is controlled* by the researcher" (p. 114). A delimitation is a limit created by the choices of the researcher that defines the scope and boundaries (St. Cloud State University, 2017; Simon, n.d.). The first item to delimit the scope of the study was the knowledge of participants. The participants may have had access to the eLearning program that was used in this study as this was widely shared at the start of the pandemic. This author had prepared the program for use for a different research design but decided that the potential benefit to those working from home outweighed the necessity to hold back exposure to the program for the purpose of a research project.

A second delimitation to this study was the choice of participants. Participants were drawn from a sample of convenience via snowball sampling and were not representative of one particular group.

The last delimitation was this author conducted both the training and assessment which could have instilled bias. In order to limit this, a second reviewer who is knowledgeable about the assessment tool was recruited.

Limitations

As cited in the literature, many of the office ergonomic training studies have lacked control groups, randomly allocating study participants, and recording postures when the participant knew they were being assessed (Swinton et al., 2017). This study also did not include a control group and participants were not randomly allocated. The

participants were drawn from a snowball sampling method using e-mail and made up a sample of convenience. Because photos were taken by the participants or family members of the participants, participants were given warning when they were being observed. As stated by Swinton et al. (2017), it "is likely that this awareness influenced participants to adapt their behaviour thus providing a source of bias" (p. 211). The final limitation was the inability to recruit the appropriate number of participants for significance, the high number of participants that dropped out of the study and none of the participants completed all components of the study.

Definition of Terms

The following terms and their definitions are used in injury prevention:

Bandwidth. This is "the capacity for data transfer of an electronic communications system" (Merriam-Webster, 2020).

Ergonomics. It is "an applied science concerned with designing and arranging things people use so that the people and things interact most efficiently and safely" (Merriam-Webster, 2019).

Participatory ergonomics. A form of ergonomics that involves creating an ergonomics team (employees, managers, ergonomists, health and safety, research experts), having an expert provide training to the team, having the team use this new knowledge to make improvements in their areas and employ "participation, communication, and group problem solving" (Rivilis et al., 2008, p. 343)

Physical risk factors. Those risk factors that are physical in nature and can increase the risk of injury. Some physical risk factors are repetitive work, static and/or

awkward postures, and amount of time spent at the computer (Berner & Jacobs, 2002; Meinert et al., 2013; Robertson et al., 2017).

Psychosocial risk factors. Psychosocial risk factors are factors that are physical, but can induce stress and include high mental loads, high job demands, low job control, lack of supervisory support, and low job security (Bongers et al., 2002; Christensen & Knardahl, 2010).

Snowball sampling. A chain-referral sampling method where participants are chosen from friends within the network of the original participants identified (Salganik & Heckathorn, 2004).

Social determinants of injury. These are similar to psychosocial risk factors and include stress, lack of control, high demand, and a perceived lack of employment security (ACIP, 2011).

Web-based training. This is training that is conducted via a device such as a smartphone or computer over the internet or intranet (Rucker, 2004).

Workplace musculoskeletal disorders (WMSDs). These are injuries of the musculoskeletal system and can include injuries of muscle, tendons, and nerves (CCOHS, 2019).

Summary

Due to the current global pandemic, many employees have makeshift areas within their homes to conduct their work which increases the chance of poor posture and the risk of discomfort and injury (Kline, 2020). There are currently limited choices for employees to remotely address their ergonomic needs during a time of physical distancing and working at home during this global pandemic. With barriers such as lack

of time, physical distancing, and inefficiency of conducting individual assessments in separate homes, there is a requirement to provide an abbreviated office ergonomic education program that provides feedback from someone with advanced knowledge of ergonomics (Ducharme, 2020; Yasdani & Wells, 2018). This study will evaluate the effectiveness of an abbreviated office ergonomics course offered through distance education for employees working from home during the current global pandemic.

Chapter 2. Literature Review

Musculoskeletal injuries associated with increasing computer use in the workplace are on the rise (Blatter & Bongers, 2002; Dalkilinç & Kayihan, 2014; Meinert et al., 2013; Robertson et al., 2009, 2017; Swinton et al., 2017). There have been various methods to try and address this concern such as self-assessment checklists, use of an ergonomic expert, instructor-led training, participatory ergonomics, and web-based approach to training (Bohr, 2000; Dalkilinç & Kayihan, 2014; Janowitz et al., 2002; Kirk et al., 2013; Liebregts et al., 2016; Meinert et al, 2013; Rivilis et al., 2008; Robertson et al., 2009, 2017; Rucker, 2004). With the current pandemic and the increased requirement to work from home, many employees are finding that their current home office setup is causing issues of increased discomfort (Boyle, 2020; Kline, 2020).

In order to determine effectiveness, a program needs to be evaluated. Evaluation in web-based programs, programs involving participatory ergonomics, and self-assessment methods will be reviewed. Despite these evaluations, there is a lack of effectiveness shown in the current literature to address office ergonomic concerns (Swinton et al., 2017; Hoe et al., 2018).

Injuries in the Workplace

There has been an increase in workplace musculoskeletal injuries that cause employees discomfort associated with increasing computer use (Blatter & Bongers, 2002; Dalkilinç & Kayihan, 2014; Meinert et al., 2013; Robertson et al., 2009, 2017; Swinton et al., 2017). Musculoskeletal injuries (MSI) are estimated to cost Canadians $22 billion per year (WHSC, 2016).

The costs of occupational injuries are not just a simple number. They represent direct costs such as medical costs to both the employer and employee, indirect costs such as productivity loss, salaries, employee benefits, ability for the employee to perform household work, legal costs, and administrative costs including the cost of recruitment and training of new employees (Lebeau & Duguay, 2013). There are also human costs "based on the value of the change in the quality of life of the injured worker and those in [their] circle (family, friends, co-workers, and other members of the community)" (p. 19).

Addressing injuries benefits private industry, the public sector, the taxpayer, and most importantly, the quality of life for the employee.

Office Ergonomics

One method to address injuries in the workplace is through the use of ergonomics. Ergonomics is the "scientific discipline concerned with the understanding of interactions among humans and other elements of a system" (IEA, n.d.). The intent is to reduce the risk of workplace MSI. Office ergonomics is the application of this scientific discipline to the office setting and the goal is "to set up your office work space so that it fits you and the job you are doing" (HealthLinkBC, 2017). Office ergonomics has been around for several years in order to address the various hazards within the office, especially since the advent of the computer (Bohr, 2000). It is thought that if the risk factors of awkward posture, repetitive motion, and static posture are addressed to encourage a neutral posture and frequent breaks with movement, the risk of injury due to the office will be reduced and provide a cost savings to the employer (HealthLinkBC, 2017; WCB NS, n.d.).

Approaches to Addressing the Issue

There are many approaches to trying to address the issue of setting up the employee in a neutral posture in the hopes of trying to reduce the pain, discomfort, and economic costs of musculoskeletal injuries in the home-based office.

Self-Assessment Checklist

One method of assessment of office ergonomics is through the use of a self-assessment checklist (OHCOW, 2008; WCB Alberta, 2007; WorkSafe NB, 2010; WCB NS, n.d.; Cal/OSHA, 2018). These checklists are developed to allow computer users to "assess and improve their own workstations" (Janowitz et al., 2002, p. 1007). It permits the user to participate in their own changes and to take some control of what they can immediately change. Two studies showed that the checklist method was not significantly effective in assisting with workstation changes when conducted by the individual or by a co-worker, but it was effective when administered by someone with in-depth knowledge of ergonomics (Baker et al., 2013; Janowitz et al., 2002).

When reviewing the study by Janowitz et al. (2002), it should be noted that there was a variability of agreement between the expert and the participant's self-evaluation. A Kappa co-efficient comparing the experts' advice to the participant's evaluation had a range of -0.05 to 0.96 and a mean of 0.24 whereas expert to expert was 0.01 to 0.92 with a mean of 0.49. Even though the overall agreement was better among experts, there were some participants that used the checklist and were effective at addressing their own issues (Janowitz et al., 2002). This means that some people may be able to use a program without feedback, but the feedback should be available to ensure improvement.

Ergonomic Expert

Another method of assessment is through the use of a consultant with advanced knowledge of ergonomics (Baker et al., 2013; Janowitz et al., 2002; Kirk et al., 2013; Liebregts et al., 2016; Meinert et al., 2013). They often use a checklist to guide their assessments (Janowitz et al., 2002; Kirk et al., 2013; Sonne & Andrews, 2012). As stated above, this method is superior to a self-assessment because the expert is able to provide feedback to the employee and is able to "capture the interactions and complexities of all possible combinations of people, task, equipment, and work environment" (CUErgo, n.d., a). The ergonomist knows the injuries and risk factors, importance of varying work postures, understands the interactions that one change has on other components of the workstation, understands visual issues in the environment, computing habits and the need for rest breaks, knowing how to change work-rest patterns, and what equipment may be appropriate and how to access it (Robertson et al., 2017). The drawback to using an expert is that it can be "costly and inefficient for an ergonomist faced with assessing a large number of workstations" (Liebregts et al., 2016, p. 318). It is also impractical during a period of physical distancing due to the current pandemic because it requires face-to-face interaction.

Participatory Ergonomics

Although many of the approaches above address the physical aspects of the office workstation, they do not address psychosocial risk factors in the work environment, which include job demands, more hours working at a computer, higher levels of psychological stress and lack of "specific ergonomic features in the workstations and office buildings" (Robertson et al., 2009, p. 124). Reports of programs that use a

participatory approach shows promising results of reducing reported levels of musculoskeletal discomfort and reduction in days lost due to work absence, but there is conflicting evidence on whether this approach addresses the behaviours of maintaining neutral posture and work-rest patterns (Bohr, 2000; Kirk et al., 2013; Rivilis et al., 2008; Robertson et al., 2017). Robertson et al. (2017) noted that:

> the impact of the macroergonomics intervention was stronger when management listened to and were responsive to workers expressed ergonomics needs…workers tended to make more behavioural changes post-intervention when they had a higher sense of belonging to the organization and community. (p. 195)

Participatory ergonomics involves creating an ergonomics team (employees, managers, ergonomists, health and safety, research experts), having an expert provide training to the team, having the team use this new knowledge to make improvements in their areas and employs "participation, communication, and group problem solving" (Rivilis et al., 2008, p. 343).

A parallel can be noted in this approach to best practices in injury prevention (ACIP, 2011). When looking at injury prevention literature, the least effective practice to reduce injuries is education alone (see Figure 1). Education combined with addressing cultural norms (attitudes and dynamics) and social determinants of injury (stress, lack of control, high demand, and a perceived lack of employment security) can create an effective injury reduction strategy (ACIP, 2011; PHAC, 2008). Participatory ergonomics addresses culture through collaboration and can provide control and decrease stress for employees. The concern with this approach is that it can be much longer than the

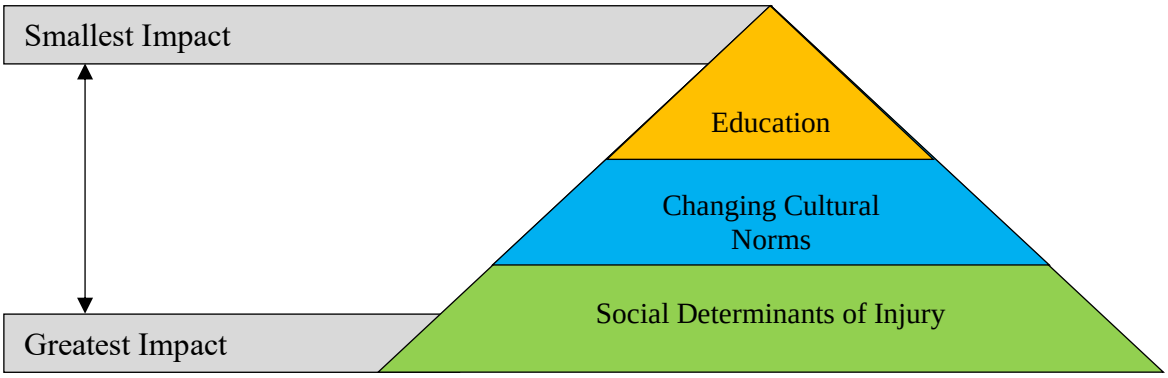
standard approaches and requires many personnel (Rivilis et al., 2008). This is also difficult to do during this current pandemic because each household is different and cannot be standardized like an office environment.

Web-based Approach

The web-based approach was reviewed as an alternative to the high cost of a professional ergonomist consultation as well as travel time of either the consultant in the case of providing training in various locations or the employee in the case of travelling to where the consultant is located to obtain the training (Rucker, 2004). Other advantages of web-based are training flexibility for the employee to take the training according to their schedule, at their own pace, the employee gains a sense of control, and the training can be provided to many employees without additional cost for the instructor (Meinert et al., 2013; Rucker, 2004). Improvement of both knowledge and behaviour resulting in participants changing their workstation setup to a more favourable position have been noted in the literature (Dalkilinç & Kayihan, 2014; Meinert et al, 2013). Meinert et al. (2013) also found a decrease in musculoskeletal complaints from the participants.

Figure 1

Best Practice and Effectiveness for Injury Prevention



It is interesting to note that the Institute for Work & Health (2015) and Public Services Health & Safety Association provide a free online eLearning course for the general public, eOfficeErgo: Ergonomics e-learning for office workers. This program is 90 minutes in duration and is "evidence-based and standard-compliant" on how to set up the office workstation (IWH, 2015). This program was based on the training developed by Michelle Robertson, PhD and Ben Amick III, PhD and is provided for free to anyone with an internet connection (D. Van Eerd, personal communication, November 15, 2019). It also recommends the use of a person with advanced knowledge of ergonomics to review the setup (IWH, 2015). The main disadvantage to web-based training is the reliance on a computer and an internet connection (Rucker, 2004).

Evaluation

In order to determine if a program is effective, it needs to be evaluated. Rucker (2004) stated that there was little evaluation of the effectiveness of instructor-led training, considering that it was a "common approach to injury prevention" (p. 3). He looked at comparing an instructor-led course with a web-based course and decided to use the Kirkpatrick method of evaluation. This is a method of evaluation in training that looks at four levels of evaluation including reaction, learning, behaviour, and results (Kirkpatrick Partners, 2019a). Reaction looks at how the learners felt about relevance of the training to their jobs and how they felt, learning looks at what the learner was able to learn at the end of the training, behaviour reviews whether the learner applies what they learn from the training, and results looks at the "degree to which targeted outcomes occur as a result of the training" (Kirkpatrick Partners, 2019b).

Rucker's (2004) design included a survey for reaction to the training, pre- and post-training questionnaire to determine the learning at the end of the training, and a behaviour interview and visual behaviour checklist to determine how effectively the employees were applying their learning. The final level of the Kirkpatrick method of evaluation, results, were not tested because of the difficulty and lack of access to the private company's financial data.

Other studies have evaluated the effectiveness of instructor-led training using instructional systems design approach and various levels of evaluation (Robertson et al., 2009, 2017). The authors specified the levels of evaluation as "(1) baseline assessment, prior to training, (2) trainee reaction, (3) learning, (4) performance, and (5) organizational results" (Robertson et al., 2009, p. 127). Other studies looked at musculoskeletal and/or visual discomfort levels associated with three groups: 1) no training 2) training only, and 3) training with addition of a chair, and did not mention specific evaluation of knowledge (Amick et al., 2003, 2012; Menéndez et al., 2012).

Participatory ergonomics have been evaluated by using comparison groups where one group receives a participatory intervention and the other group does not (Bohr, 2000; Kirk et al., 2013). In Bohr's (2000) study, she had a control group, a group that received ergonomic education and a third group that "were involved in active learning sessions incorporating discussions and problem solving exercises…" (p. 245). She evaluated the interventions using a survey and observational checklist and found decreased pain/discomfort and psychosocial work stress, even though there were "no significant differences noted across groups for work area configuration, worker postures, or overall observation scores" (Bohr, 2000, p. 248).

Kirk et al. (2013) conducted a series of "action research (AR) case study enquiries, using a non-randomized quasi-experimental design" (p. 288). They compared a control group to an office ergonomics checklist, and a skills-based training program. Comparisons were made using self-report physical discomfort questionnaires, "feedback from stakeholders and the analysis of both photographs and video records…" (Kirk et al., 2013, p. 288). The group with the office ergonomics checklist could recall the ergonomic information but did not show any observable changes in their work areas and there was no significant decrease in musculoskeletal discomfort. The skills-based group noted significantly decreased musculoskeletal pain and immediately implemented changes to the workstations during the skills-based training (Kirk et al., 2013). An interesting topic of discussion was the need to "promote a greater sense of personal responsibility and the skills for the self-management of issues associated with the development of [work related musculoskeletal discomfort]" (Kirk et al., 2013, p. 293).

Self-assessment is one possible way to promote a greater sense of personal responsibility and self-management for the employee. Three methods of self-assessment included two different checklists that focused on outcomes and a Rapid Office Strain Assessment (ROSA) tool (Janowitz et al., 2002; Sonne & Andrews, 2012). The first checklist was reviewed by three experts to determine if participant answers matched the experts. Any question that had poor agreement were modified or deleted. The next iteration of the checklist was used by three groups. One group used the checklist for self-evaluation. Another group had a co-worker use the checklist to evaluate them, and the last group had an ergonomics coordinator use the checklist to evaluate the employee. The point of the checklist was to improve the workstation and receive a lower score. The

ergonomics coordinator group was able to obtain a significant decrease in score, whereas the other two groups did not have a significant decrease (Janowitz et al., 2002). There were two iterations of this checklist, a 1994 version and a 2002 version (Eyal et al., 2012). These have been replaced by another version in 2018 which is a self-assessment version (Cal/OSHA, 2018; M. Stainer, personal communication, November 20, 2019).

The Computer Workstation Checklist (CWC) is "an 87-item self-report checklist…based on the *Creating the Ideal Computer Workstation: A Step-by-Step Guide*" (Baker et al., 2013, p. 214). It was developed to address concerns that were missing from the guide and it was then compared to a face-to-face assessment to "identify mismatches between workers' self-reported workstation problems" (p. 213). The CWC was found to be sensitive but had a high number of false negative outcomes and the study did not support the use of the CWC to identify problem areas by an employee (Baker et al., 2013).

The ROSA was assessed to determine if employees could identify musculoskeletal disorder risk factors in their work areas and see if they could decrease self-reported discomfort. This was to enable the use of the ROSA without the need for ergonomic consultants and reduce the cost to employers. Fifty-five participants were recruited and divided into two groups. Both completed a four-week training program on the ROSA and then one group completed self-assessments alone and the second group conducted self-assessments with expert feedback. The Cornell University Musculoskeletal Discomfort Questionnaire (CDMQ) was used before training and then each week after training. Significant differences were noted in the ROSA scores of both groups, with the non- feedback group being more significant than the feedback group.

The authors concluded that "the use of self-assessments performed by office workers of their own workstation using ROSA online, appears to be a valid method of assessing risk factors…" (Sonne & Andrews, 2012, p. 96).

Lack of Effectiveness

As we look through the timeline of the literature, there does not appear to be a lot of effectiveness for training and other interventions, but the amount of money being spent on various interventions and equipment has been steadily increasing. In fact, some firms have "enjoyed explosive growth in the last 15 years" (Mannix, 2018). This is despite the fact that various interventions such as height adjustable or active workstations have low quality evidence, arm supports or using a different mouse show inconsistent evidence, supplementary breaks has very low-quality evidence of effectiveness, and attending an ergonomic training program may have an effect, but there are only a few studies and they lack heterogeneity (Swinton et al., 2017; Hoe et al., 2018).

Suggestions for Future Research

From the systematic reviews, some of the suggested strategies for future research included avoiding single-group intervention designs, randomly allocating study participants, and using strategies to record postures to avoid anticipatory responses of the participants such as recording equipment, chairs with inbuilt sensors, or wearable technologies (Swinton et al., 2017).

Other suggestions included evaluating a training program before determining that it is effective and that there should be further studies on web-based ergonomics training (Rucker, 2004).

Summary

A review of the literature shows little change in the effectiveness of reducing MSIs in office ergonomics. There are several directions for research, including avoiding single-group intervention designs, randomly allocating study participants, and using strategies to record postures to avoid anticipatory responses of the participants such as recording equipment, chairs with inbuilt sensors, or wearable technologies (Swinton et al., 2017). One thing is clear. Any office ergonomics intervention should start by being cost effective and address the abilities of the employee. In the case of employees working from home during the current pandemic, the intervention needs to be accessible and account for physical distancing.

In order to begin the journey of best practice from an injury prevention perspective, a succinct frontline training program should be evaluated to determine its effectiveness before looking at culture and social determinants of injury. To that end an abbreviated distance education course was evaluated to determine its usefulness for remote ergonomics education.

Chapter 3. Methodology

Introduction

As mentioned in chapter 1, the current pandemic has created a situation of physical distancing and increased working at home. Due to limited access to advice from a person with advanced ergonomic knowledge, the primary research question was: how effective will an abbreviated distance education course for office ergonomics training be to address behaviour and discomfort for employees working from home during the current global pandemic?

Subquestions to be explored included:

1. What was the effectiveness of providing advanced ergonomic advice after completing the eLearning course?
2. What were the drivers and the barriers that allow the employee to enable changes in their behaviour towards the use of proper office ergonomics for employees working from home?

Original Design

The original design of this study was to compare two groups of employees at a private financial services company. One group was going to be provided face-to-face training by this author using a standardized checklist. This author has received training in ergonomics through a physiotherapy degree and ergonomic certificate courses and has been conducting ergonomic assessments for over 15 years, which was going to satisfy the requirements for an ergonomics coordinator with extensive knowledge (Baker et al., 2013; Janowitz et al., 2002). The second group was going to be provided education through an eLearning course, Office Ergonomics for Employees and then submit photos

and receive feedback provided by this author. A randomized-cluster design was going to be used to minimize knowledge sharing between the two groups (Robertson et al., 2009, 2017).

Using the financial services company allowed for the recruitment of a minimum of 21 participants per group. This number was calculated using the Wilcoxon-Mann-Whitney test (two groups) in G*Power 3.1 and effect size of 0.8 and power of 0.8 identified in previous studies (Faul et al., 2007; Sonne et al., 2012). The original intention was to recruit 60 participants to allow for loss of participants.

While developing the research proposal, the research ethics board at Athabasca University suspended all in-person research due to the global pandemic (AU, n.d.). The study was redesigned during the Spring of 2020 to allow avoidance of human contact.

Mixed Methods Design

A mixed methods explanatory sequential design was used for this study. This type of design requires the researcher to collect and analyze quantitative data at the beginning of the study. Qualitative data is then collected and analyzed after the quantitative analysis in order to "help explain, or elaborate on, the quantitative results obtained in the first phase" (Creswell & Plano Clark, 2018a, p. 97). In this case the quantitative data was the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) combined with the GuardingMinds@Work Initial Scan (see Appendix A), a pre- and post-training questionnaire (see Appendix B), reaction to training survey (see Appendix C), and the Rapid Office Strain Assessment (ROSA; see Appendix D) using subjects who had been identified through snowball sampling via e-mail to assess whether the office ergonomics education provided through distance education affected behaviour and discomfort

(Creswell & Plano Clark, 2018a; Robertson et al., 2009, 2017). The ROSA was used for the baseline, post-training, and transfer of learning assessment as it has shown good reliability with remote assessment via photos (Liebregts et al., 2016).

The education was provided using the eLearning course Ergonomics Training for the Office. This course was produced by this author using Articulate Storyline 360 and consisted of five objectives: 1) to be able to define appropriate postures while using an office workstation, 2) to know basic steps to reduce injury and decrease/avoid pain, 3) to know how to make adjustments to the chairs you are using and demonstrate the ability to properly adjust your chair, 4) to know how to properly set up your desk area for single and dual monitor use, and 5) to be familiar with the myths and typical situation for using a height adjustable workstation and how to properly set one up. The course was uploaded to a Google storage account. The course could be started, stopped, and resumed or restarted. The course was not housed in a learning management system and did not allow for statistics such as how long each participant spent on the course. This was to allow access to the course whenever the learner wanted access and they could review and replay the chair setup videos as often as they preferred.

The second part of the design was the qualitative phase. The qualitative phase was used to help explain the quantitative results by exploring the employee views regarding their ability to use the knowledge to follow appropriate office ergonomic behaviour. The central question to be explored during this phase was how do employees working from home during a pandemic describe their capacity to enable changes in their behaviour of office ergonomics? The expectation was to conduct this phase through formal interviews, if permitted by the participants. This was to avoid the limitation of

response biases and non-completion of surveys (Kreitchmann et al., 2019; LaRose & Tsai, 2014).

Finally, as described by Creswell and Creswell (2018a), a mixed methods research question was included as it "represents what the researcher needs to know about the integration or combination of the quantitative and qualitative data" (p. 237).

Mixed Methods Research Question

As discussed above, the mixed methods question for this study was: what are the drivers and the barriers that allow the employee to enable changes in their behaviour towards the use of proper office ergonomics?

Paradigm

As described by Creswell and Creswell (2018b), a paradigm is considered the researcher's "worldview or belief" (p. 46). In this author's case, both postpositivism and constructivism are choices for the worldviews. Postpositivism tries to take a scientific approach to research and is popular among health professionals (Creswell & Poth, 2018a). Postpositivism "recognizes that all observation is fallible and has error and that all theory is revisable" (Manuel, 2013). Groups that follow this framework do not believe in a strict cause and effect but believe that the outcome is from probability of whether it will happen or not. As an example, if I were to take a look at the current quantitative literature on web-based office ergonomics training, I might think that there will be a direct result of improvement by providing these assessments via distance education. But do we really know if it is the distance education that created the improvement, or was the improvement due to other factors such as avoiding painful positions, changing jobs, or improving psychological safety?

Constructivism is similar in that the researcher wants to obtain multiple views. Where it differs is that the researcher using a constructivist framework does not start with a theory. They try to use questions that are as open-ended as possible and try to use the participants' point of view of the situation (Creswell & Poth, 2018a). Meaning and knowledge is based on social interaction (iNtgrty, 2016). In other words, the situation is based on the interactions of everyone around and the cultural norms of the group.

At this point in time, it would be worth mentioning that even though I bring my own philosophical assumptions, so does anyone who would evaluate my research (Bull, 2015; Creswell & Poth, 2018a). In my case, I work in health care where there is a strong push for quantitative and mixed methods research. I do not subscribe to only one paradigm. This is evident in mixed methods research and the worldview of pragmatism. Using this philosophical assumption, "the research question should be of primary importance – more important than either the method or the philosophical worldview that underlies the method" (Creswell & Plano Clark 2018b, p. 39). The paradigm of pragmatism will be used as an over-arching approach for the purpose of this study (Creswell & Plano Clark 2018c).

Epistemology

Epistemology is the philosophical assumption of "how researchers gain knowledge about what they know" (Creswell & Plano Clark, 2018b, p. 34). In the case of the postpositivism paradigm, the epistemology is considered that of distancing oneself from the subjects and being impartial (Creswell & Plano Clark, 2018b). For constructivism, the epistemology is being close and subjective, visiting with participants (Creswell & Plano Clark, 2018b). For the purpose of this study, I will be using a combination of both

epistemologies. As pointed out in the previous paragraph, the research question is the most important aspect of this study.

Research Design

Participants

The participants for this study came from an online sample of convenience. All participants were at least 18 years of age in order to cover the age of consent for all provinces in Canada, be able to consent, and needed to have used a computer for at least four hours per day when they were working in the office and are now working from home during the current pandemic (Government of Canada, 2019). This author recruited participants through purposive sampling in order to ensure that the group will be able to provide the best information for the research problem of office ergonomic education in the time of COVID-19 (Creswell & Poth, 2018b). Participants needed to be identified that were working from home. Therefore, this author decided to use snowball sampling by reaching out to their current network and asking them to reach out to anyone they know that used to work in an office and is now working at home (Tenny et al., 2020). All participants came from a group that had already been given permission to use the free online eLearning office ergonomics program without feedback. It was initially not known how many individuals had completed the course, but none of the study participants completed the course. Consent was sought from any participant that wanted to be a willing participant and was asked to forward the request to anyone in their network that they knew may be working from home but originally working in an office.

Sampling

Quantitative sampling. The sample of participants was obtained through snowball sampling by sending out an advertising poster to this author's personal network via e-mail (see Appendix E). As mentioned earlier, the office ergonomics eLearning course had been previously shared to provide just in time advice to friends and acquaintances of the principal investigator when the COVID-19 pandemic first occurred. None of the study participants previously completed this course. The original email requesting volunteers was sent out on July 29, 2020. Recruitment of participants was slow and other emails were sent on August 12 and August 25, 2020. An email was also sent out to the Canadian Physiotherapy Association (CPA) with a request for participants that was forwarded to all CPA members in an email bulletin sent out August 27, 2020. In the end, only five participants from the original request participated in the study and only one of these participants completed every component of the study.

Qualitative sampling. As described by Creswell and Plano Clark (2018d), in an explanatory sequential design, the qualitative review should involve a subset of the original participants instead of all the participants, but the "important consideration lies in collecting enough qualitative information so meaningful themes can be developed that provide explanation for selected quantitative results" (p. 191). The original intention was to identify a subset. This author decided to interview the first four participants that maintained contact throughout the study to explore to shed light on possible barriers and drivers to applying the knowledge of the office ergonomics education.

Ethical Considerations

This study used human participants. The study was approved by the Athabasca University Research Ethics Board prior to commencement. From there, the participants were provided an information letter (see Appendix F), and then asked to sign a consent (see Appendix G) if they agreed to participate. The participants were fully informed of the purpose of the study and were provided opportunity to ask the lead investigator questions pertaining to the project. They were informed that their information would be kept confidential. For example, participants were asked to take pictures for review. Those pictures were stored on a Samsung T5 portable SSD, encrypted, and accessed from a password protected computer. At the end of the study, aggregate data will be shared with the participants.

Reliability and Validity

Validity in mixed methods research has been under some debate. From a general principle, Creswell and Plano Clark (2018e) identify "a need to address the specific types of validity checks associated with" (p. 251) both quantitative and qualitative data. Validity looks to address any potential threats to the correct inferences drawn from the data (Creswell & Plano Clark, 2018e). Validity threats are determined based on the mixed methods design. In the case of an explanatory sequential design, the validity threat is the failure of finding the critical quantitative results to explain with qualitative questions (Creswell & Plano Clark, 2018e). The strategy to be employed is to "consider all possibilities for explanation of results" (p. 253).

Other validity concerns will come up with the pre- and post-training questionnaires, the discomfort questionnaire, the ROSA, and the use of photos for the

distance education model (see Appendix I). The pre- post-training questionnaires are the same questionnaire. All questionnaires were piloted for feedback in July 2020. The discomfort questionnaire has two components: 1) the Cornell Musculoskeletal Discomfort Questionnaire and 2) the GuardingMinds@Work Initial Scan. Both have good face validity and have been used to assess for physical discomfort and psychological safety (CUErgo, n.d., b; GuardingMinds@Work, 2018).

The Rapid Office Strain Assessment (ROSA) was used for baseline, post-training and transfer of learning observation to ensure the research participants have implemented the training they have previously received. The ROSA has shown moderate construct validity when compared to other ergonomic instruments and good intra- and inter-observer reliability (Rahman & Mohamad, 2017; Rodrigues et al., 2019; Sonne et al., 2012). The ROSA has also showed "the overall reliability between expert assessor final and sub-scores were generally fairly good to excellent" when used with remote assessment using static images (Liebregts et al., 2016, p. 322).

Results

There was a total of 11 participants that consented to participate in the study, although one participant did not consent to the use of photos and was therefore unable to participate. Only five participants continued contact with this author throughout the study beyond the pre-training components.

Data Collection

Participants were asked to create a unique identifier when they signed their consent forms. Each participant was entered into a Microsoft Office Excel file in order of consent to participate and the unique identifiers were listed in this file to determine

contact during the study. All quantitative and qualitative data collected used the unique identifier from this point forward.

Quantitative data. Participants were asked to complete the online pre-training survey (Appendix A), take photos of their current setup as per Appendix I, complete the pre-training questionnaire (Appendix B), and then take the eLearning course *Ergonomics Training for the Office*. The course could be completed on a mobile device or desktop computer. Once the course was completed, the participants were asked to take another set of photos as per Appendix I, complete the post-training questionnaire (Appendix B), and the reaction survey (Appendix C).

The participant photos were assessed using the ROSA (Appendix D) for both the pre- and post-training photos and were assigned a score based on this assessment. Feedback was then provided to the participants on their post-training photos to further make any improvements that were recommended by the study author. This is in keeping with the advice from previous studies that participants should be provided feedback from someone with advanced ergonomic knowledge to ensure an appropriate setup (Baker et al., 2013; Janowitz et al., 2002).

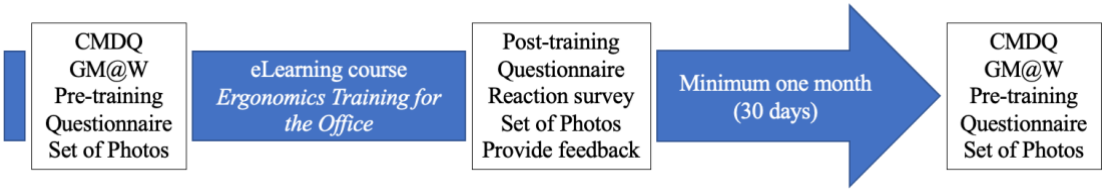
A minimum of 30 days after the photo feedback was provided, the participants were asked to submit another set of photos and complete the follow-up survey (Appendix A, less demographic data). All questionnaires were accessed via LimeSurvey and pilot tested in July 2020 to ensure appropriate grammar and clarity. See figure 2 for a visual representation of the timeline for data collection.

The initial survey (Appendix A) was used to determine the participant's baseline discomfort, provide a scan for psychological safety, ask if their manager supported

purchasing equipment and obtain demographic data. The pre- and post-training questionnaires were administered to determine baseline knowledge and determine if there was a change in knowledge after the eLearning program. The post-training photos were used to determine if any changes were made after reviewing the eLearning program and to obtain feedback from the author of this study. One-month post-feedback photo follow-up was used to determine if there was a transfer of training (e.g. behaviour) and to determine if there were any changes to the overall discomfort, psychological safety, and managerial support for equipment.

Figure 2

Diagram Representing Timeline for Data Collection



Missing data. Only five participants completed most of the components of the study, participants 1, 2, 3, 5, and 10. Of these five participants, one did not complete the pre-training questionnaire (participant 5) and two others did not complete the post-training photos as they did not feel they had the equipment they needed to change (participants 1 and 2). Of these two participants, participant 1 did not complete the one-month follow-up survey or photos because they did not make any changes based on the feedback provided (Table 1). Only these five participants will be discussed from this point forward.

Qualitative data. From the data that was being collected, there was a theme that knowledge was increasing after the eLearning course, but equipment appeared to be a

barrier to putting that knowledge into practice. This author decided to interview the first four participants (participants 1, 2, 3, and 5) that maintained contact throughout the study to shed light on some possible drivers and barriers to applying the knowledge of the office ergonomics education. The four participants consented to an interview and agreed to have the interview recorded to allow the author to transcribe the interviews for coding at a later date. Even though participant 1 declined to complete the survey and photos after one month, they were still invited to participate in the interview because they had increased knowledge and stated equipment was a barrier when they declined to provide the photos at one month follow-up.

Table 1

Study Components Missed by Participants

Participant number	Pre-training questionnaire	Post-training photos	One-month survey	One-month photos
1	Completed	Not completed	Not completed	Not completed
2	Completed	Not completed	Completed	Completed
3	Completed	Completed	Completed	Completed
5	Not completed	Completed	Completed	Completed
10	Completed	Completed	Not completed	Not completed

Note: This table shows the components each participant completed for the study.

Phenomenology will often use structured or semi-structured interviews to gather the interviewee's perspective of the phenomenon (Berner-Rodoreda et al., 2020; Guerrero-Castañeda et al., 2017). The questions in a semi-structured interview are "a guide whereby the order can be altered depending on the conversation, it being possible to emphasize some questions and include new ones" (Guerrero-Castañeda et al., 2017, p. 3). In order to prepare for the interview, there is usually one or two open-ended questions to guide the interview (Creswell & Poth, 2018c; Guerrero-Castañeda et al., 2017). The interview questions used for this study were prepared by the author and reviewed by one

of the author's research committee members (C. Blodgett-Griffin, personal communication, September 29, 2020). The initial questions were used to set the tone and other questions were prepared to guide the interviewer if enough information was not obtained (see Appendix K).

Researcher's Lens. Before conducting the interviews, this author must go through a process of self-examination and reflection in order to identify any biases and try to remove them as much as possible from the research (Creswell & Poth, 2018c). This will enable the researcher to have the ability to see the message behind the participants' voices. Professionally, I conduct ergonomic assessments via a similar distance education version of office ergonomics training that I created for the current health authority that employs me. I have the bias that a face-to-face assessment is not required and by using a distance education method there is an increase in the efficiency of conducting these assessments. However, these have been met by opposition as some employees prefer a face-to-face approach. I need to recognize that I want this approach to work, but I have to try and bracket this desire away from the interviews. I need to reflect on the current quantitative data and understand that not everyone felt that there was an improvement and I need to try and find out why. By approaching this interview with a curiosity of what the drivers and barriers could be and an openness to accept these, I can look into what the drivers and barriers of using this approach during the current pandemic can bring.

Interviews. After obtaining additional consent, the interviews were conducted online using Zoom to record the interviews for transcription purposes. Technical problems occurred with one participant and the recording was completed via a telephone call routed from an iPhone 11 ProMax through an iMac desktop computer and recorded

using ScreenFlow 9, recording both the VXi Talkpro UC2 headset with microphone output and computer audio stream input.

Data Analysis

Quantitative analysis. The quantitative data was downloaded as Excel files from the LimeSurvey site. There were five files in total for: pre-training survey, pre-training questionnaire, reaction to training, post-training questionnaire, and one month follow-up questionnaire. Each file was reviewed for completeness. If an entry was not completed, it was removed from the Excel file with the exception of data for the CMDQ. As per the instructions for the CMDQ, if there were missing values in the frequency value, it was coded as zero. In the case of missing data in the interference or discomfort categories, these areas were coded as 1 in order to keep the frequency value (CUErgo, n.d., b). Marks for the pre- and post-training questionnaires were assigned for each participant based on correct answers with a maximum total of 16.

Photos were collected as pre-training, post-training, and one month follow-up and scored by this author using the ROSA. Initially there was going to be a secondary assessor, but due to the lack of participants and schedule of the secondary assessor, it was determined that this was not necessary. With the low participation rate there was not any level of significance for the results.

Data was assessed using the IBM® SPSS® Statistics Version 24 package and included frequencies and descriptive statistics, where possible. For example, pre- and post-training discomfort scores are only available for three participants and are therefore shown in tabular format.

Qualitative analysis. Once the interviews were transcribed, this author checked the transcripts to ensure accuracy and then reviewed the data to find "sentences, or quotes that provide an understanding of how the participants experienced the phenomenon" (Creswell & Poth, 2018c). This involved coding the data, reviewing the individual lines of the code, and applying a code to a phrase, sentence, or paragraph. All codes were then listed and reviewed for commonalities and overarching themes (Shulz, 2012). Themes (e.g. categories) were identified within the codes and the transcriptions were further reviewed to try and match codes with similar codes. The interview transcriptions were then imported into Computer Assisted Qualitative Data Analysis Software (CAQDAS) to further refine the coding (Tenny et al., 2020). The CAQDAS used in this process was NVivo 12, Release 12.6.0 (3841).

Assumptions

As previously mentioned in this chapter, I bring my own philosophical assumptions and so does anyone who would evaluate my research (Bull, 2015; Creswell & Poth, 2018a). The paradigm of pragmatism was used as an over-arching approach for the purpose of this study (Creswell & Plano Clark 2018c). This is evident in mixed methods research and the worldview of pragmatism. Using this philosophical assumption, "the research question should be of primary importance – more important than either the method or the philosophical worldview that underlies the method" (Creswell & Plano Clark 2018b, p. 39).

Delimitations. As previously noted in Chapter 1, the "two words delimitations and limitations are often confused (Mauch & Park, 2003). A limitation is a factor that may or will affect the study but *is not under control* of the researcher; a delimitation

differs, principally, in that it *is controlled* by the researcher" (p. 114). The first item to delimit the scope of the study was the choice of participants. Participants were drawn from a sample of convenience via snowball sampling that included the author's personal network and members of the CPA.

The next delimitation was this author conducted both the training and assessment which could have instilled bias.

Limitations. This study did not include a control group and participants were not randomly allocated. The participants were drawn from either a snowball sampling method using e-mail, or an advertisement sent to the CPA membership and made up a sample of convenience. Because photos were taken by the participants or family members of the participants, participants were given warning when they were being observed. The final limitations were the inability to recruit the appropriate number of participants for significance, the high number of participants that dropped out of the study and only one of the participants completed all components of the study.

Summary

The methodology used for this study was an explanatory sequential mixed methods design that collected quantitative data pertaining to discomfort, knowledge, and behaviour for office ergonomic training and then collected qualitative data to help shed light on the outcomes of the quantitative data. Data was limited because of a lack of participants.

Chapter 4. Results

Introduction

This chapter will review the data obtained for the five individuals that participated in this study in order to try to answer the main research question, how effective was an abbreviated distance education course for office ergonomics training to address behaviour and discomfort for employees working from home during the current global pandemic? Data will be presented in tabular form and descriptive statistics will be used, where possible. The transition from quantitative data to qualitative data will be reviewed and I will try to answer the subquestions, what was the effectiveness of providing advanced ergonomic advice after completing the eLearning course, and what are the potential drivers and barriers that allow employees to enable changes in their behaviours towards the use of proper ergonomics while working at home.

Demographic data.

All participants were female, age range 34 to 50, BMI 19.8 to 33.3, spent between 4.5 and nine hours per day behind a computer, worked for their current company between 1.5 years and 20 years and spent an average of 2 to 15 hours participating in physical activity per week (Table 2).

Primary Research Question

As noted in Chapters I and III, the primary research question for this study was: how effective will an abbreviated distance education course for office ergonomics training be to address behaviour and discomfort for employees working from home during the current global pandemic?

Table 2

Demographic Data of Participants

Participant number	Age	BMI	Computer hours	Current work years	Hours physical activity
1	50	19.8	9.0	20.0	3
2	38	33.3	4.5	1.5	2.5
3	47	30.3	8.0	17.67	10
5	34	29.6	5.0	2.67	5
10	46	22.3	8.0	6.42	2

Note: This table contains demographic data obtained during the initial survey.

Knowledge.

Training is provided to increase the knowledge of participants for setting up their home office workstations. It is hoped that this training will provide the skills necessary for the participant to be able to change behaviour (Arlinghaus & Johnston, 2018). In this case, four out of five participants completed the eLearning course and both the pre- and post-training questionnaires. The questionnaires were the same and consisted of various questions with a total of 16 points. When comparing pre- and post-training results, a box plot was created to see the general trend of both results (see Figure 2). As it can be seen, overall, the post-training results were higher than the pre-training results. Pre-test results ranged from 3 to 9 points out of a possible total of 16 points. Post-test results ranged from 10 to 14 points out of 16. Participant 5 did not complete the pre-training questionnaire, but their post-training questionnaire results fell within the range of post-training results of the other participants. The other four participant pre-post differences were all positive ranging from 3 to 11 points with a mean of 5.75, standard deviation 3.59 and a variance of 12.917 (Table 3). The distribution of the data points was not normal, showing a skewness of 1.696 and a kurtosis of 3.014. As identified by Huck (2012), a positive skewness means that the distribution of the data points is on the lower end of the

continuum and are leptokurtic (more peaked). A box plot and histogram of these results can be seen as Figures 3 and 4.

Figure 3

Box Plot of Both Pre- and Post-Training Results

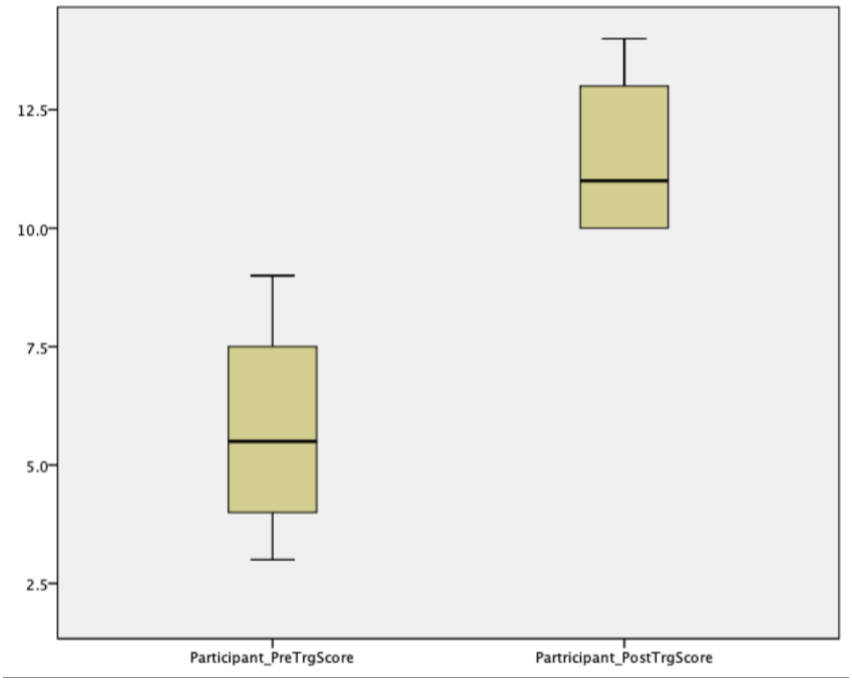


Table 3

Pre- and Post-Knowledge Testing for Elearning Course

Participant #	Pre-test	Post-test	Pre-post difference
1	3	14	11
2	6	10	4
3	9	12	3
5	Not completed	12	Not applicable
10	5	10	5

Note: This table reviews the pre- and post-test results of the knowledge check for the eLearning course, Ergonomics training for the office. The total possible score is out of 16.

Figure 4

Box Plot of Difference of Pre- and Post-Training Results

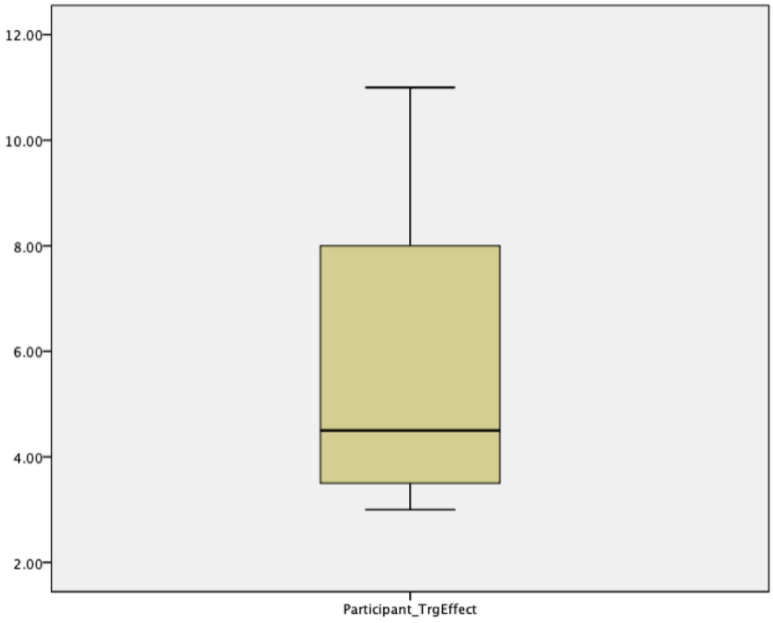
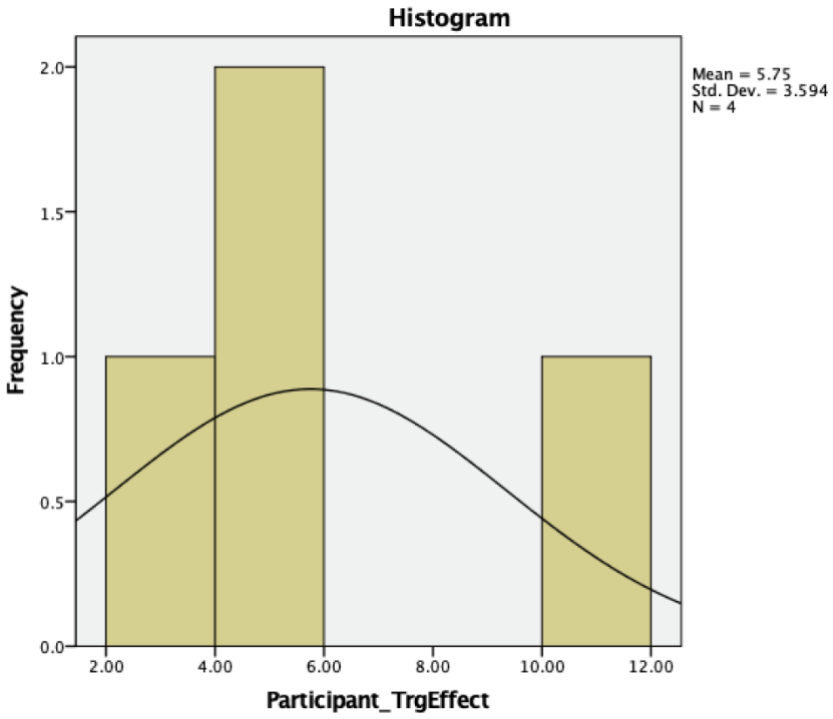


Figure 5

Histogram Showing Frequencies of Training Difference for Participants



CMDQ

The Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) was administered as part of the pre-training and one-month post-feedback surveys to determine discomfort levels prior to commencing training and one-month after the feedback was provided for the post-training photos (CUErgo, n.d., b). As provided in the instructions, there are differing ways to tabulate the results. In order to spread out the scores to see higher severity, it is suggested to multiply the frequency, interference, and discomfort scores. At this time three participants completed the survey as part of the pre-training survey at the beginning and one-month post-feedback follow-up. Initial discomfort and one-month follow-up scores for participants 2, 3, and 5 were 133.5 and 26.5, 24.5 and 4.5, and 162 and 16, respectively. This showed a trend of an overall decrease in discomfort. For a breakdown of scores for the three participants, see Table 4.

ROSA.

In order to assess behaviour, the ROSA was used to look at pre- and post-training and then one-month post-feedback. It has been shown that this assessment tool can be used with photos (Liebregts et al., 2016). As noted by Swinton et al. (2017), a minimum of one-month follow-up is required to provide a "valid assessment of the intervention" (p. 210). There were only three participants that completed the one-month post-feedback follow-up photo review for assessment with the ROSA. These were participants 2, 3, and 5. In this study the number of photos were altered to allow realistic expectations of someone taking photos that has not taken photos for ergonomics before. If more information or photos were required, this could be discussed with the participant after photo submission. All five participants completed the pre-training photos, but only two

participants submitted all three sets of photos (Table 1). Participant 3 had a ROSA score of 7, 6, and 6 and participant 5 had a ROSA score of 6, 5, and 3 for pre-training, post-training, and one-month post-feedback respectively. As noted by the creators of the ROSA, a score of 5 is used to determine if immediate change is necessary (Sonne et al., 2012).

Table 4

Participant CDMQ Scores

Body Part	Participant 2		Participant 3		Participant 5	
	Pre-training	One-month post	Pre-training	One-month post	Pre-training	One-month post
Neck	40	0	3.5	1.5	3	1.5
Shoulder right	0	3.5	0	0	7	1.5
Shoulder left	0	3.5	0	0	7	1.5
Upper back	0	0	3.5	1.5	0	0
Upper arm right	3.5	0	0	0	0	0
Upper arm left	0	0	0	0	0	0
Lower back	40	3.5	7	1.5	20	7
Forearm right	0	0	0	0	0	0
Forearm left	0	0	0	0	0	0
Wrist right	40	0	0	0	60	1.5
Wrist left	0	0	0	0	60	1.5
Hip/buttocks	10	9	3.5	0	5	1.5
Thigh right	0	7	3.5	0	0	0
Thigh left	0	0	3.5	0	0	0
Knee right	0	0	0	0	0	0
Knee left	0	0	0	0	0	0
Lower leg right	0	0	0	0	0	0
Lower leg left	0	0	0	0	0	0
Total	133.5	26.5	24.5	4.5	162	16

Note: This table reviews the pre-training and one-month post-feedback results of discomfort for participants 2, 3, and 5.

In a previous study the CMDQ was compared to ROSA scores to determine if there was a correlation between discomfort and ergonomic setup (Sonne et al., 2012). The authors compared certain scores of the ROSA to certain combinations of the CMDQ

scores. Specifically, the ROSA chair score was correlated with the cumulative score of both shoulders, upper and lower back, hip/buttocks, and both thighs. The ROSA monitor and telephone score was correlated with the cumulative score for the neck and upper back. The ROSA mouse and keyboard score was correlated with the cumulative score of bilateral shoulders, bilateral upper and lower arms and bilateral wrists. Finally, the ROSA final score was correlated with the total cumulative score for the CMDQ. The purpose of doing this was to "examine the effects of discomfort on areas that are known to become injured during office work" (Sonne et al., 2012, p. 104). The study by Sonne et al. (2012) looked at total body scores with and without leg discomfort and found that the highest correlation was with the leg discomfort omitted with R = 0.432. As the data collected in this study only had one instance of leg discomfort, the total cumulative score will be used. The data comparison for the three participants that completed both surveys can be seen in Table 5.

Table 5

CDMQ and ROSA Scores for Participants 2, 3 and 5

Participant	Score	Chair	Monitor-keyboard	Mouse-keyboard	Final ROSA
2	CDMQ Pre	50	40	43.5	133.5
	ROSA Pre	8	7	5	8
	CDMQ Post	26.5	0	7	26.5
	ROSA Post	7	5	5	7
3	CDMQ Pre	21	7	0	24.5
	ROSA Pre	7	3	7	7
	CDMQ Post	3	3	0	4.5
	ROSA Post	6	1	3	6
5	CDMQ Pre	39	3	134	162
	ROSA Pre	5	3	6	6
	CDMQ Post	11.5	1.5	6	16
	ROSA Post	3	3	5	3

Note: This table compares the discomfort scores with various components of the ROSA pre-training and one-month post-feedback results for participants 2, 3, and 5.

Ignoring the post-training ROSA, there was some change in behaviour shown for participant 5 and a minor change in behaviour for participants 2 and 3. All three participants showed decrease in discomfort. The answer to the primary research question, how effective will an abbreviated distance education course for office ergonomics training be to address behaviour and discomfort for employees working from home during the current global pandemic, is that the training may show an ability to improve behaviour and decrease discomfort.

Psychological safety.

Previous literature has discussed the possibility of psychosocial risk factors affecting levels of discomfort in office ergonomics (Bohr, 2000, 2002; Meinert et al., 2013; Robertson et al., 2017). The GuardingMinds@Work survey was included in the pre-training and one-month post-feedback surveys to determine if there was an overall change to psychological safety as perceived by the participants. All five participants were able to complete The GuardingMinds@Work portion of the initial questionnaire, but only three participants were able to complete the survey at the one-month follow-up. This data was not able to be scored because the website that provides a report on the data requires a minimum of 10 participants (GuardingMinds@Work, 2020). One thing to note from the data is that all participants either agreed or strongly agreed that in the last six months I have experienced worry, “nerves” or stress from mental fatigue at work.

An additional question pertaining to managerial support of obtaining resources was included in the initial and one-month surveys. In the initial survey all the participants except participant 2 disagreed that their manager would support them in obtaining the appropriate resources to set up their workstation. Participant 2 agreed. At the one-month

follow-up, participant 2 disagreed and participant 5 strongly agreed to this statement. This is a reversal of what both participants stated in the initial survey.

Sub-questions

Once the quantitative portion of the study was completed, the qualitative phase of the study proceeded. In this next section I will address the sub-questions, *what was the effectiveness of providing advanced ergonomic advice after completing the eLearning course*, and the other subquestion of *potential drivers and barriers to allowing employees to enable changes in behaviour towards the use of proper ergonomics while working at home*?

Interviews.

The quantitative results did show a trend of improving knowledge and behaviour as well as decreasing discomfort. Another theme that stood out prior to the one-month follow-up was the expressed reliance on ergonomic equipment to ensure a proper setup. This was apparent because two of the participants declined to provide photos of their post-training setups as they did not believe that they could show a proper setup without purchasing the appropriate equipment. This author decided to interview all participants that maintained contact up to the one-month post-feedback in order to look at the barriers and drivers of setting up a home office.

All four participants that maintained contact throughout the study were asked if they would be willing to take part in a qualitative interview to determine the barriers and drivers. All agreed and signed a similar consent to the first one allowing this author to record the interviews through Zoom for transcription purposes.

Coding.

Once transcribed, the data was then coded to try and identify a commonality between the interviews pertaining to the phenomenon. This involved reviewing the individual lines of the code and applying a code to a phrase, sentence, or paragraph. All codes were then listed and reviewed for commonalities and overarching themes (Shulz, 2012). Themes (e.g. categories) were identified within the codes and the transcriptions were further reviewed to try and match codes with similar codes. This process originally produced a list of 72 codes. These codes were counted to determine which codes were being repeated and could provide guidance on themes (Table 6).

Table 6

Initial Coding for Participant Interviews (P1, P2, P3, P5)

Code	P1	P2	P3	P5	Code	P1	P2	P3	P5
Positioning (knowledge)	1	2			Immediate feedback	1			
Equipment	8	5	2	12	Helpful	2			
Lack of knowledge	2	1			Video design	1			
Lack of experience	1				Equipment improper		1		1
Increase in knowledge	2	4		5	Discomfort decrease		1		3
Not applying knowledge	1				Convenience		2	1	7
COVID-19 fear	2			2	Lack of knowledge transfer		1	3	
Lack of equipment knowledge	3				Resource (lobbying)		2		
Change	2				Dependence		1		
Time constraints	2		1	1	Reluctance		1		3
Tactile desire	2				Lack of trust in management		1		
Change attempt	1				Equipment alternatives		1		
Medical condition	1			2	Manager support		1	1	3
Pictorial perception	1	1			Independence		1		3
Pictorial perception error	1				Efficiency				1
Applying knowledge/critical thinking	1				Accessibility				3
Provision of service	1				COVID-19				2
Own pace	1		2		Learn new skills				1
Security	1				Reinforce good behaviour				2
Ease of use	1	2	5		Transferability				1
Increased comfort	1				Fear of being incorrect				1
Not specific (to situation)	4				Knowledge transfer				1

Personalization	3	1		2	Embarrassment				1
Code	P1	P2	P3	P5	Code	P1	P2	P3	P5
Feedback helpful	1		2		Differing abilities with technology				1
Resource availability	1		2	1	Not age dependent				1
Resource (immediate)	1				Feedback support			1	2
Resource (financial)	2	1	2	1	COVID-19 adaptability			1	1
Quick change necessary	2				Ergonomic strategy				1
Discomfort	1			3	Healthy habits				1
Inconvenience	1				Competing priorities			2	2
Personal motivation	1		1		Self-importance			1	4
External factors	2				Desire to change				2
Behaviour change	3	1		10	Readiness for change				1
Easy dissemination	2			1	Barrier to change				1
Limited dissemination	1				Access to expertise				1
Review for clarity	1	4	1		Lack of technology access				2
Difficult to clarify	1				Remote/rural access				1
Knowledge review	1	2			Comfort with technology				1

Note: This table reviews the initial codes and their respective counts for each participant interview.

The interview transcriptions were then imported into NVivo 12, Release 12.6.0 (3841) and the text from the interviews were assigned to nodes as listed in Table 6. Using the table counts and the coding in NVivo, themes emerged. Nodes were moved as children under the main nodes (themes) and each node was revisited for further refinement. It should be noted that in the code count equipment and convenience had high counts in addition to behaviour change and increase in knowledge. When the nodes were reviewed, equipment came under the parent node resources and convenience came under the child node accessibility under the parent node access. The final themes can be viewed in Appendix L.

In order to see the interaction of the chosen themes, a hierarchy chart was used (see Figure 5). The predominant themes for drivers and barriers were behaviour change, equipment, design, and accessibility. Barriers to change encompassed a large portion of behaviour change.

Looking at the research subquestion of what was the effectiveness of providing advanced ergonomic advice after completing the eLearning course, participant 1 made a comment that the "feedback was definitely beneficial", but did not produce a photo review after feedback, so it is not known if the feedback was truly helpful. Participant 3 found that "the feedback is helpful to kind of adjust further and to recognize you know, where you could improve". Participant 3 did not have an overall reduction in their final ROSA score after feedback, but there was a reduction of the monitor-keyboard and mouse-keyboard components of the ROSA (Table 5).

Figure 6

Hierarchy Chart of Main Themes of Qualitative Review

Note. Largest categories for drivers and barriers to implement knowledge of office ergonomics in the work from home situation were behaviour change, resources, design, and access.

A review of the qualitative data and the sub-question, what are the potential drivers and barriers that allow the employee to enable changes in their behaviour towards the use of proper office ergonomics for employees working from home showed that

design and accessibility of the eLearning course were drivers for the participants to apply the knowledge. Participant 1 liked “having a set of easy-to-follow videos” and that the course “allow[ed] you to do things at your own pace”. Participant 2 stated they thought the course “was easy to follow what it was I was supposed to be doing”. Participant 5 “felt like it was really interactive” and liked the fact that they could “use it on their own time”. Participant 5 mentioned that “it was nice to have something that I could do really quickly” and “you’re getting the same level of support, in terms of like, academics and understanding from a professional”. This is similar to other studies that found advantages of web-based are training flexibility for the employee to take the training according to their schedule, at their own pace, and the employee gains a sense of control (Meinert et al., 2013; Rucker, 2004).

There was a strong inclination for barriers related to behaviour change and resources such as equipment as large barriers to change. Some examples of behaviour change are changing habits, competing priorities readiness for change and self-importance. This is not surprising as current literature on behaviour change shows that even though behaviour change interventions can be effective, they are often temporary and not maintained (Kwasnicka et al., 2016). This is one of the reasons that follow-up for behaviour change needs to be at least 30 days, if not longer (Swinton et al., 2017). In addition, previous studies in office ergonomics have shown that providing equipment such as an adjustable chair in combination with office ergonomic training significantly reduces pain and visual symptoms when compared to training only or a control group (Amick et al., 2003, 2012; Menéndez et al., 2012).

Reaction to training.

Four out of five of the participants completed this survey, participants 1, 2, 3, and 5. All participants agreed to strongly agreed to all of the reaction survey statements, except *I am able to apply this knowledge immediately to any computer workstation that I move to*. One participant disagreed, one participant was neutral, and the other two were agree and strongly agree. There appears to be confusion to these results as the participants believe the training is beneficial and would advise their co-workers to take the training, but one participant does not feel they can apply the knowledge to any computer workstation. One reason could be that the reaction survey was completed before feedback was provided or recognizing that someone familiar with ergonomics should verify the setup (Janowitz et al., 2002). Other comments provided were:

- Pace and quality of the videos were excellent. Sometimes a long lag between finishing talking and when the video actually ended. I would keep it running because I wasn't sure if you would say more (which you did not).
- My own chair and desk have limited adjustments possible. It would be helpful to add some suggestions for what to look for in a buying a new chair.
- Really enjoyed the overall content and made notes to work on my own work environment – thank-you.
- It would have been nice to have a complete overview at the end of what a proper position looks like.
- Easy to understand. Very interactive. Short videos demonstrating adjustments to work space were clear and concise. The questions were great to test my knowledge and understanding of the material. Content was well organized,

appropriately sequenced and thorough. The additional info specific to setting up a laptop proved to be very helpful in my situation.

Summary

The main research question, *how effective will an abbreviated distance education course for office ergonomics training be to address behaviour and discomfort for employees working from home during the current global pandemic* was reviewed using the quantitative data obtain. The quantitative results did show a trend of improving knowledge and behaviour as well as decreasing discomfort.

The transition from quantitative data to qualitative data was reviewed to attempt to answer the subquestions, *what was the effectiveness of providing advanced ergonomic advice after completing the eLearning course* and *what are potential drivers and barriers to allowing employees to enable changes in behaviour towards the use of proper ergonomics while working at home*? This review showed that the feedback may have been effective, but it is not entirely clear. It also showed a strong inclination that potential drivers and barriers could be related to behaviour change and resources such as equipment as large barriers to change and design and access being drivers to change. Some examples of behaviour change are changing habits, competing priorities readiness for change and self-importance.

Chapter 5. Discussion

The current COVID-19 pandemic has resulted in an increase of employees working from home and a shift of employees wanting to continue to work from home (Weikle, 2020). In October 2020, statistics show that the number of Canadians working from home that do not normally do so was 2.4 million (StatsCan, 2020). Unfortunately, this has resulted in increasing injuries because of poor ergonomic setups such as using laptops while sitting on a couch or working at the dining room table (Allen, 2020; Wilser, 2020). Employers need to consider workplace health and safety in order to reduce the risk of these injuries (Lindner et al., 2020). One approach to doing this is to provide remote education and assessment of the employee's ergonomic setup. There are self-assessment checklists that have been used, but there is a concern that without the input from someone with extensive knowledge of ergonomics, the office setup may not be effective (Janowitz et al., 2002; OHCOW, 2008; WCB Alberta, 2007; WorkSafe NB, 2010; WCB NS, n.d.; Cal/OSHA, 2018). Some web-based approaches have proven effective for improving knowledge and behaviour and reducing discomfort (Dalkilinç & Kayihan, 2014; Meinert et al, 2013; Rucker, 2004).

In the case of the current pandemic, there needs to be a way to provide remote ergonomic assessments and professional feedback. Telehealth can be useful, but a limitation to this approach is the cost for the time for the ergonomic expert and in some cases the bandwidth for communication (Baker & Jacobs, 2014; Ritchie et al., 2017). There is also a need for brevity in the training as many of the employees working from home are parents who now find themselves busier than ever from the addition of childcare (Gillis, 2020; Mercado, 2020; Pappas, 2020). A distance education design for

remote office ergonomics education and assessment was created using an abbreviated eLearning program and feedback from photo review of the participant's setup.

Photo review has been shown that it could be effective to assess an ergonomic workstation, but there was a limitation (Liebregts et al., 2016). As discussed by the authors, their method was "more likely to correctly classify a workstation than to incorrectly classify one" (Liebregts et al., 2016, p. 321). Many of the errors were related to false positives which benefits the employee by identifying workstations that need immediate rectification. From the perspective of the employer, this could lead to more investment than is necessary (Liebregts et al., 2016).

Participants

Recruitment for the study was more difficult than expected. The request for participants was open from July 15, 2020 to August 31, 2020. This deadline was extended to September 30, 2020 and a second email call out was sent out on August 25, 2020 requesting participants. An invite was also forwarded by the CPA to its members on August 27, 2020. It is not specifically known why participation was lacking, but one common statement from various participants was the increase in work that they had to complete due to the pandemic.

In the end there were five participants that completed most components of the study. One of the participants completed every component of this study (Table 1). All participants were female, age range 34 to 50, BMI 19.8 to 33.3, spent between 4.5 and nine hours per day behind a computer, worked for their current company between 1.5 years and 20 years, and spent an average of 2 to 15 hours participating in physical activity per week (Table 3).

Research Question 1 – Effectiveness

The results of this study showed a possibility that this method of training and feedback could be effective to improve knowledge and behaviour and to decrease discomfort related to a work at home ergonomic setup. Increasing knowledge is not surprising. Several other reviews have shown increased knowledge with training (Bohr, 2000; Dalkilinç & Kayihan, 2014; Kirk et al., 2013; Meinert, et al., 2013; Robertson et al., 2009, 2017; Rucker, 2004). The result that should be observed with caution is the change in behaviour as there have been previous barriers to its occurrence (Berner & Jacobs, 2002; Kirk et al., 2013).

Behaviour change is multi-faceted and dependent on several factors within the individual and outside the individual (Kwasnicka et al., 2016). Behaviour can change immediately but holding onto that change long-term is often difficult. This is one of the reasons that follow-up sessions are a minimum of one-month post-intervention and some studies have six- and 12-month follow-ups (Bohr, 2000, 2002; Swinton et al., 2017). One of the factors to affect this is previous habits. A new habit of getting up often to reduce pain may interfere with the old habit of sitting for prolonged periods of time to complete an increasing workload. The employee may not have an effective strategy to self-regulate themselves, such as a reminder to get up every 15 minutes which results in non-adoption of the new behaviour (Kwasnicka et al., 2016). Psychological and physical resources need to be "plentiful" (Kwasnicka et al., 2016, p. 283). This means if someone is tired and trying to maintain a large change in behaviour, they may not have the psychological resources to maintain the new behaviour and they go back to old habits as they take less effort. If a physical resource such as an adjustable chair is not available, the employee

may see no change in discomfort and go back to their old ways or worse, will not have the ability to apply the new knowledge (Amick et al., 2003, 2012).

Subquestion of feedback effectiveness.

As previously mentioned, this study used a mixed methods explanatory sequential design. This was to be able to make sense of what the quantitative data showed. In this case, the eLearning program appeared to be effective in altering behaviour and decreasing discomfort in three participants. Participant 2 did not take any post-training photos but showed a little improvement between the pre-training photos and the one-month post-feedback photos. So, the question becomes what caused this change? Was it the eLearning program or the feedback provided? In the case of participant 2, they felt that the feedback that provided alternate strategies to set themselves up was beneficial. The feedback provided "some suggestions to use some of the things around my house to make it as best as possible".

Participants 3 and 5 provided photos for pre-training, post-training, and one-month post-feedback. Participant 3's final ROSA score was 7, 6, and 6 respectively. The final scores do not show a large improvement. When looking at the components of ROSA between post-training and one-month follow-up, there was no reduction in the chair score. Participant 3 stated that they found the feedback beneficial and this did show when reviewing the monitor-keyboard and mouse-keyboard scores. Monitor-keyboard reduced to 1 from 3 and the mouse-keyboard scores reduced from 5 to 3 between the post-training and one-month follow-up photos. During the interview it was noted that participant 3 purchased their own monitor riser and keyboard tray based on the feedback, but the chair did not change overall. The overall minimal reduction and importance of the chair for the

ROSA scores make sense as some of the literature discusses the need to provide an adjustable chair in combination with training to improve effectiveness (Amick et al., 2003, 2012; Menéndez et al., 2012).

For participant 5, in each instance there was an improvement in the ROSA score from 6 to 5 to 3, respectively. The score of 3 shows that immediate change is not necessary (Sonne et al., 2012). When reviewing the interview from participant 5, they did not feel that the feedback was effective in assisting them. They did state that "if I am doing it wrong, he is going to let me know, um, to the best of his ability remotely". They found the program convenient but did not necessarily find the feedback beneficial. Participant 5 provided some explanation for this difference. They stated that the feedback did not necessarily help them, but some people may have difficulty with technology and need assistance. This is in contrast to participant 2 that found it beneficial.

It is reasonable to say that feedback should be a requirement of any mobile instructional design (Bikanga Ada, 2018; Hsu & Ching, 2013). This has also been found to be the case when it comes to office ergonomics. Without the advice of someone with experience in ergonomics, an employees' setup can be ineffective, although occasionally an employee may be able to use a program without feedback (Janowitz et al., 2002).

Subquestion of potential drivers and barriers.

Prior to the qualitative phase of this study, two participants did not want to provide post-training photos because they felt that they could not adjust their work areas without purchasing the appropriate equipment. Feedback was provided to both of them based on the pre-training photos. In the case of participant 1, they felt that they still required additional equipment to make the necessary changes. In the case of participant

2, alternate methods were provided in the feedback (e.g. use of an ironing board as a height adjustable surface for their keyboard and mouse), but the participant found it difficult to enable changes without proper equipment.

During the qualitative phase, possible barriers identified were personal barriers to changing behaviour (self-influences) and resources which included equipment, managerial support for purchasing equipment, and resource availability. In the case of participant 1, they are self-employed and therefore their financial resource was specific to themselves and not to a manager. Health promotion talks about personal reasons to limit adoption of behaviour change, but it also points out that a lack "of health resources presents a second class of barriers to healthful behaviour" (Bandura, 1998, p. 629). This agrees with the qualitative outcomes of this study. Knowledge can create the "precondition for change" (p. 624) but "additional self influences are needed to overcome the impediments to adopting new lifestyle habits" (p. 624) in addition to the necessity of resources to enable the behaviour (Bandura, 1998). As an example, let us suppose that someone takes the advice provided in the education to get up often. When they sit down, they sit on the couch in a slouched posture because they do not have a desk or adjustable chair available. They may be able to mitigate this risk by getting up often, but as time progresses, will the old behaviour of sitting down for prolonged periods of time in a slouched posture come back because of deadlines for work? There is limited "evidence for the sustainability of behaviour change in response to interventions" (Kwasnicka et al., 2016, p. 277). Through a systematic review of behaviour theories, Kwasnicka et al. (2016) have identified that:

> Theoretical explanations of behaviour change maintenance focus on the differential nature and role of motives, self-regulation, resources (psychological and physical), habits, and social influences from initiation to maintenance (p. 277).

One barrier to change that came up during the interview with participant 5 was the need to look for self-importance. For example, "that is one thing that I find that tends to make me think about myself more" when discussing their current situation. They also went on to say, "so definitely, a barrier to me making that change is, is thinking about myself and my needs". This mirrors a comment from Kirk et al. (2013) where they identified a need to "promote a greater sense of personal responsibility and the skills for the self-management of issues associated with the development of [work related musculoskeletal discomfort]" (p. 293).

Although there is low participation in the current study, the outcomes regarding barriers does coincide with current literature.

When looking at the drivers of design and accessibility, the participants provided qualitative evidence that matched other studies that have found the advantages of web-based training approaches are training flexibility for the employee to take the training according to their schedule, at their own pace, and the employee gains a sense of control (Meinert et al., 2013; Rucker, 2004). In addition to comments in Chapter 4, participant 1 added that you "can't offer it to people as widely as you are able to with this format that you've got" when comparing a face-to-face approach and the approach of this study.

Limitations

This study had a low participation rate (five participants) and only one of the participants completed all components of the study. If strict protocols were used, the results of this study would be based on one participant. This study did not include a control group in its design for comparison. This limits the ability to determine if an intervention created a change that could not be created by chance (Swinton et al., 2017). The participants were not randomized into separate groups. This is difficult with ergonomics because of information sharing between employees, but a cluster randomization method should be included (Swinton et al., 2017).

Participants were chosen through purposive and snowball sampling. The purpose was to find participants that were specifically working from home and used to work in an office. Snowball sampling can make inferences about the people in the network but cannot make "estimates directly about the population" (Salganik & Heckathorn, 2004, p. 205).

The use of photographs to conduct a review has been used in the past (Liebregts et al., 2016). The protocol in the current study used four photographs instead of the five in the Liebregts et al. (2016) study and was not validated due to low participation. This can create a source of error, especially when combined by a family or friend taking the photos. Environmental constraints such as appropriate space to take the pictures or the height the pictures are taken from can affect the information (Liebregts et al., 2016). A final limitation regarding photographs is the ability of the participant to have the photos taken. If the person is alone and does not have someone available to take the pictures,

they cannot participate. This occurred with one participant who had to drop out of the study.

Recommendations for Future Research

The first recommendation is to overcome the hurdle of low participation rate. A larger group can provide a level of significance to the data provided and a randomized-cluster design could be used to provide a control and experiment group. A control group could have the eLearning program only and be compared to a group with both the eLearning program and feedback. This way bias is limited from employees sharing the eLearning program.

The second recommendation would be to add validation of the photography method by having more than one person with extensive knowledge of ergonomics review the photos and assess them using the ROSA, assuming there are more participants than the current study. This can limit false positives and negatives. This study's photographic protocol should also be compared to the Liebregts et al. (2016) protocol.

A third recommendation would be use video setup or inertial measurement units (IMUs) in addition to the ROSA to monitor the participant. The ROSA-photograph protocol can be used to ensure appropriate application of ergonomic knowledge, but the participant is provided a warning when a photo is taken and may inadvertently adopt a more appropriate posture (Swinton et al., 2017). The use of video or IMU could assist in determining if behaviour is truly changed after the intervention (Meltzer et al., 2020; Swinton et al., 2017).

Conclusion

This study attempted to address the issue of accessibility to office ergonomics training and assessment during a global pandemic. Many employees have makeshift areas within their homes to conduct their work which increases the chance of poor posture and increases the risk of discomfort and injury. This study looked at the ability of a distance education office ergonomics course to address ergonomic issues for participants in Canada who normally work in an office and are now working from home because of the global pandemic where physical distancing limits the ability to obtain a face-to-face ergonomic assessment. There was a trend shown for the eLearning program to increase knowledge and the feedback to possibly assist with proper adoption of the knowledge. One of the largest barriers to applying the knowledge was related to access of resources such as equipment. Drivers included access and design. In future, a larger group should be identified to recreate this study using a randomized-cluster design, the photograph protocol should be validated, and behavioural review with video or IMUs should be implemented.

References

Allen, B. (2020, May 28). *Employers need to get serious about preventing workplace injuries in the home during pandemic, expert says.* CBC News. https://www.cbc.ca/news/canada/saskatchewan/work-from-home-injuries-1.5587164

Amick, B. C., Menéndez, C. C., Bazzani, L., Robertson, M., DeRango, K., Rooney, T., & Moore, A. (2012). A field intervention examining the impact of an office ergonomics training and a highly adjustable chair on visual symptoms in a public sector organization. *Applied Ergonomics*, *43*(3), 625–631. https://doi.org/10.1016/j.apergo.2011.09.006

Amick, B. C., Robertson, M. M., DeRango, K., Bazzani, L., Moore, A., Rooney, T., & Harrist, R. (2003). Effect of Office Ergonomics Intervention on Reducing Musculoskeletal Symptoms. *Spine*, *28*(24), 2706–2711. https://doi.org/10.1097/01.BRS.0000099740.87791.F7

Arlinghaus, K. R., & Johnston, C. A. (2018). Advocating for Behavior Change With Education. *American Journal of Lifestyle Medicine*, *12*(2), 113–116. https://doi.org/10.1177/1559827617745479

Athabasca University. (n.d.). COVID-19 Guidance Related to Research with humans. https://www.athabascau.ca/research-centre/documents/covid-19-guidance-related-to-research-with-humans.pdf

Atlantic Collaborative on Injury Prevention. (2011). *The social determinants of injury*. https://parachute.ca/en/professional-resource/publications/

Baker, N. A., Livengood, H., & Jacobs, K. (2013). Reliability and concurrent validity of the Computer Workstation Checklist. *Work 45*(2), 213-221. https://doi.org/10.3233/WOR-131603

Bandura, A. (1998). Health promotion from the perspective of social cognitive theory. *Psychology & Health*, *13*(4), 623–649. https://doi.org/10.1080/08870449808407422

Berner, K., & Jacobs, K. (2002). The gap between exposure and implementation of computer workstation ergonomics in the workplace. *Work, 19*(2), 193-199.

Berner-Rodoreda, A., Bärnighausen, T., Kennedy, C., Brinkmann, S., Sarker, M., Wikler, D., Eyal, N., & McMahon, S. A. (2020). From Doxastic to Epistemic: A Typology and Critique of Qualitative Interview Styles. *Qualitative Inquiry*, *26*(3–4), 291–305. https://doi.org/10.1177/1077800418810724

Bikanga Ada, M. (2018). Using design-based research to develop a Mobile Learning Framework for Assessment Feedback. *Research and Practice in Technology Enhanced Learning*, *13*(1), 3. https://doi.org/10.1186/s41039-018-0070-3

Blatter, B. M., & Bongers, P. M. (2002). Duration of computer use and mouse use in relation to musculoskeletal disorders of neck or upper limb. *International Journal of Industrial Ergonomics, 30*(4), 295-306. https://doi.org/10.1016/S0169-8141(02)00132-4

Bohr, P. C. (2000). Efficacy of office ergonomics education. *Journal of Occupational Rehabilitation, 10*(4), 243-255.

Bohr, P. C. (2002). Office ergonomics education: A comparison of traditional and participatory methods. *Work, 19*(2), 185-191.

Bongers, P. M., Kremer, A. M., & ter Laak, J. (2002). Are psychosocial factors, risk factors for symptoms and signs of the shoulder, elbow, or hand/wrist?: A review of the epidemiological literature. *American Journal of Industrial Medicine, 41*(5), 315-42. https://doi.org/10.1002/ajim.10050

Boyle, M. (2020, March 24). *Aching work-at-home backs driving demand for ergonomic chairs.* Bloomberg.com. https://www.bloomberg.com/news/articles/2020-03-24/aching-work-at-home-backs-driving-demand-for-ergonomic-chairs

Bull, B. (2015, February 1, 2015). Research paradigms video [YouTube video]. https://youtu.be/v0T4GSgOiqM

Cal/OSHA, Division of Occupational Safety and Health, California Department of Industrial Relations. (2018). *Easy ergonomics for desktop computer users.* https://www.dir.ca.gov/dosh/dosh_publications/ComputerErgo.pdf

Canadian Centre for Occupational Health & Safety. (2019, November 28). *Work-related musculoskeletal disorders (WMSDs)*. https://www.ccohs.ca/oshanswers/diseases/rmirsi.html

Christensen, J. O., & Knardahl, S. (2010). Work and neck pain: A prospective study of psychological, social, and mechanical risk factors. *Pain, 151*(1), 162-173. https://doi.org/10.1016/j.pain.2010.07.001

Cornell University Ergonomics Web. (n.d., a). *Performance oriented ergonomic checklist for computer (VDT) workstations.* http://ergo.human.cornell.edu/CUVDTChecklist.html

Cornell University Ergonomics Web. (n.d., b). *Cornell musculoskeletal discomfort questionnaires (CMDQ).* http://ergo.human.cornell.edu/ahmsquest.html

Covalla, E.D. (2003). *Visual posture observation error and training* (Master's thesis). http://www.lib.ncsu.edu/resolver/1840.16/689

Creswell, J. W., & Creswell, J. D. (2018a). Research questions and hypotheses. In *Research design. Qualitative, quantitative, and mixed methods approaches* (5th ed., pp. 224-243). SAGE Publications, Inc. https://www.pdfdrive.com/research-design-qualitative-quantitative-and-mixed-methods-approaches-e196908202.html

Creswell, J. W., & Creswell, J. D. (2018b). The selection of a research approach. In *Research design. Qualitative, quantitative, and mixed methods approaches* (5th ed., pp. 42-68). SAGE Publications, Inc. https://www.pdfdrive.com/research-design-qualitative-quantitative-and-mixed-methods-approaches-e196908202.html

Creswell, J. W., & Plano Clark, V. L. (2018a). Core mixed methods designs. In *Designing and conducting mixed methods Research* (3rd ed., pp. 51-100) [Kindle Edition]. SAGE Publications, Inc.

Creswell, J. W., & Plano Clark, V. L. (2018b). The foundations of mixed methods research. In *Designing and conducting mixed methods Research* (3rd ed., pp. 21-50) [Kindle Edition]. SAGE Publications, Inc.

Creswell, J. W., & Plano Clark, V. L. (2018c). Complex applications of core mixed methods designs. In *Designing and conducting mixed methods Research* (3rd ed., pp. 101-142) [Kindle Edition]. SAGE Publications, Inc.

Creswell, J. W., & Plano Clark, V. L. (2018d). Collecting data in mixed methods research. In *Designing and conducting mixed methods Research* (3rd ed., pp. 173-208) [Kindle Edition]. SAGE Publications, Inc.

Creswell, J. W., & Plano Clark, V. L. (2018e). Analyzing and interpreting data in mixed methods research. In *Designing and conducting mixed methods Research* (3rd ed., pp. 209-258) [Kindle Edition]. SAGE Publications, Inc.

Creswell, J. W., & Poth, C. N. (2018a). Philosophical assumptions and interpretive frameworks. In *Qualitative inquiry & research design. Choosing among five approaches* (4th ed., pp. 54-96) [Kindle Edition]. Thousand Oaks: SAGE Publications, inc.

Creswell, J. W., & Poth, C. N. (2018b). Data collection. In *Qualitative inquiry & research design. Choosing among five approaches* (4th ed., pp. 275-334) [Kindle Edition]. SAGE Publications, Inc.

Creswell, J. W., & Poth, C. N. (2018c). Five qualitative approaches to inquiry. In *Qualitative inquiry & research design. Choosing among five approaches* (4th ed., pp. 135-214) [Kindle Edition]. SAGE Publications, Inc.

Dalkilinç, M. & Kayihan, H. (2014). Efficacy of web-based [e-learning] office ergonomics training: A test study. *Journal of Musculoskeletal Pain, 22*(3), 275-285. https://doi.org/10.3109/10582452.2014.907851

Ducharme, J. (2020, March 11). *World Health Organization declares COVID-19 a 'pandemic.' Here's what that means.* Time. https://time.com/5791661/who-coronavirus-pandemic-declaration/

Eyal, L., Ribak, J., & Badihi, D. R. Y. Remote online ergonomic assessment in the office environment as compared to face-to-face ergonomic assessment. *Work, 41*(Suppl 1), 516-23. https://doi.org/10.3233/WOR-2012-0206-516

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175-91. https://doi.org/10.3758/bf03193146

Gillis, H. (2020, June 2). *Working from home while trying to parent? Feel like you're failing at both? You're not alone.* CBC News. https://www.cbc.ca/news/canada/newfoundland-labrador/parenting-and-working-from-home-1.5595495

GuardingMinds@Work. (2018). *Initial scan*. https://www.guardingmindsatwork.ca/resources

GuardingMinds@Work. (2020). *Sign Up and Launch Survey.* https://www.guardingmindsatwork.ca/about/about-signup

Guerrero-Castañeda, R. F., de Oliva Menezes, T. M., & Ojeda-Vargas, Ma. G. (2017). Characteristics of the phenomenological interview in nursing research. *Revista Gaúcha de Enfermagem*, *38*(2), 1–5. https://doi.org/10.1590/1983-1447.2017.02.67458

Government of Canada. (2019, July 10). *Requirements for Informed Consent Documents*. https://www.canada.ca/en/health-canada/services/science-research/science-advice-decision-making/research-ethics-board/requirements-informed-consent-documents.html

Government of Canada. (2020, April 11). *Coronavirus disease (COVID-19): Being prepared*. https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/being-prepared.html#a2

HealthLinkBC. (2017, November 29). *Office ergonomics.* https://www.healthlinkbc.ca/health-topics/tr5915

Hoe, V. C., Urquhart, D. M., Kelsall, H. L., Zamri, E. N., Sim, M. R. (2018). Ergonomic interventions for preventing work-related musculoskeletal disorders of the upper limb and neck among office workers. *The Cochrane Database of Systematic Reviews, 10*. https://doi.org/10.1002/14651858.CD008570.pub3

Hsu, Y.-C., & Ching, Y.-H. (2013). Mobile App Design for Teaching and Learning: Educators' Experiences in an Online Graduate Course. *The International Review of Research in Open and Distributed Learning*, *14*(4), 24. http://www.irrodl.org/index.php/irrodl/article/view/1542/2635

Huck, S. W. (2012). Descriptive statistics the univariate case. In *Reading Statistics and Research* (6th ed., pp. 18-43). Pearson Education, Inc.

Institute for Work & Health. (2015, January). eOfficeErgo: Ergonomics e-learning for office workers. https://www.iwh.on.ca/tools-and-guides/eofficeergo-ergonomics-e-learning-for-office-workers

International Ergonomics Association. (n.d.). *Definition, domains of specialization, systemic approach.* https://iea.cc/definition-and-domains-of-ergonomics/

iNtgrty. (2016, August 4). The research paradigms: Social constructivism. *Publishing and the Mentoring Network Journal.* http://www.intgrty.co.za/2016/08/04/the-research-paradigms-social-constructivism/

Janowitz, I., Stern, A., Morelli, D., Vollowitz, E., Hudes, M., & Rempel, D. (2002). Validation and field testing of an ergonomic computer use checklist and

guidebook. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 46*(13), 1007-1011. https://doi.org/10.1177/154193120204601301

Kirk, E., Strong, J., & Burgess-Limerick, R. (2013). Developing computer competencies for eWorkers within call centres. *Work, 46*(3), 283-95. https://doi.org/10.3233/WOR-121533

Kirkpatrick Partners. (2019a). *Kirkpatrick's four levels of training evaluation*. https://www.kirkpatrickpartners.com/Products/Kirkpatricks-Four-Levels-of-Training-Evaluation

Kirkpatrick Partners. (2019b). *The Kirkpatrick Model*. https://www.kirkpatrickpartners.com/Our-Philosophy/The-Kirkpatrick-Model

Kline, T. (2020, April 14). *Work-from-home setups might cause issues.* The Daily Item. https://www.dailyitem.com/coronavirus/work-from-home-setups-might-cause-issues/article_15519abc-2ec8-5dda-b229-f5bf46cb3e79.html

Kreitchmann, R. S., Abad, F. J., Ponsoda, V., Nieto, M. D., & Morillo, D. (2019). Controlling for response biases in self-report scales: Forced-choice vs. psychometric modelling of Likert items. *Frontiers in Psychology, 10*, 1-12. https://doi.org/10.3389/fpsyg.2019.02309

Kwasnicka, D., Dombrowski, S. U., White, M., & Sniehotta, F. (2016). Theoretical explanations for maintenance of behaviour change: A systematic review of behaviour theories. *Health Psychology Review*, *10*(3), 277–296. https://doi.org/10.1080/17437199.2016.1151372

LaRose, R., & Tsai, H. S. (2014). Completion rates and non-response error in online surveys: Comparing sweepstakes and pre-paid cash incentives in studies of online

behavior. *Computers in Human Behavior, 34,* 110-119. https://doi.org/10.1016/j.chb.2014.01.017

Lebeau, M., & Duguay, P. (2013). Studies and research projects: The cost of occupational injuries. A review of the literature (Report No. R-787). The Institut de recherhe Robert-Sauvé en santé et en sécurité du travail. https://www.irsst.qc.ca/media/documents/PubIRSST/R-787.pdf

Liebregts, J., Sonne, M., & Potvin, J. R. (2016). Photograph-based ergonomic evaluations using the Rapid Office Strain Assessment (ROSA). *Applied Ergonomics, 52*, 317-324. https://doi.org/10.1016/j.apergo.2015.07.028

Lindner, J., Sahdra, S., Bernier, C.-A., DeVries, L., & Bélanger, C. (2020, April 7). *COVID-19 update: The "New Normal" – Facilitating work-from-home arrangements*. McCarthy Tétrault. Insights and Seminars. https://www.mccarthy.ca/en/insights/blogs/canadian-employer-advisor/covid-19-update-new-normal-facilitating-work-home-arrangements

Mannix, L. (2018, September 30). *A difficult position: Experts question whether ergonomics holds up.* The Sydney Morning Herald. https://www.smh.com.au/lifestyle/health-and-wellness/a-difficult-position-experts-question-whether-ergonomics-holds-up-20180910-p502w5.html

Manuel. (2013, July 10). Qualitative research in corporate communication. https://blogs.baruch.cuny.edu/com9640epstein/?author=14092

Mauch, J. E., & Park, N. Preparation of the proposal. In *Guide to the successful thesis and dissertation. A handbook for students and faculty* (5th ed, pp. 97-141). CRC Press.

Meinert, M., König, M., & Jaschinski, W. (2013). Web-based office ergonomics intervention on work-related complaints: a field study. *Ergonomics, 56*(11), 1658-1668. https://doi.org/10.1080/00140139.2013.835872

Meltzer, A. J., Hallbeck, M. S., Morrow, M. M., Lowndes, B. R., Davila, V. J., Stone, W. M., & Money, S. R. (2020). Measuring Ergonomic Risk in Operating Surgeons by Using Wearable Technology. *JAMA Surgery*, *155*(5), 444. https://doi.org/10.1001/jamasurg.2019.6384

Menéndez, C. C., Amick, B. C., Robertson, M., Bazzani, L., DeRango, K., Rooney, T., Moore, A. (2012). A replicated field intervention study evaluating the impact of a highly adjustable chair and office ergonomics training on visual symptoms. *Applied Ergonomics, 43*(4), 639-644. https://doi.org/10.1016/j.apergo.2011.09.010

Mercado, D. (2020, September 23). *Dealing with childcare while working at home? How employers will help.* CNBC. https://www.cnbc.com/2020/09/23/dealing-with-childcare-while-working-at-home-how-employers-will-help.html

Merriam-Webster. (2019). Definition of ergonomics. https://www.merriam-webster.com/dictionary/ergonomics

Merriam-Webster. (2020). Definition of bandwidth. https://www.merriam-webster.com/dictionary/bandwidth

Occupational Health Clinics for Ontario Workers. (2008, May). *Office ergonomics handbook*, 5th ed. https://www.ohcow.on.ca/edit/files/workbooks/24234%20OHCOW%20Office%20Ergonomics%20Handbook%20Website.pdf

Pappas, S. (2020, August 10). *Pandemic childcare is way more stressful for moms than dads.* Live Science. https://www.livescience.com/pandemic-work-from-home.html

Pereira, M., Comans, T., Sjøgaard, G., Straker, L., Melloh, M., O'Leary, S., Chen, X., & Johnston, V. (2019). The impact of workplace ergonomics and neck-specific exercise versus ergonomics and health promotion interventions on office worker productivity: A cluster-randomized trial. *Scandinavian Journal of Work, Environment and Health, 45*(1), 42-52. https://doi.org/10.5271/sjweh.3760

Public Health Agency of Canada. (2008). The Chief Public Health Officer's report on the state of public health in Canada 2008 – Employment and working conditions. https://www.canada.ca/en/public-health/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/report-on-state-public-health-canada-2008/chapter-4c.html

Rahman, M. N. A., & Mohamad, S.S. (2017). Review on pen-and-paper-based observational methods for assessing ergonomic risk factors of computer work. *Work, 57*(1), 69-77. https://doi.org/10.3233/WOR-172541

Ritchie, L. W., Miller, L. L., Antle, D. M. (2017). A case study detailing key considerations for implementing a telehealth approach to office ergonomics. *Work, 57*(4), 469-473. https://doi.org/10.3233/WOR-172579

Rivilis, I., Van Eerd, D., Cullen, K., Cole, D.C., Irvin, E., Tyson, J., & Mahood, Q. (2008). Effectiveness of participatory ergonomic interventions on health outcomes: A systematic review. *Applied Ergonomics 39*(3), 342-358. https://doi.org/10.1016/j.apergo.2007.08.006

Robertson, M., Amick III, B. C., DeRango, K., Rooney, T., Bazzani, L., Harrist, R., & Moore, A. (2009). The effects of an office ergonomics training and chair intervention on worker knowledge, behaviour and musculoskeletal risk. *Applied Ergonomics, 40*(1), 124-135. https://doi.org/10.1016/j.apergo.2007.12.009

Robertson, M. M., Huang, Y. H., & Lee, J. (2017). Improvements in musculoskeletal health and computing behaviors: Effects of a macroergonomics office workplace and training intervention. *Applied Ergonomics, 62,* 182-196. https://doi.org/10.1016/j.apergo.2017.02.017

Rodrigues, M. S., Sonne, M, Andrews, D. M., Tomazini, L. F., de Oliveira Sato, T., & Chaves, T. C. (2019). Rapid office strain assessment (ROSA): Cross cultural validity, reliability and structural validity of the Brazilian-Portugese version. *Applied Ergonomics, 75*, 143-154 https://doi.org/10.1016/j.apergo.2018.09.009

Rucker, N. P. (2004). *Efficacy of office ergonomics training: An evaluation and comparison of instructor and web-based training* (Doctoral dissertation, Texas A&M University). https://pdfs.semanticscholar.org/ae81/6e5712f98860f8b50daa26ce6b6bbea7e70d.pdf

Salganik, M. J., & Heckathorn, D. D. (2004). Sampling and estimation in hidden populations using respondent-driven sampling. *Sociological Methodology, 34*(1), 193-239. https://doi.org/10.1111/j.0081-1750.2004.00152.x

Sasson, J. R., & Austin, J. (2005). The effects of training, feedback, and participant involvement in behavioral safety observations on office ergonomic behavior.

Journal of Organizational Behavior Management, 24(4), 1-30. https://doi.org/10.1300/J075v24n04_01

Schulz, J. (2012, August 14). *Analysing your interviews*. [Video]. YouTube. https://www.youtube.com/watch?v=59GsjhPolPs&feature=emb_logo

Simon, M. (n.d.). *Assumptions, Limitations and Delimitations*. https://pdf4pro.com/view/assumptions-limitations-and-delimitations-2ec0f0.html

Sonne, M., & Andrews, D. M. (2011/2012). The Rapid Office Strain Assessment (ROSA): Validity of online worker self-assessments and the relationship to worker discomfort. *Occupational Ergonomics, 10*(3), 83-101. https://content.iospress.com/articles/occupational-ergonomics/oer00194

Sonne, M., Villalta, D. L., & Andrews, D. M. (2012). Development and evaluation of an office ergonomic risk checklist: ROSA – Rapid office strain assessment. *Applied Ergonomics, 43*(1), 98-108. https://doi.org/10.1016/j.apergo.2011.03.008

St. Cloud State University. (2017, March 28). Limitations and delimitations in research [Blog]. https://blog.stcloudstate.edu/ims/2017/03/28/limitations-and-delimitations-in-research/

Statistics Canada (2020, November 6). *Labour Force Survey, October 2020*. The Daily. https://www150.statcan.gc.ca/n1/daily-quotidien/201106/dq201106a-eng.htm

Swinton, P. A., Cooper, K., & Hancock, E. (2017). Workplace interventions to improve sitting posture: A systematic review. *Preventive Medicine*, *101*, 204–212. https://doi.org/10.1016/j.ypmed.2017.06.023

Tenny, S., Brannan, G. D., Brannan, J. M., & Sharts-Hopko, N. C. (2020). Qualitative Study. *StatPearls*, 9. https://www.ncbi.nlm.nih.gov/books/NBK470395/

Weikle, B. (2020, September 7). *Office work could be changed forever by COVID-19. Here's why that matters.* CBC News. https://www.cbc.ca/news/business/office-workers-home-covid-19-1.5711334

Wilser, J. (2020, September 4). *The Pandemic of Work-From-Home Injuries.* The New York Times. https://www.nytimes.com/2020/09/04/well/live/ergonomics-work-from-home-injuries.html

Workers' Compensation Board Alberta. (2007). *Office ergonomics: Think detection. Think prevention. Think activity.* https://www.wcb.ab.ca/assets/pdfs/public/office_ergo.pdf

Workers' Compensation Board of Nova Scotia (n.d.). *Office ergonomics resource guide*. http://www.worksafeforlife.ca/portals/worksafeforlife/Media/MSI/Comms-Publications-MSI%20Office%20guide_ABSOLUTE%20FINAL.pdf

Workers Health & Safety Centre. (2016, February). *The economics of ergonomics.* https://www.whsc.on.ca/Files/Resources/Ergonomic-Resources/RSI-Day-2016_MSD-Case-Study_The-economics-of-ergon.aspx

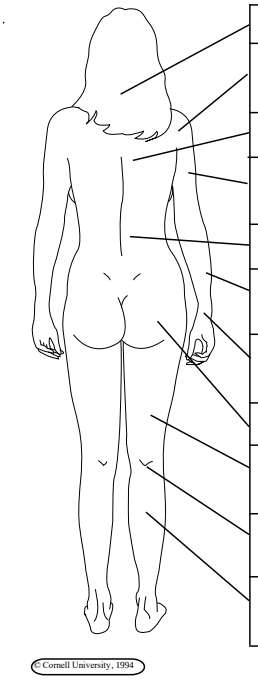
Work Safe Alberta. (n.d.). Backs and Bums: Applying basic ergonomics. https://ohs-pubstore.labour.alberta.ca/el002

WorkSafe NB. (2010, January). *Office ergonomics. Guidelines for preventing musculoskeletal injuries.* https://www.worksafenb.ca/media/1599/officeedist-1.pdf

Yazdani, A., & Wells, R. (2018). Barriers for implementation of successful change to prevent musculoskeletal disorders and how to systematically address them. *Applied Ergonomics*, *73*, 122-140. https://doi.org/10.1016/j.apergo.2018.05.004

Appendix A: CMDQ – GuardingMinds@Work Initial Scan

The diagram below shows the approximate position of the body parts referred to in the questionnaire. Please answer by marking the appropriate box.



	During the last work week how often did you experience ache, pain, discomfort in:					If you experienced ache, pain, discomfort, how uncomfortable was this?			If you experienced ache, pain, discomfort, did this interfere with your ability to work?		
	Never	1-2 times last week	3-4 times last week	Once every day	Several times every day	Slightly uncomfortable	Moderately uncomfortable	Very uncomfortable	Not at all	Slightly interfered	Substantially interfered
Neck	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Shoulder (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Shoulder (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Upper Back	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Upper Arm (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Upper Arm (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lower Back	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Forearm (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Forearm (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wrist (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wrist (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Hip/Buttocks	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Thigh (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Thigh (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Knee (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Knee (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lower Leg (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lower Leg (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

After you have filled out the diagram on the previous page, please answer the following questions as best as you can. Please note that your answers are anonymous and individual responses will be kept confidential. If you have concerns after answering these questions, please contact the principal investigator at 1-902-488-4551.

	Strongly Agree	Agree	Disagree	Strongly Disagree
I am satisfied with the amount of involvement I have in decisions that affect my work.	☐	☐	☐	☐
I feel I am well rewarded (in terms of praise and recognition) for the level of effort I put out for my job.	☐	☐	☐	☐
In the last six months, too much time pressure at work has caused me worry, “nerves” or stress.	☐	☐	☐	☐
In the last six months, I have experienced worry, “nerves” or stress from mental fatigue at work.	☐	☐	☐	☐
I am satisfied with the fairness and respect I receive on the job.	☐	☐	☐	☐
My supervisor supports me in getting my work done.	☐	☐	☐	☐
My supervisor supports me in obtaining the resources I need to properly set up my workstation.	☐	☐	☐	☐

Demographic Data:

Please answer the following questions as best as you can. Please note that your answers are anonymous and individual responses will be kept confidential.

What is your age (in years)? _____

What is your body mass in kilograms? _____

What is your height in centimeters? _____

On average, how many hours per day did you spend behind the computer when you worked in an office environment? _____

How long have you been working for your current company (years/months)?

_____

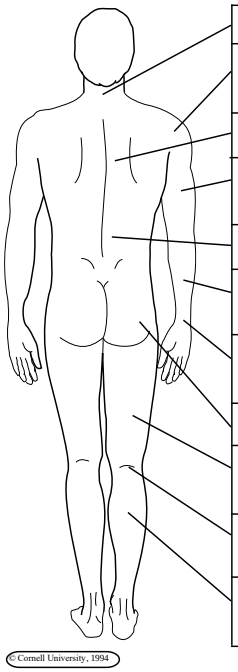
What is your sex (asked to determine body type)? Male Female

On average, how many hours of physical activity do you perform during your leisure time? _____

Please enter your unique identifier (combination of first initial of first and last name, first three digits of postal code, first three letters of street of home address and numeric identifier of birth month. For example: RTB3LWIL08).

Participant unique identifier: _____

The diagram below shows the approximate position of the body parts referred to in the questionnaire. Please answer by marking the appropriate box.



	During the last work week how often did you experience ache, pain, discomfort in:					If you experienced ache, pain, discomfort, how uncomfortable was this?			If you experienced ache, pain, discomfort, did this interfere with your ability to work?		
	Never	1-2 times last week	3-4 times last week	Once every day	Several times every day	Slightly uncomfortable	Moderately uncomfortable	Very uncomfortable	Not at all	Slightly interfered	Substantially interfered
Neck	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Shoulder (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Shoulder (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Upper Back	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Upper Arm (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Upper Arm (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lower Back	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Forearm (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Forearm (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wrist (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wrist (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Hip/Buttocks	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Thigh (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Thigh (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Knee (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Knee (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lower Leg (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lower Leg (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

After you have filled out the diagram on the previous page, please answer the following questions as best as you can. Please note that your answers are anonymous and individual responses will be kept confidential. If you have concerns after answering these questions, please contact the principal investigator at 1-902-488-4551.

	Strongly Agree	Agree	Disagree	Strongly Disagree
I am satisfied with the amount of involvement I have in decisions that affect my work.	☐	☐	☐	☐
I feel I am well rewarded (in terms of praise and recognition) for the level of effort I put out for my job.	☐	☐	☐	☐
In the last six months, too much time pressure at work has caused me worry, “nerves” or stress.	☐	☐	☐	☐
In the last six months, I have experience worry, “nerves” or stress from mental fatigue at work.	☐	☐	☐	☐
I am satisfied with the fairness and respect I receive on the job.	☐	☐	☐	☐
My supervisor supports me in getting my work done.	☐	☐	☐	☐
My supervisor supports me in obtaining the resources I need to properly set up my workstation.	☐	☐	☐	☐

Demographic Data:

Please answer the following questions as best as you can. Please note that your answers are anonymous and individual responses will be kept confidential.

What is your age (in years)? _____

What is your body mass in kilograms? _____

What is your height in centimeters? _____

On average, how many hours per day did you spend behind the computer when you worked in an office environment? _____

How long have you been working for your current company (years/months)?

_____

What is your sex (asked to determine body type)? Male Female

On average, how many hours of physical activity do you perform during your leisure time? _____

Please enter your unique identifier (combination of first initial of first and last name, first three digits of postal code, first three letters of street of home address and numeric identifier of birth month. For example: RTB3LWIL08).

Participant unique identifier: _____

Appendix B: Pre- and Post-Training Questionnaire

Please enter your unique identifier (combination of first initial of first and last name, first three digits of postal code, first three letters of street of home address and numeric identifier of birth month. For example: RTB3LWIL08).

Participant unique identifier: _____

1. Which posture can produce neck and upper back pain?

    a. Typical posture.
    b. Squinting.
    c. Wrists extended.
    d. Leaning on desk.

2. What ergonomic risk factors exist in the office (list three of them)?

    a. _____.
    b. _____.
    c. _____.

3. True or False: Standing is better for you than sitting.

    a. True
    b. False

4. True or False: Staying in a good posture all day will reduce my discomfort.

    a. True
    b. False

5. How often should I get up from my desk?

    a. Once every 2 hours.
    b. Once every 10 minutes.
    c. Once every 20-30 minutes.
    d. Once every hour.

6. List four features of a properly set up chair. (fill in the blank)

    a. Elbows at or a little less than _____ degrees.
    b. Wrists in _____ position.
    c. Hips _____ knees.
    d. Feet _____ on floor or footrest.

7. What can you do if your chair is too low? (choose two answers)

    a. Raise the height of the armrests.
    b. Rest your arms on the desk and move the keyboard and mouse away from the edge of the desk.
    c. Get a height adjustable keyboard tray.
    d. Get up from my chair at least once every 90 minutes.

8. How far should your monitor be from you?

    a. 20-74 cm (7.9-30 in).
    b. 50-100 cm (19.7 to 39.4 in).
    c. 30-80 cm (11.8 to 31.5 in).
    d. 60-110 cm (23.6 to 43.3 in).

9. If you use a sit-stand (height adjustable) desk, how often should you change positions? (choose one answer)

    a. After 20 minutes of sitting.
    b. After 40 minutes of sitting.
    c. After 60 minutes of sitting.
    d. Whenever you feel that you need to change position or when you feel discomfort.

10. True or False: A height adjustable workstation (sit-stand desk) will help me avoid being sedentary.

    a. True.
    b. False.

Appendix C: Reaction to Training Survey

Please enter your unique identifier (combination of first initial of first and last name, first three digits of postal code, first three letters of street of home address and numeric identifier of birth month. For example: RTB3LWIL08).

Participant unique identifier: _____

For the following statements, please check the most appropriate answer.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Disagree
I have learned a lot regarding the proper setup of my work area.	☐	☐	☐	☐	☐
I am able to apply this knowledge immediately to any computer workstation that I move to.	☐	☐	☐	☐	☐
I feel that the training will help reduce my discomfort.	☐	☐	☐	☐	☐
I felt that this method of training was beneficial.	☐	☐	☐	☐	☐
I will advise my co-workers to take their training through this method.	☐	☐	☐	☐	☐
The time spent on training was appropriate.	☐	☐	☐	☐	☐
Rate the overall training.	☐	☐	☐	☐	☐

Do you have any other comments about the course that you would like to share?

Appendix D: Rapid Office Strain Assessment Tool

UserName _____ Group _____

Date _____

Assessed By _____

THE RAPID OFFICE STRAIN ASSESSMENT
DEVELOPED BY MICHAEL SONNE, MHK, CK.

Section A - Chair

Chair Height — AREA SCORE 0

Non-Adjustable (+1)

Knees at 90° (1) | Too low - Knee Angle <90° (2) | Too High - Knee Angle >90°(2) | No foot contact on ground (3) | Insufficient Space Under Desk - Ability to Cross Legs(+1)

Pan Depth — AREA SCORE

Non-Adjustable (+1)

Approximately 3 inches of space between knee and edge of seat (1) | Too Long - Less Than 3" of space (2) | Too Short - More than 3" of Space(2)

Armrests — AREA SCORE

Non-Adjustable (+1)

Elbows supported in line with shoulder, shoulders relaxed (1) | Too High (Shoulders Shrugged) /Low (Arms Unsupported) (2) | Hard/damaged surface (+1) | Too Wide (+1)

Back Support — AREA SCORE

Back Rest Non-Adjustable (+1)

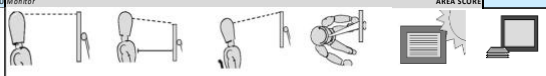
Adequate Lumbar Support - Chair reclined between 95°-110° (1) | No Lumbar Support OR Lumbar Support not Positioned in Small of Back (2) | Angled Too Far Back (Greater than 110°) OR Angled Too far forward (Less than 95°) (2) | No Back Support (ie Stool, OR Worker Leaning forward) (2) | Work Surface too High (Shoulders Shrugged)(+1)

DURATION | CHAIR SCORE

Chair	Monitor and Telephone	Mouse and Keyboard		ROSA FINAL SCORE

Section B - Monitor and Telephone

Monitor — AREA SCORE



Arm's Length Distance (40-75cm) / Screen at Eye Level (1) | Too Low (below 30°) (2) Too Far (+1) | Too High (Neck Extension) (3) | Neck Twist Greater than 30° (+1) | Glare on Screen (+1) | Documents - No Holder (+1)

DURATION | Monitor Score

Telephone — AREA SCORE

No Hands-Free Options (+1)

Headset / One Hand on Phone & Neutral Neck Posture (1) | Too Far of Reach (outside of 30cm) (2) | Neck and Shoulder Hold (+2)

Phone Score

DURATION | ROSA SCORE

Section C - Mouse and Keyboard

Mouse — AREA SCORE

Mouse in Line with Shoulder (1) | Reaching to Mouse (2) | Mouse/Keyboard on Different Surfaces (+2) | Pinch Grip on Mouse (+1) | Palmrest in Front of Mouse (+1)

DURATION | MOUSE SCORE

Keyboard — AREA SCORE

Platform Non-Adjustable (+1)

Wrists Straight, Shoulders Relaxed (1) | Wrists Extended/ Keyboard on Positive Angle (>15° Wrist extension) (2) | Deviation while Typing (+1) | Keyboard Too High - Shoulders Shrugged (+1) | Reaching to Overhead Items (+1)

DURATION | KEYBOARD SCORE | ROSA SCORE

DURATION INSTRUCTIONS | Peripherals and Monitor Score

If less than 30 minutes continuously, or less than 1 hour per day, mark as **-1**.
If between 30 minutes and 1 hour continuously, or between 1 and 4 hours per day, mark as **0**.
If greater than 1 hour continuously, or more than 4 hours per day, mark as **+1**.

Appendix E: Email and Invitation to Participate

EMAIL INVITE

Do you have concerns with your ergonomic setup since you have been asked to work from home? Are you interested in being part of a research project? Would you like to be guided on how to properly setup your area and have your setup assessed free of charge?

This study is open to anyone who has not participated in an office ergonomics assessment or training in the past six months and wishes to complete an eLearning course and then take photos of themselves that will be used for assessment. After, you may be invited to participate in a WebEx interview to discuss the process. Participants should be willing to contribute approximately two hours in total to complete the steps in the first part of the study. If selected for the second part of the study, up to another hour for online interview.

Participation is completely voluntary. All information provided is confidential and confidentiality will be maintained according to privacy standards outlined by Athabasca University and legislation in the province of Nova Scotia. These processes will be further explained prior to commencing the interview process.

Please contact the investigator if you would like more information or you would like to consider participating in this project.

Appendix F: INVITATION TO PARTICIPATE

Efficacy of Efficient Remote Office Ergonomics Education

July 10, 2020

Principal Investigator (Researcher):
Randall Tresidder, PT
Master of Education (DE) Student
Athabasca University
Athabasca, AB
Cell Ph: 902.488.4551
E-mail: rtresidder1@athabasca.edu

Supervisor:
Mohamed Ally, PhD
Faculty of Humanities and Social Sciences
Athabasca University
Athabasca, AB
Phone: 1-866-916-8650
E-mail: mohameda@athabascau.ca

My name is Randy Tresidder and I am a Master of Education (Distance Education) student at Athabasca University. As a requirement to complete my degree, I am conducting a research project about the effectiveness of office ergonomic programs provided through distance education for office workers who are now working at home because of the current pandemic. I am conducting this project under the supervision of Dr. Mohamed Ally.

I invite you to participate in this project because you may be working from home over the past couple of months and finding it difficult to get comfortable.

The purpose of this research project is to determine if computer workstation ergonomics training and feedback through distance is effective and to identify what helps or hinders the effectiveness.

Your participation in this project would involve taking an eLearning course on office ergonomics, answering online surveys both before and after the training between July 15 and August 31, 2020 and one month after feedback has been provided and to take pictures before and after the eLearning course and one month after feedback has been provided. The expected total time to complete all of these tasks will be approximately two hours. You will be asked to sign a consent for this part of the study. E-mail will be used to send the consent form and to provide the pictures to the principal investigator. LimeSurvey will be used for online surveys. Their servers are located in Canada and your data will not be subjected to the US Patriot Act.

Once this data has been analysed, some participants will be contacted to participate in an interview conducted online. This interview would be arranged for a time that is convenient for you and your schedule. The interview will take between 30-60 minutes and will be recorded for transcription and review purposes. The interview will be recorded for transcription and review purposes and will be conducted via Cisco WebEx

to ensure a secure connection. You will be asked to again fill out a similar consent to the first.

The research should benefit you by assisting you in setting up an office area in your home to reduce the risk of injuries that occur with computer use. I do not anticipate that you will face any risks as a result of participating in this research. A donation in the amount of $10 to the charity of your choice from the following options will be paid by me:

- Feed Nova Scotia (https://www.feednovascotia.ca/about)
- Byrony House (https://www.bryonyhouse.ca/about-us/)
- Adsum House (https://adsumforwomen.org/about-us-1)
- Phoenix House (https://phoenixyouth.ca/who-we-are)
- Other charity that involves feeding those in our community, helps to provide support to those impacted by domestic violence, or displaced youth as a result of this current pandemic.

You will be provided a breakdown of the total funds provided and how much went to each charity at the end of the study. No tax receipts will be issued to the participants.

Thank you for considering this invitation. If you have any questions or would like more information, please contact me, Randy Tresidder by e-mail, rtresidder1@athabasca.edu or my supervisor by e-mail, mohameda@athabascau.ca.

Thank you.

Randall Tresidder

This project has been reviewed by the Athabasca University Research Ethics Board. Should you have any comments or concerns regarding your treatment as a participant in this project, please contact the Research Ethics Office by e-mail at rebsec@athabascau.ca **or by telephone at 1-800-788-9041, ext. 6718.**

Appendix G: Letter of Information for Participants

Efficacy of Efficient Remote Office Ergonomics Education

June 15, 2020

Principal Investigator (Researcher):
Randall Tresidder, PT
Master of Education (DE) Student
Athabasca University
Athabasca, AB
Cell Ph: 902.488.4551
E-mail: rtresidder1@athabasca.edu

Supervisor:
Mohamed Ally, PhD
Faculty of Humanities and Social Sciences
Athabasca University
Athabasca, AB
Phone: 1-866-916-8650
E-mail: mohameda@athabascau.ca

You are invited to take part in a research project entitled '*Efficacy of Efficient Remote Office Ergonomics Education*'.

This form is part of the process of informed consent. The information presented should give you the basic idea of what this research is about and what your participation will involve, should you choose to participate. It also describes your right to withdraw from the project. In order to decide whether you wish to participate in this research project, you should understand enough about its risks, benefits and what it requires of you to be able to make an informed decision. This is the informed consent process. Take time to read this carefully as it is important that you understand the information given to you. Please contact the principal investigator, Randy Tresidder if you have any questions about the project or would like more information before you consent to participate.

It is entirely up to you whether or not you take part in this research. If you choose not to take part, or if you decide to withdraw from the research once it has started, there will be no negative consequences for you now, or in the future.

Introduction
My name is Randall Tresidder and I am a Master of Education (Distance Education) student at Athabasca University. As a requirement to complete my degree, I am conducting a research project to look at the effectiveness of an office ergonomics program conducted through distance education. I am conducting this project under the supervision of Dr. Mohamed Ally.

Why are you being asked to take part in this research project?
You are being invited to participate in this project because you worked with a computer in an office for a minimum of four hours per day prior to the COVID-19 pandemic and now find yourself working on your computer from home. You also have not taken part in an office ergonomic assessment nor an office ergonomic training session in the past six months.

What is the purpose of this research project?
The purpose of this study is to evaluate the effectiveness of an abbreviated office ergonomics course offered through distance education for employees working from home during the current global pandemic. It hopes to answer the question *how effective will an abbreviated distance education design for office ergonomics training be to address behaviour and employee discomfort*?

What will you be asked to do?
Your participation in this project would involve taking an eLearning course on office ergonomics, answering online surveys both before and after the training between July 15 and August 31, 2020 and one month after feedback has been provided and to take pictures before and after the eLearning course and one month after feedback has been provided. The expected total time to complete all of these tasks will be approximately two hours. E-mail will be used to send the consent form and to provide the pictures to the principal investigator. LimeSurvey will be used for online surveys. Their servers are located in Canada and your data will not be subjected to the US Patriot Act.

Once this data has been analysed, some participants will be contacted to participate in an interview conducted online. This interview would be arranged for a time that is convenient for you and your schedule and should take between 30-60 minutes. The interview will be recorded for transcription and review purposes and will be conducted via Cisco WebEx to ensure a secure connection.

What are the risks and benefits?
The research should benefit you by assisting you in setting up an office area in your home to reduce the risk of injuries that occur with computer use. I do not anticipate that you will face any risks as a result of participating in this research. A donation in the amount of $10 to the charity of your choice from the following options will be paid by me:

- Feed Nova Scotia (https://www.feednovascotia.ca/about)
- Byrony House (https://www.bryonyhouse.ca/about-us/)
- Adsum House (https://adsumforwomen.org/about-us-1)
- Phoenix House (https://phoenixyouth.ca/who-we-are)
- Other charity that involves feeding those in our community, helps to provide support to those impacted by domestic violence, or displaced youth as a result of this current pandemic.

You will be provided a breakdown of the total funds provided and how much went to each charity at the end of the study.

Do you have to take part in this project?

As stated earlier in this letter, involvement in this project is entirely voluntary. If you wish to end your participation, advise the principal investigator either by e-mail or phone. You will be asked if the data obtained up to that point in time can still be used in the study. If you say no, the data will be removed and not used for the study.

There will be no consequences to you withdrawing from the study.

Please note that data (surveys, photos, pre- and post-testing) can be removed any time before September 30, 2020. If you are part of the focus group being interviewed after September 1, 2020, you can remove your complete interview data any time before October 15, 2020.

How will your privacy and confidentiality be protected?
The ethical duty of confidentiality includes safeguarding participants' identities, personal information, and data from unauthorized access, use or disclosure. You will be asked to create a unique identifier that you will use when completing online surveys, providing photos, and if you participate in an interview as part of the focus group. All data will be published as aggregate data. In other words, as a number or theme of part of the larger group. You will not be identified in any publications.

How will my anonymity be protected?
Anonymity refers to protecting participants' identifying characteristics, such as name or description of physical appearance. Your anonymity will be maintained by the use of the unique identifier and your pictures will only be accessible by the principal investigator, secondary investigator and the supervisor.

Every reasonable effort will be made to ensure your anonymity; you will not be identified in publications without your explicit permission.

How will the data collected be stored?

The data will be stored on an external hard drive that will be stored in a locked cabinet within the principle author's residence while the study is being conducted and then in a safety deposit box belonging to the principle investigator once the study has been completed. It will be retained for six years after the masters thesis has been defended. The data will be destroyed by formatting the external hard drive and rewriting miscellaneous files onto the hard drive. This will be repeated a minimum of three times.

There will be no secondary use of the data.

The online surveys and pre- and post-testing will be accessed through LimeSurvey. This company has their servers in Canada and are not affected by the US Patriot Act. The security and privacy policy for the web survey company can be found at the following link: https://www.limesurvey.org/data-protection-statement.

Who will receive the results of the research project?
The existence of the research will be listed in an abstract posted online at the Athabasca University Library's Digital Thesis and Project Room and the final research paper will be publicly available. The research will also be submitted for publication, but only aggregate data will be used to ensure anonymity. There will be no personally identifying information used. No photos will be used in the thesis or the publication submission.

Should you wish a copy of the summary of the findings, I can provide you with these.

Who can you contact for more information or to indicate your interest in participating in the research project?
Thank you for considering this invitation. If you have any questions or would like more information, please contact me, (the principal investigator) by e-mail rtresidder1@athabasca.edu or my supervisor by mohameda@athabascau.ca. If you are ready to participate in this project, please complete and sign the attached Consent Form, scan or take a photo of each page and send them to me via email at rtresidder1@athabasca.edu prior to July 15, 2020.

Thank you.

Randall Tresidder

This project has been reviewed by the Athabasca University Research Ethics Board. Should you have any comments or concerns regarding your treatment as a participant in this project, please contact the Research Ethics Office by e-mail at rebsec@athabascau.ca **or by telephone at 1-800-788-9041, ext. 6718.**

Appendix H: Informed Consent

Your signature on this form means that:

- You have read the information about the research project.
- You have been able to ask questions about this project.
- You are satisfied with the answers to any questions you may have had.
- You understand what the research project is about and what you will be asked to do.
- You understand that you are free to withdraw your participation in the research project without having to give a reason, and that doing so will not affect you now, or in the future.
- You understand that if you choose to end your participation **during** data collection, any data collected from you up to that point will be retained by the researcher, unless you indicate otherwise.
- You understand that if you choose to withdraw **after** data collection has ended, your data can be removed from the project at your request, up to September 30, 2020 for the survey and photo data and October 15, 2020 for the interview data, if you are involved in the focus group.
- You previously worked with a computer in an office for *at least* four hours per day and now work from home due to the current pandemic (COVID-19).
- You also not taken part in an office ergonomic assessment nor an office ergonomic training session in the past six months.

Please choose the applicable part of the study that you are providing consent:

eLearning course on office ergonomics, answering online surveys, taking pictures ☐

Interview ☐

	YES	NO
I agree to be audio-recorded	☐	☐
I agree to be video-recorded	☐	☐
I agree to be photographed	☐	☐
I agree to the use of direct quotations	☐	☐

* Audio recordings will be used by the principal investigator for transcription and data review purposes. Some excerpts (quotes) may be used in publications and/or conference presentations without any identifying information.

** Video recordings will be used by the principal investigator for transcription and data review purposes. **No images from the video recordings will be used**. Some excerpts (quotes) may be used in publications and/or conference presentations without any identifying information.

Please create a unique identifier for yourself:

Please create a unique identifier for yourself. This will be used in every survey and photo submission that provide. Please copy this down as it will be unique to you. It is created by combining the first initial of your first and last name, first three digits of your postal code, first three letters of the street of your home address and a numeric identifier of your birth month. For example: RTB3LWIL08.

Unique identifier: _____

Your signature confirms:

- You have read what this research project is about and understood the risks and benefits. You have had time to think about participating in the project and had the opportunity to ask questions and have those questions answered to your satisfaction.

- You understand that participating in the project is entirely voluntary and that you may withdraw at any time as described in this document without any penalty or negative consequences. Please note that if you withdraw after the dates listed above, your data cannot be removed from the project.

- You have been given a copy of this Informed Consent form for your records; and

- You agree to participate in this research project.

_____ _____

Signature of Participant Date

Principal Investigator's Signature:

I have explained this project to the best of my ability. I invited questions and responded to any that were asked. I believe that the participant fully understands what is involved in participating in the research project, any potential risks and that he or she has freely chosen to participate.

_____ _____

Signature of Principal Investigator Date

Appendix I: Instructions for Distance Education Photos

1

2

3

4

For the photos, you will need to ask a friend or co-worker to take the pictures. Please follow the instructions below for each of the images.

Photo setup:

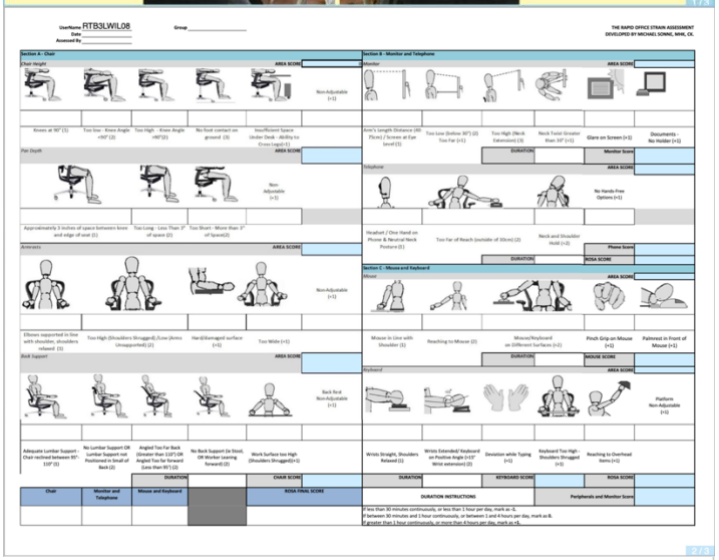
For images 1 and 4, have your picture taken from the side with the camera at the same level or a bit higher than your shoulder. Make sure that the picture shows from your head to your feet as best as possible.

- For image 1 – if you cannot get head to feet, please move the chair to an area that has enough room to allow this.
- For image 4 – if you cannot get head to feet, get as much of yourself and the desk in the picture as possible.

For images 2 and 3, have someone take a picture of you and your desk with the camera over each shoulder. Please ensure the pictures show your hand position as if you are working at the computer, as best as possible.

Once you are happy with the images, please send them to rtresidder1@athabasca.edu using the identifier you created for yourself (combination of first initial of first and last name, first three digits of postal code, first three letters of street of home address and numeric identifier of birth month. For example: RTB3LWIL08).

Appendix J: Example of a ROSA PDF Scoring Sheet

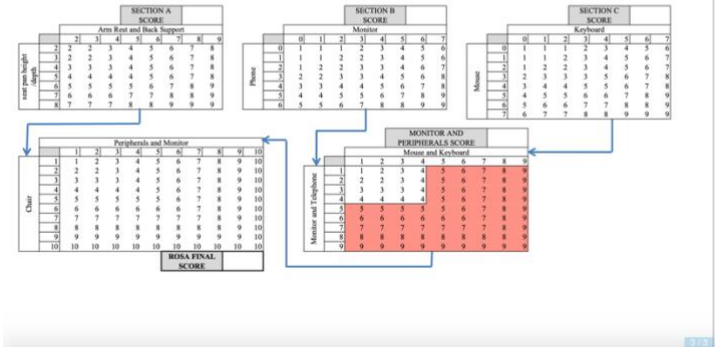


RAPID OFFICE STRAIN ASSESSMENT

EMPLOYEE NAME: RTB3LWIL08
DATE:
ASSESSED BY:

ROSA SCORING INSTRUCTIONS

1. Add Seat Pan and Seat Depth scores together to receive Section A vertical Axis Score. Add Arm Rest and Back Rest scores together to receive the vertical axis score. Using these scores, follow the scoring chart to receive the Chair Score. Add the appropriate duration score based on the amount of time the worker spends in the chair per day.
2. Add the score for the Monitor with the appropriate duration score to receive the value for the horizontal axis in Section B. Add the telephone score together plus the appropriate duration score to receive the vertical axis for Section B. Using these scores, follow the scoring chart to receive the Section B score.
3. Add the score for the keyboard to the appropriate duration score to receive the value for the horizontal axis in Section C. Add the score of the mouse to the appropriate duration score to receive the vertical axis for Section C. Using these scores, follow the scoring chart to receive the Section C score.
4. Use the score from step 2 to receive the score for the vertical axis in the peripheral and monitor section. Use the score from step 3 to receive the score for the horizontal axis in the peripheral and monitor section.
5. Use the score from Step 1 (Section A) to receive the value for the vertical axis in the grand score chart. Use the score from step 4 to receive the score for the horizontal axis in the grand score chart. Using these two scores, find the corresponding Grand ROSA score.



Appendix K: Qualitative Interview Questions

Pre-amble: These are possible questions to be used but may change depending on the results of the quantitative data.

Principal Investigator: Could you please verify your unique identifier? As a reminder, it was a combination of first initial of first and last name, first three digits of postal code, first three letters of street of home address and numeric identifier of birth month.

Principal Investigator: There were a few participants that agreed to complete the training, but I was unable to determine any trends from the data provided. This interview process is to try and to determine the value of the eLearning course Office Ergonomics and the feedback I provided to you. Are you okay to proceed?

NOTE: If participant says no, thank them for their time and say goodbye. If they say yes, proceed with the appropriate questions.

The following questions are *possible* questions but may change based on the quantitative outcomes.

Question 1:

> When you first agreed to the study, what were your perceptions of what was necessary to ensure good office ergonomics?

Question 2:

> How did this training work for you?

From here, the following questions can be used for prompts to Question 2.

Question 1:

> What benefits do you see for yourself using the distance education version of office ergonomics training while working from home during this pandemic?

Question 2:

> If you were reluctant to use a distance education version of office ergonomics training, what would be your concerns with the distance education version you completed?

Question 3:

> Do you have any other thoughts or concerns regarding the use of this distance education version?

Question 4:

> Prior to providing feedback, there was no agreement to being able to apply the knowledge gained from the eLearning course. Did the provision of feedback through email and drawing on the pictures you provided have any impact on your ability to apply the knowledge?

Question 5:

> Were you able to make any changes to your office setup?

Question 6:

> What do you think are the drivers or barriers that allow or disallow the participants to change their behaviour towards the use of proper office ergonomics for employees working from home?

Question 7:

> What do you think are the strengths and weaknesses of this approach to ergonomic education?

Appendix L: Qualitative Data Final Themes

The following are the themes of the qualitative data. Included are the sub-themes and sub-sub-themes:

Access
- Access to expertise
- Accessibility
- Ease of use
- Limited dissemination

Behaviour Change
- Barrier to change (Main)
  - Changing habits
  - Competing priorities
  - Desire to change
  - External factors
  - Not applying knowledge
  - Personal motivation
  - Reluctance to change
  - Self-importance
- Behaviour change
  - Prioritizing
  - Readiness for change
  - Reinforce good behaviour

COVID-19
- COVID-19 Adaptability
- COVID-19 Complications
- COVID-19 Fear

Design
- Feedback support
- Independence
- Personalization
- Pictorial perception errors
- Video design

Knowledge
- Comfort with technology
- Knowledge increase
- Lack of knowledge
- Transferability

Musculoskeletal
- Discomfort
- Discomfort decrease

Resources
- Equipment
- Manager support
- Resource availability
- Resource financial

Appendix M: Ethics Approval

Athabasca University
RESEARCH CENTRE

CERTIFICATION OF ETHICAL APPROVAL

The Athabasca University Research Ethics Board (REB) has reviewed and approved the research project noted below. The REB is constituted and operates in accordance with the current version of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2) and Athabasca University Policy and Procedures.

Ethics File No.: **24012**

Principal Investigator:
Mr. Randall Tresidder, Graduate Student
Faculty of Humanities & Social Sciences\Master of Education in Distance Education (MEd)

Supervisor:
Dr. Mohamed Ally (Supervisor)

Project Title:
Efficacy of Efficient Remote Office Ergonomics Education

Effective Date: July 28, 2020 **Expiry Date**: July 27, 2021

Restrictions:

Any modification or amendment to the approved research must be submitted to the AUREB for approval.

Ethical approval is valid *for a period of one year*. An annual request for renewal must be submitted and approved by the above expiry date if a project is ongoing beyond one year.

A Project Completion (Final) Report must be submitted when the research is complete *(i.e. all participant contact and data collection is concluded, no follow-up with participants is anticipated and findings have been made available/provided to participants (if applicable))* or the research is terminated.

Approved by: **Date: July 28, 2020**

Michael Lithgow, Chair
Faculty of Humanities & Social Sciences, Departmental Ethics Review Committee

---

Athabasca University Research Ethics Board
University Research Services, Research Centre
1 University Drive, Athabasca AB Canada T9S 3A3
E-mail rebsec@athabascau.ca
Telephone: 780.675.6718