A NEW USER’S PERCEPTIONS AND EXPERIENCES OF THE ACTIVE WORKSTATION AT WORK: A CASE STUDY

by Amanda J. Zylstra

Levels of physical activity at work are decreasing as jobs and technology change. The active workstation is a potential solution to incorporating more physical activity into the office setting, but little is understood about the perceived experience of active workstation use. This case study used purposeful sampling to explore the perceptions and experiences of a new active workstation user at work. Data was generated using weekly interviews and were subject to inductive coding, analysis and interpretation using researcher triangulation. The main benefit was knowing she could walk at work. The main barrier experienced was a lack of perceived physical benefits. Active workstation use also required a negotiation of external influences and the logistics of walking while working. If there are few experienced benefits, active workstation users may lose motivation. Further research is needed to better understand what hinders or facilitates active workstation use.
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ACTIVE WORKSTATION AT WORK: A CASE STUDY

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Chapter One: Introduction

‘Physically inactive’ and ‘sedentary lifestyles’ are two phrases that are commonly used to describe the majority of the adult population in the United States. Furthermore, the Behavioral Risk Factor Surveillance Survey (BRFSS) survey demonstrates that only 26.2% of the U.S. adults engage in recommended levels of physical activity (CDC, 2003). Many industrial nations do not meet the recommended physical activity guidelines, which is often attributed to the agricultural, industrial, and technological revolutions that have transpired in the last 150 years that have transformed the way in which they work and play (Sallis, Baumen, & Pratt, 1998). For example, the advancement of technology has caused a shift away from reliance on manual labor resulting in a decrease in physical activity in all aspects of life (Brownson, Boehmer, & Luke, 2005). Moreover, the benefits of the industrial and technological revolutions came at the expense of a loss of human energy expenditure (Lanningham-Foster, Nysse, & Levine, 2003). Before the industrial age, humans hunted for their meals; in the present day, people can pick up their dinner at a drive through window without even leaving their car. The lifestyle transformation that enables humans to move less is also clearly evident in the workforce, where many people spend at least eight hours of their waking day (Brownson et al., 2005).

As time progresses, the level of physical activity that people engage in at work is decreasing. According to Brownson et al. (2005) in 1950, 23.3% of the population (16 million people) in the U.S. were employed in low-activity occupations. These are jobs that require little movement for the task to be performed and as a result create a sedentary situation for the employee. By 1970, 41% of the population (33.7 million) people were employed with low-activity occupations, and this number has remained relatively stable. According to the 2000 Census, 58.2 million, or 42.6% of the working population, are now employed in low-activity occupations (Brownson et al., 2005). In contrast, the percent of the working population in high-activity occupations remained steady at approximately 30% from 1950 to 1970 and has declined slowly to an estimated 22.6% in 2000 (Brownson et al., 2005). This demonstrates that the workforce is shifting from high activity jobs to low activity jobs. One potential contributor to this transformation of occupational activity levels is the physical design of the workplace, also known as the built environment.
The built environment is defined as, “encompassing aspects of a person’s surroundings which are human-made or modified, as compared with naturally occurring aspects of the environment” (Papas, Alberg, Ewing, Helzlsouer, Gary, & Klassen, 2007, p. 130). From driving a vehicle instead of walking to work, to taking the elevator/escalator instead of using the stairs, these creative man-made laborsaving devices have successfully replaced the dwindling opportunities for movement with technology. Research is now directed at examining the effects of the built environment on sedentary living and working on obesity, chronic diseases, and other quality of life issues (Booth, Chakravarthy, Gordon & Spangenburg, 2002; Killingsworth, Earp, Moore, & Arch, 2003). With low-activity occupations on the rise, ideas about the way these occupations look and operate are under inspection, with alternatives arising that may enable the transformation of office design. One such design provides an alternative to the office chair, one of the largest barriers to movement in the office setting, by replacing it with a treadmill.

In 1993, Nathan Edelson patented an adjustable portable exercise desk. The intention was that one could sit and work, or elevate the desk and place a treadmill under it and walk while they work (Edelson, 1993). Edelson’s purpose in inventing the adjustable portable exercise desk was to combat what he called, “postural fixity” of the sedentary office worker. In an article in the New York Times, Edelson argues that, “many of the aches and pains, as well as stress and illness, that afflict those who must sit in front of their video display terminals for long periods are due not to how one sits, but rather how long one sits” (Markoff, June 22, 1988). Edelson suggested that his invention is both an opportunity to prevent ergonomic injuries from sitting all day, but also understood the health benefits of increasing physical activity. Edelson’s idea did not become mainstream; however, it did attract the attention of other researchers.

Research on walking while working, while still relatively new, continues to gain traction. In particular, James Levine of the Mayo Clinic has directed considerable attention toward the active workstation, a treadmill desk similar to Edelson’s original design (Levine & Miller, 2007; Thompson, Foster, Eide, & Levine 2007; & Fidler, Carroll, Ogden, & Johnson, 2008). The active workstation is a product designed by Steelcase that consists of a height adjustable desk integrated with a treadmill. The website further describes the active workstation, “Make it a moving experience. Walkstation lets you walk comfortably, burn calories, feel healthier and more energized ... all while accomplishing the work you normally do seated” (Steelcase, Grand Rapids, MI). Previous research has examined the cognitive abilities required to perform work
as well as the physiological effects of using an active workstation, but no research has examined the experiences and perceptions of office workers who use the active workstation in their natural setting (Levine et al., 2007; Cox, In press; John et al., 2009; Ohlinger, Horn, Berg, & Cox, In press; Straker et al., 2009; Fidler et al., 2008). The current case study will use qualitative methods to examine perceptions of the active workstation. The case study will examine the experiences and perceptions of a participant as she implements an active workstation into her office environment. Therefore, the purpose of my study is to better understand what it is that facilitates or hinders using the active workstation at work from the experiences and perspectives of a new user.
Chapter Two: Literature Review

This chapter provides an overview of the existing literature on a relatively new idea of transforming the sedentary workplace. First, it will address the dramatic shift from physically active living, consisting of farming, and activity oriented occupations, to sedentary living because of advancement in technology, transformation of the food industry, and low activity occupations. It will then address the effects that the built environment has on physical activity, particularly in the workplace. Next, the sedentary design of the office setting will be reviewed including potential solutions to enhance activity; focusing on the active workstation. Finally, the literature review will examine the gaps in research and demonstrate what new knowledge this study will contribute to the field.

Physical Activity Versus Sedentary Living

Throughout history, physical activity has dramatically shifted in purpose. Physical activity is defined as, “bodily movement that is produced by the contraction of skeletal muscle and that substantially increases energy expenditure above the basal level” (CDC, 1998, p. 20). Historically, it was only through physical activity that humans were able to accomplish necessary tasks such as finding food, transportation, and production of goods. However, where people once used walking to transport themselves to and from work, they now use an automobile. In order to eat, one had to hunt and grow their food, rather than buy it from a supermarket. Instead of washing clothes by hand one can now use the washing machine. The advancement of technology and “laborsaving devices” has produced an environment that decreases physical activity and increases sedentary living (Sallis & Owen, 1998). Sallis et al. (1998) further describes the situation:

For the vast majority of people in industrialized nations, hardly any physical activity is needed to put in a day’s work, feed oneself, or be entertained. This is a unique situation in human history, and we are now finding that there are severe health consequences from the current epidemic of sedentary lifestyles. (p. 6)

This transition away from human labor to mechanized labor is only one component of a complex system that has led to the continual deterioration of healthy living; other factors include: obesity, genetics, and energy expenditure.

Often the result of decreased physical activity is a sedentary lifestyle. The word sedentary comes from the word ‘sedentarius’ meaning ‘one that sits,’ and is used synonymously
with the term physical inactivity defined as “activity equivalent to less than thirty minutes of brisk walking per day” (Booth et al., 2002, p. 5). According to Booth et al. (2002) around 70% of adults in the United States do not meet the recommended 30 minutes of moderate physical activity five or more times per week, which includes the 24% of Americans who have no physical activity. In addition, “chronic low levels of physical stresses are associated with musculoskeletal (osteoporosis), cardiovascular (hypertension, coronary heart disease, ischemic stroke), metabolic (obesity, insulin resistance, type II diabetes), mental (depression) and other (some cancers) disorders” (Surgeon General, 1996). As a result, “physical inactivity is the third leading cause of death in the United States and contributes to the second leading cause (obesity), accounting for at least 1 in 10 deaths” (Booth, 2002, p. 5). As previously contended, modern comfort and convenience have significantly contributed to the promotion of sedentary living.

It is important to understand the impact physical inactivity, or low physical stress on the body, has on one’s health. In one study examining the absence of physical stress on the body, Greenleaf, Bulbulian, Bernaurer, Haskell and Moore looked at astronauts in a micro-gravity environment (1989). They found a significant reduction in bone density, muscular strength and endurance, impaired coordination and fitness levels, increased tendency to faint and a deterioration in mood and psychological state (Greenleaf et al., 1989). While this example of anti-gravity is far from the reality of Americans, it does demonstrate at an accelerated rate what happens when a person does not have physical activity. In a much more realistic setting, Watenpaugh et al. (2000) found that after fifteen consecutive days of controlled bed-rest of eight healthy and relatively fit males between 24-49 years old, “time to exhaustion during an upright treadmill exercise test decreased 10%, peak oxygen consumption during the test decreased 14%, and sprint speed decreased 16%” (p. 218). While the typical person does not spend their entire day in bed, this study demonstrates the impact that physical inactivity has on the body. In addition to a loss of functional capabilities such as time to exhaustion, maximal oxygen consumption, and maximal speed, sedentary living has also been linked to obesity, a current epidemic within the United States.

**Obesity.** Concurrently with the increase of sedentary living in the United States, obesity rates have been rapidly rising. Between 1988 and 2008, the prevalence of overweight (having a BMI greater than 25) has increased from 55.9% to 68%, and more specifically, the age adjusted prevalence of obesity (having a BMI greater than 30) has increased from 22.9% to 33.8%
(Flegal, Carroll, Ogden, & Johnson, 2002; Flegal, Carroll, Ogden, & Johnson, 2010). These trends have transcended three major ethnic groups and include both sexes (Flegal et al., 2010). Excess weight is also associated with an increase risk of high blood pressure, type 2 diabetes mellitus, gallbladder disease, osteoarthritis, and heart disease. (Must, Spadano, Coakley, Field, Colditz, & Dietz, 1999).

Obesity is also impacting the workforce. According to National Health Institute Data, obesity has also been attributed to 39.2 million work days lost each year as well as the number of physician visits attributed to obesity increasing by 88% from 1988 to 1994. (Wolf & Colditz, 1998). With over two-thirds of the adult American population being either overweight or obese, it is imperative to understand what is behind this epidemic and how to move forward to reverse it. One component contributing to obesity is the sedentary work force that is continuing to increase in numbers (Brownson et al., 2005). Another component that many contend contributes to our physical response to the environment in which we live is our genetic make-up.

**Genetics.** Researchers such as Booth, Chakravarthy, Gordon, and Spangenburg (2002) and Cordain, Gotshall, Eaton and Eaton III (1998) present the scientific community with a hypothesis that physical activity is programmed into our genomes from the Late Paleolithic Era. They state that, “modern Homo sapiens are still genetically adapted to a preagricultural hunter-gatherer lifestyle because the overall genetic makeup of Homo sapiens has changed little during the past 10,000 years” (Booth et al., 2002, p. 5). Cordain et al. (1998) go on to say, “The portion of our genome that determines basic anatomy and physiology has remained relatively unchanged over the past 40,000 years” (p. 328). With such little change occurring in the genetic makeup of humans despite the complete overhaul in the environment in which we live, Booth et al. (2002) believe that it is the constant access to food with the decreased necessity to move that is the culprit for many diseases such as heart disease, type II diabetes, obesity and more. Booth, Gordon, Carlson, & Hamilton (2000) further describe the situation, “Our genes expect the body to be in a physically active state if they are to function normally. In evolutionary terms, inactivity elicits an abnormal phenotypic expression of our genes” (p. 780). With this hypothesis, physical activity is an essential component for maintaining homeostatic balance. If this hypothesis is true, it is important to ask: What type of physical activity is required to maintain this homeostatic balance?
Physical Activity and Energy Expenditure. One way to better understand the complexity of sedentary living is to examine how energy expenditure occurs and which areas are most capable of changing. Simply put, when the energy intake is greater than expenditure, the excess energy will be stored as body fat (Levine, Vander Weg, Hill, & Klesges, 2005). The total daily expenditure of energy (TDEE) is divided into four categories: resting metabolic rate (RMR), thermogenesis, non-exercise activity thermogenesis (NEAT), and exercise (Ravussin, 2005). Resting metabolic rate accounts for approximately 50-70% of expended energy that is used for body maintenance, ventilation, circulation, and other involuntary body functions. Thermogenesis makes up around 10% of the body’s daily expenditure and it is used for the ingestion and digestion of food (Ravussin, 2005). There is little opportunity to change one’s RMR and thermogenesis, instead it is through NEAT and exercise that one can increase their daily energy expenditure, which make up the remaining 20-40%. Exercise is defined as, “planned, structured, repetitive bodily movement done to improve or maintain one or more components of physical fitness” (Casperson, Powell, & Christenson, 1985, p. 128) Whereas NEAT is, “the energy expenditure of all physical activities other than volitional sporting-like exercise” (Levine et al., 2005a, p 731). Levine et al. (2005) contends that since many people do not expend energy through exercise for various reasons, that the most viable option for an increase in energy expenditure is by focusing on ways to increase NEAT energy expenditure.

Levine et al. (2005b) conducted a study examining the role non-exercise activity thermogenesis (NEAT) plays in obesity. They recruited ten lean and ten mildly obese individuals and measured their body postures (e.g. sitting, standing, lying down) and movements for ten days. Levine et al. (2005) found that obese individuals were seated on average for two hours longer per day than the lean individuals. This study suggests that one way to counteract obesity is to add more movement throughout the day, and Levine et al. (2005) propose that this movement need not be in the form of structured exercise, but rather in non-exercise activity thermogenesis (NEAT). This could potentially increase their caloric expenditure up to 350 calories per day. The idea that non-exercise activity thermogenesis is a plausible way to obtain the needed physical activity each day is often over-looked as an effective tool for weight management and healthy living. However, this form of activity may be a valuable tool in the future for the majority of Americans who, for many various reasons, choose not to participate in structured exercise programs. Many perceive that physical activity can only occur during their
leisure time, but new research suggests that non-exercise activity thermogenesis can take place in all aspects of life, including work.

**Paradigm Shift.** For health benefits, weight control, or the desire to look better, people often consider adding structured exercise as the only option for increasing their activity levels. For many, this option appears more daunting and unobtainable than simply adding low intensity physical activity throughout the day; such as intentionally fidgeting at one’s desk, standing during commercial breaks while watching television, or gardening. Part of this perception may be due to the recommendations of nationally recognized organizations such as the CDC and the American College of Sports Medicine (ACSM) whose original position from the 1970’s until the mid 1990’s placed an emphasis on sustained physical activity for fitness benefits, versus physical activity for health benefits (Pollock et al., 1998). Their original position stated, “Every U.S. adult should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week” (Pate et al., 1995, p. 403). However, in recent years the CDC and ACSM has changed their position when it comes to physical activity for health benefits stating, “Physical activity can be accumulated through the day in shorter bouts of 10 minute durations” (Pollock et al., 1998, 975). This transition of moving away from longer stretches of exercise to shorter, more organically occurring opportunities for exercise supports the emphasis on increasing one’s NEAT energy expenditure.

The exercise movement that swept the nation in the 1970’s left many to believe that “more is better,” and it must be of a certain intensity to count (Levine, 2007b). However, it is time for a shift in thinking. With 70% of Americans not achieving the recommended 30 minutes of moderate to vigorous activity of five or more days of the week and with obesity and chronic diseases occurring at epidemic proportions, the “more is better” mentality is not working (Killingsworth, Earp, Moore, & Arch, 2003). While moderate to vigorous activity still provides many health benefits, and is essential for physical fitness, there is emerging evidence that increasing the amount of low-intensity physical activity can have similar health benefits (Levine, 2007b).

According to Owen, Leslie, Salmon, & Fotheringham (2000), “The new public health focus places its primary emphasis on increasing population-wide energy expenditure through moderate intensity physical activities” (p. 154). Walking for an hour a day for recreation or riding a bike to work are examples of moderate intensity physical activity. In addition, there is a
shift from solely focusing on physical activity through the lens of exercise physiology and health promotion to broadening the scope and including fields such as architecture, urban design, city planning and transportation to add to the body of knowledge (Killingsworth et al., 2003). The reason for incorporating such sub-disciplines is attributed to the desire to better understand how the built environment influences health. The idea that physical activity can take place outside of the realm of exercise and still have health benefits, has been labeled by some as the ‘active living’ movement (Killingsworth et al., 2003). This shift in thinking about physical activity is moving beyond structured exercise as the answer and as a result researchers are beginning to examine the environment that hinders or facilitates increased movement, or ‘active living,’ throughout the day.

The Built Environment

A key factor that affects sedentary living is the built environment in which one lives. The built environment is defined as, “encompassing aspects of a person’s surroundings which are human-made or modified, as compared with naturally occurring aspects of the environment” (Papas et al., 2007). The design of the dominant culture within the United States encourages overconsumption of energy while discouraging energy expenditure.

For many years, as obesity and chronic diseases have steadily increased in incidence and prevalence, resulting in increases in mortality rates, the focus has been on the individual and the choices that people make. However, in more recent years, research has expanded to consider the bigger picture; the environment in which Americans live and work, and the impact it has on physical activity. While individual beliefs and attitudes are key components for physical activity, it is essential to also consider the environment in which they live. Researches such as Sallis refer to this as the ‘ecological approach’ (Sallis, Cervero, Ascher, Henderson, Kraft, & Kerr, 2006). This approach recognizes that far more than individual choice affects one’s physical activity levels; instead it looks at the individual, the social environment, the physical environment, and the policies that affect a population’s ability to be physically active (Sallis et al., 2006). For example, a study by Sallis, Johnson, Calfas, Caparosa, & Nichols (1997) found that there was a 70 minute difference in physical activity by those who lived in high-walkability neighborhoods (those with higher residential density, land use mix, street connectivity, aesthetics, and safety) as opposed to those who lived in low-walkability neighborhoods. Those in the higher-walkability neighborhoods also had a lower prevalence of obesity. Neighborhood
characteristics are just one of many variables that compose the built environment; the work place is another example of how the design impacts the ability to be physically active.

In a study examining the energy expenditure saved as a result of “labor saving devices,” Lanningham-Foster et al. (2003) found that energy expenditure was significantly less when daily tasks such as washing clothes, dishwashing, and transportation to work were done with machines versus manually. Labor saving devices reduce energy expenditure by 111 calories a day (Lanningham-Foster et al., 2003). With food readily available, the average American consumes 2,200 pounds of food each year, with an estimated 3,829 calories available for consumption per day (FAOSTAT, 2005). The abundant availability of food often leads to over consumption and as a result, the average American adult gains around two pounds a year (Hill, Wyatt, Reed, & Peters, 2003). It is within this environment that chronic diseases are flourishing.

The following are all examples of how the built environment is impacting health. Two major environmental determinants of activity are the automobile and suburban living. According to the National Household Transportation Survey (NHTS) in 2001, adults drove a personal vehicle for an average of 55 minutes and 29 miles per day. For daily travel to work, the proportion of trips by automobile increased from 67% in 1960 to 88% in 2000, while work-trips by walking or public transit declined (Brownson et al., 2005). Brownson et al. (2005) also discussed the issue of a decline in physical education in the schools; which from 1991-2001 the schools with PE programs decreased from 41.5% to 32.2 %. The built environment is made up of many structures that hinder or facilitate active living, this literature review will focus on the built environment of the workplace, and its impact on millions of workers.

**Sedentary Workforce.** The built environment in which Western nations currently work looks drastically different than it did even fifty years ago. The physical demands that jobs once required have been replaced with machinery and technology. One example of this dramatic shift is the forestry industry in Sweden. Between 1960 and 1990, the number of employees in forestry declined from 67,000 to 21,000; also, technological advancements changed forestry from being a highly manual labor job to one of a seated operation of forest mechanics that required less than 5% of maximal muscular capacity (Axelson & Ponten, 1990). Another example of a dramatic change in the workforce has occurred in agriculture. Agricultural employment has decreased from 12.2% of total number of jobs in the United States in 1950, to less than 2% in 2000.
(Brownson et al., 2005). It is within the built environment of the low physical activity occupations that this literature review will center its focus.

Within the United States, the high activity occupations have been waning since 1950, and low activity occupations have been on the rise (See Figure 1). 58.2 million Americans were identified with a low activity occupation in 2000 (Brownson et al., 2005).

![Figure 1 Trends in occupational activity, United States, 1950-2000.](Brownson et al., 2005)

Computer usage in the workplace is at an all time high, resulting in many people spending their working day sitting (Levine et al., 2007). This shift from high to low activity occupations has created serious health concerns for many Americans.

**Health Implications.** This shift from high activity occupations to low activity occupations may be beneficial for enhancing the speed, quality, and volume of work being produced, but many unintended health consequences enter the picture as a result. For example, Pronk, Martinson, Kessler, Beck, Simon, & Wang (2004) conducted a study with four different sampling frames and over 700 participants to test the association between lifestyle-related modifiable health risks; more specifically: physical activity, cardiorespiratory fitness, obesity and work performance. They found that: moderate levels of physical activity were positively related to both the quality and overall job performance; vigorous physical activity levels were related only to job performance; higher levels of cardiorespiratory fitness were related to the quantity of work performed; obesity levels (BMI of 30 or higher) were related to a higher difficulty in getting along with coworkers; and severe obesity (BMI of 40 or higher) was associated with a significantly higher number of work-loss days (Pronk et al., 2004). This study demonstrates that work performance may be affected by factors such as physical fitness, cardiovascular health, and obesity.
In another study by King et al. (2005), the interaction between leisure-time physical activity and occupational physical activity was assessed among 4,889 employed adults over the age of 20, using data from the National Health and Nutrition Examination Survey. The results indicated that the prevalence of obesity increased with low occupational activity and no leisure time physical activity, and it decreased with vigorous leisure time physical activity and high occupational activity.

![Figure 2: Age-adjusted obesity prevalence for occupational activity level and leisure-time physical activity level for the disease-free adult population above 20 y of age employed in high and low activity occupations (King et al., 2005)](image)

The toll of sedentary living and working not only impacts the workers’ health, and production levels, but also directly impacts the health care costs as well. Wang, McDonald, Champagne and Edington (2004) conducted a study with 23,490 employees grouped into three categories; normal weight, overweight, and obese. They also factored in the activity levels of the employees: from sedentary (0 times per week), to physically moderately active (1-2 times per week), to very active (3 or more times per week). Wang et al. (2004) found that the sedentary employees paid $250 more in health care costs annually then those who were physically active, and that there was a difference of $450 within the obese subpopulation.

It is evident that sedentary workplaces, specifically the office setting, have created more barriers than facilitators to building movement into the work day. When options such as the proximity of parking, taking the elevators instead of the stairs, and sitting in one’s desk all day exist; including the social pressures of doing what is ‘normal’ or ‘expected,’ such as sitting at a desk and working instead of standing or even walking, it is easy to understand why employees struggle to be physically active.
Barriers to Physical Activity in the Workplace

With a workplace that for millions of people is inhibiting physical activity for eight hours of their waking day, it is imperative to examine the design of the workplace itself to better understand its limitations to movement as well as finding solutions to physical inactivity. This section will focus specifically on the office setting, where work is completed in the sedentary position of sitting at a desk with the use of a computer for a majority of the workday.

Sedentary Design. The built environment of an office setting is recognizable throughout the country and most of the world. Whatever the task may be, it is the social norm to see the employee sitting in either an office or a cubicle, with a chair, a desk, and often a computer. This design has set Americans up for sitting in a static position for hours at a time. For the sake of work productivity, this design is extremely efficient, or at least claims to be. However, “sedentary work in general, and computer work in particular, is associated with low physical stresses, including negligible circulatory demands,” meaning this high level of productivity may come at a cost to the employee’s health (Straker & Mathiassen, 2009, p. 1215). Many employers have attempted to bring change to their employees through wellness programs and challenges (i.e. StairWELL initiative, LEAN works) (CDC, 2010). However, the effectiveness of such programs has been questioned, since estimates indicate that only 20-30% of eligible employees participate when a program is offered, and only one third to one half are exercising regularly, in addition to the fact that these programs do not address the issue of sedentary work itself (Dishman, Oldenburg, O’Neal & Shephard, 1998). Several reasons established for the low participation in physical activity programs can be attributed to having no time during work and lack of time before or after work (Kruger, Yore, Bauer, & Kohl, 2007). With these barriers in mind, it is imperative to find another alternative to counteract the sitting time that occurs during the workday. One solution is to combat the serious barrier of sedentary work by combining work with low intensity physical activity by removing the chair and replacing it with a treadmill.

Solutions for Increasing Physical Activity in the Workplace

In 2007, James Levine and his coworkers created an active workstation in response to the idea that non-exercise activity thermogenesis is the most plausible way to increase energy expenditure. His hypothesis was that the active workstation would be a way to enhance weight loss in obese office workers (Levine et al., 2007). The use of the active workstation at work is not considered exercise, nor is it intended to raise levels of physical fitness. The goal of active
workstation use is to increase physical activity throughout one’s day, which will increase energy expenditure, more specifically energy from the non-exercise activity thermogenesis. The active workstation consists of a motorized treadmill and a height adjustable desk, with the intention that one could sit and work, or raise the desk up and walk on the treadmill and work, with speeds ranging from 0.5 km/h to 3.2 km/h (Levine et al., 2007).

To test his hypothesis, Levine et al. (2007) recruited fifteen healthy, sedentary, and obese (BMI of 30-35) volunteers who did not exercise on a regular basis. Each participant’s energy expenditure was measured by indirect calorimetry while they were: at rest, lying motionless (but not asleep); sitting in office chair and typing; standing motionless; walking at one, two, and three miles per hour; and while working at an active workstation at a self-selected speed and typing a document about their personal history. Levine et al. (2007) found that the participants had no troubles with using the active workstation; there were no falls, or injuries, or unsteadiness and it took the participants around two to three minutes to acclimate to walking and typing. The average sitting energy expenditure was 72 calories per hour, and the average energy expenditure of walking while working at a self-selected speed of 1.1 mph was 191 calories per hour. The mean increase of walking over sitting was 119 calories per hour (Levine et al., 2007). If an obese person were to add two to three hours of walking to their workday, it is estimated that they could theoretically lose upwards of forty pounds in a year (Levine et al., 2007).

The previously mentioned study demonstrated the benefits of increasing one’s energy expenditure and potential weight loss, but it did not consider levels of work productivity. In another recent study, John, Bassett, Thompson, Fairbrother, & Baldwin (2009) examined the effects of using an active workstation on performance of simulated work tasks. Twenty participants completed a battery of tests to assess: selective attention and processing speed (Stroop test), typing speed (Mavis Beacon Teaches Typing 17), mouse clicking/drag-a-drop speed, and GRE math and reading comprehension in both a seated and walking position (John et al., 2009). John et al. (2009) found that walking while working decreased scores on tests of typing, mouse proficiency, and math solving ability by 6-11%. This may be attributed to the idea that, “walking puts an increased load on both mental processing and motor control” (John et al., 2009, p.619). However, while there was a decrease in performance, John et al. (2009) contests that since the decrease in typing while walking went from 40.2 to 36.9 adjusted words per minute (AWPM), that it was only one adjusted word per minute away from the average
typing speed of 38-43 adjusted words per minute, meaning that there may be only marginal impact on work productivity (Ostrach, n.a). Additionally, a limitation that John et al. (2009) mentioned that could impact performance results was the limited time for acclimation that participants had with walking and working.

Ohlinger (2009) conducted the Auditory Consonant Trigram Test, the Golden Stroop Color and Word Test, and the Digital Finger Tapping Test on fifty employees of a Midwestern university while sitting, standing, and walking on an active workstation. Ohlinger (2009) found that low-intensity walking resulted in a small, yet significant performance decrement on the Digital Finger Tapping Test, and no significant decrease in the Stroop Color and Word Test or the Auditory Consonant Trigram Test. These results suggest that walking while working will not interfere with cognitive tasks but tasks such as typing may be affected by walking (Ohlinger, 2009). Again, a limitation to this study is that the participants had little or no acclimation time to walking and working.

In another study Cox (2009) sought to assess how speech quality and energy expenditure is affected between sitting, standing, and walking. Thirty-one participants read silently, read aloud, and spoke spontaneously while sitting, standing, and walking at 1.6 km/h. The results were similar to that of Levine et al. (2007) in regards to the energy expenditure; demonstrating a significant increase in VO2 between sitting, standing and walking (Cox, 2009). In addition there was no significant difference in speech between the three postural positions, suggesting that walking while working and successfully talking to another employee or on the phone is highly plausible (Cox, 2009). While the previously mentioned studies examined the potential health benefits of walking at work as well as the potential effects of work performance, the active workstation has yet to be implemented into an actual office setting, creating significant gaps in the research of the active workstation’s effectiveness.

Finally, Straker, Levine, and Campbell (2009) conducted a mixed method study examining the effects that the active workstation had on speed and error during typing, mouse pointing, and combined mouse and keyboard tasks. Thirty office workers performed these tasks while sitting, standing, walking at 1.6 km/h, walking at 3.2 km/h, cycling at 5 watts and cycling at 30 watts. Straker et al. (2009) measured actual performance, perceived performance, and heart rate. After each of the tests, the participants rated their perceived performance on speed and error rate (1=very enhanced to 5=very diminished). At the end of the study they were also asked
several follow-up questions about using an active workstation at their workplace. Across all three tests, there was a decrement in scores in typing, mousing, and the combination of the two when participants were walking or cycling. There was no significant difference between sitting and standing. Interestingly, the perceived decrement was consistently more than the actual. People perceived they were doing worse than they actually were. For example, those who walked and typed had a 6% decrement, but perceived a 17% decrement, with an actual error rate of 3%, but perceived an error rate of 26% (Straker et al., 2009). In addition, 50% thought that implementing the walking condition was feasible, and 13% said maybe feasible. 83% believed that standing and working would be feasible (Straker et al., 2009). The two follow up questions produced answers such as, “It was a good way to break up the day,” “It may help creativity,” “Fine motor coordination was affected,” “The movement of the display (relative to head) was dizzying,” and “Enhanced concentration was required.” (Straker et al., 2009, p. 838).

Gaps in the Research

Research on the active workstation is still in its infancy stage, and much is left to be explored. Up to this point, all research has taken place in a lab. There is currently no published literature regarding active workstation use in authentic work settings; however we are currently conducting a longitudinal study examining active workstation usage in the workplace. What is known about the active workstation suggests that: the energy expenditure increases in response to using an active workstation instead of being seated; there is a slight but debatable decrease in work performance of participant’s using the active workstation for the first time; there is no significant decrease in voice quality when using an active workstation; and there is a perception that the error rate in typing and mouse tasks is higher than in actuality (Levine et al., 2007; John et al., 2009; Ohlinger, 2009; Cox, 2009; Straker et al., 2009).

The active workstation provides a potential solution to what seems to be an insurmountable barrier to increasing physical activity at work; walking in place of sitting at a desk during the workday. Unpublished data from other studies demonstrate that each employee interprets active workstation use differently. Therefore, a necessary step to better understanding the effectiveness of the active workstation is to understand an employee’s perceptions and experiences who begins to use one at work. By removing this large barrier within the built work environment, it is imperative to better understand what small limitations continue to stand in the way. There is a need to gather data regarding personal experiences, with the goal of discovering
valuable information about how users experience the active workstation. This knowledge of the personal experience may allow implementation to be tailored in such a way that active workstation usage will increase.

The active workstation transforms the work environment in a way that completely changes what the typical “behavior setting” for physical activity looks like. Behavior settings are defined as, “the physical and social contexts in which behavior occurs” (Sallis, Bauman, and Pratt, 1998, p. 380). Up until now, the traditional office setting has severely inhibited opportunities to be physically active by the nature and purpose of its design. In a setting that once prevented physical activity, the active workstation provides an option for moving while working. Will people accept this paradigm shift? Will office administrators be willing to change the social norm of the office? Will new users be able to work as productively?

Currently, the literature is absent of an active workstation user’s perceptions and experiences of increasing physical activity in a low activity or sedentary occupation. As a result, little is known about the experiences a person has when they implement a tool such as the active workstation into their environment in attempt to counter this imbalance of activity. Therefore, it is with these unanswered questions in mind that the purpose of this study is to better understand what it is that facilitates or hinders using the active workstation at work from the perspective and experiences of a new user—including physically, cognitively, emotionally, and socially, through a qualitative case study of an employee who begins using the active workstation at work.
Chapter Three: Methods

The goal of this study is to address the following question: What do new users of a workplace active workstation perceive and experience as the barriers and facilitators to active workstation usage? To establish the foundation from which I built and conducted my research, I begin by explaining the key components of qualitative research. Then I will provide a background for my own preliminary sense of the problem. Next, I will discuss the method I chose to use to address my research question, and finally I will describe the procedures I used.

Definition and Components of Qualitative Research

Previous studies examining the effectiveness of the active workstation have only been quantitative or mixed methods in nature. However, understanding the perceptions, attitudes and beliefs of those who are using the active workstation is essential to creating an implementation protocol for new users. This generation of new knowledge cannot be done through surveys, measurements, or testing a hypothesis alone, but also by allowing the space to search for meaning from another’s experience of walking while working. While there is no “right” way of conducting qualitative research, there are generally accepted methods that guide the research. For the sake of this study, qualitative research will be defined as, “a form of systematic empirical inquiry into meaning” (Shank, 2006, p. 4). Based on this definition, the ultimate goal is to produce meaning from the findings in a way that is planned, orderly, and based on world experiences, not just theory (Shank, 2006). Qualitative research would suggest that even when a researcher attempts to be objective in their observations, it is impossible because of the lens through which they view any new knowledge is impacted by the values, experiences and beliefs under which they live, and therefore it is nearly impossible to separate one’s self from these views. Whereas this is a confounding variable that quantitative research must control for, qualitative research embraces the researcher’s perspective and provides a space for those values and beliefs to influence the research.

Another component of qualitative research that sets itself apart from quantitative methods is the idea of, “working with and through complexity rather than around or in spite of it” (Schram, 2006, p. 7). Qualitative research examines issues from a holistic perspective, aiming to problematize the phenomena of focus, as opposed to breaking it down into smaller, more measureable components. Problematizing means, “inviting consideration of other plausible interpretations of phenomena and inviting attention to their complexity” (Schram, 2006, p. 24).
This study will be structured in such a way that allows for problematizing to occur, meaning that there will be space to examine each case holistically in contrast to focusing only on particular aspects.

Other key characteristics of qualitative research that guided this study include: natural setting, multiple sources of data, inductive data analysis, emergent design, and interpretive inquiry (Creswell, 2007). This study occurred within the natural setting of the office workplace, allowing the facilitators and hindrances that one experiences using the active workstation in a realistic setting to be uncovered. This study generated new knowledge from several sources of data including: interviews, blogging, baseline and follow up assessments, and observations. Data analysis was utilized, with the goal of generating new knowledge from emerging themes rather than using a theory to guide the exploration of the phenomena. Along the same lines, this study utilized emergent design, allowing it to be open and flexible to change or shift as data was collected and analyzed. Finally, this study executed interpretive inquiry to make meaning of all the knowledge gained.

**Data Collection Versus Data Generation.** The case study presented here is product of generating new knowledge with the participants, not just about the participants. All new knowledge was constructed by both the participants and myself as the researcher. The participants’ perceptions of their experience were essential to this process, and yet I also contributes to the construction of this dat. Creswell (2007) describes this as the “researcher as the key instrument” (p. 38). Where quantitative research uses equipment, computer programs, questionnaires to collect and analyze the data, qualitative research utilizes the researcher as the data collector and analyzer.

**Validity.** The term ‘validity’ has traditionally been associated with quantitative research. However, qualitative researchers also attribute validity to a study when they refer to a study that is, “plausible, credible, trustworthy, and therefore, defensible” (Johnson, 1999, p. 160). I focused on techniques that promoted the validity of the data generated. Creswell (2007) describes validation in qualitative research as, “an attempt to assess the “accuracy” of the findings, as best described by the researcher and the participants” (p. 206). In attempt to accomplish this, assessing the ‘accuracy’ of the findings, my first technique was participant feedback. Participant feedback is described by Johnson (1999) as, “The feedback and discussion of the researcher’s interpretations and conclusions with the actual participants and other
members of the particular community for verification and insight” (p. 161). By using participant feedback, also known as ‘member checking,’ I was able to clear up any points of miscommunication and/or misunderstanding that occurs between the interview, transcribing the interview, and interpreting the interview (Johnson, 1999; Creswell, 2007). This required me to allow the participant to review the interpretation of the interview. This technique, according to Johnson (1999), is considered a part of a subsection of validity known as interpretive validity, which is, “accurately portraying the meaning attached by participants to what is being studied by the researcher” (p. 162). Having the person who was interviewed read the interpretation and provide feedback about misunderstandings is one of the strongest ways to enhance interpretive validity.

A second technique that I used to ensure a high quality qualitative interview was reflexivity. Johnson (1999) defines reflexivity as, ‘self-awareness and ‘critical self-reflection’ by the researcher on his or her potential biases and predispositions as these may affect the research process and conclusions” (p. 161). Creswell (2007) describes reflexivity as “clarifying researcher bias” (p. 208). This required that I recognize my own beliefs and biases that can affect how I view, interpret, and draw conclusions from any situation. As a result, I entered the interviews, knowing what my biases and beliefs are so that I could attempt to control them. I was aware that my assumptions and bias aid in constructing my view of the active workstation, and thus was better prepared to control them when interviewing, transcribing, interpreting, and drawing conclusions from the interview. Reflexivity is also a key criteria in Richardson and St. Pierre’s (2005) interpretive standards for conducting qualitative research.

Finally, the last technique I would use is extended fieldwork. Extended fieldwork is described by Johnson (1999) as, “When possible, qualitative researchers should collect data in the field over an extended period of time.” With this study, I collected data using interviews, blogging, and fitness assessments until saturation. This required that I collected data until no new knowledge was generated. It was imperative to consider ways to enhance the validity of this study through techniques often used in the field.

**Incorporating Theory.** As previously mentioned, this study was conducted using inductive data analysis which is defined as, “building patterns, categories, and themes from the ‘bottom-up,’ and by organizing the data into increasingly more abstract units of information” (Creswell, 2007, p 38). It is because of this that I did not use any theories to shape my research
problem or methods. However, as Schram (2006) argues, there are several ways in which theory may contribute to the final interpretation of knowledge generated. One way is through connectedness, as he explains, “theory offers a way to join your work to some larger issue or body of knowledge, in part by inviting you to consider classes of events rather than only single instances” (Schram, 2006, p. 60). While theory may set up an explicit framework from which to build a study, it may also severely limit the way knowledge is gathered and interpreted. With this in mind, this study aligns with the mentality of Van Maanen (1988) who suggests that, “theory does not determine the fieldwork experience, but it may provide the dictionary with which it is read” (p. 97-98). Therefore, this study may utilize theory to connect the new knowledge to the larger issues at hand, but use theory in its design.

**The Qualitative Interview**

Often a driving reason for conducting qualitative research is due to the ontological and epistemological beliefs of the researcher. In this study, I align myself with the assumption that “people’s knowledge, perceptions, views, understandings, interpretations, experiences, and interactions are meaningful properties of social reality,” and as a result, it is essential to learn more about the participant’s view point through direct and intentional conversations (Mason, 2002, p.63). The qualitative interview is a central avenue that allows the participant to generate the data with the researcher, and it is for this reason that I used qualitative interviews.

**Interview Format.** This study used a semi-structured format with open-ended questions that took place roughly on a weekly basis. I began each interview session with what Shank (2006) describes as a ‘grand tour question,’ that empowered the participant to guide the conversation by answering the question with what is pertinent to them. From there I followed their lead and asked follow up questions that further engaged the co-constructed conversation. Additionally, I focused on questions that pertain to the participants lived experiences, not on hypothetical situations that the participant had not actually experienced (Mason, 2002).

Mason (2002) describes four components that are common in qualitative interviews; first, there is an interactional exchange of dialogue; second, the interview is a conversation with a purpose; third, the interview takes a topic-centered or narrative approach that provides the flexibility to develop unexpected themes; and finally, there is an assumption that the qualitative interview generates knowledge that is contextual and thus the meanings that are discovered are constructed by both the interviewee and the interviewer. It is with these ideas in mind that I
engaged in the interview process with a mindset focused on generating new knowledge with the participant, not solely as an excavator attempting to formulate new ideas on my own.

**Limitations.** While the interview process is the most common way to gain the perspectives, views, and beliefs of other people, it also comes with limitations. Creswell (2007) addresses some of these limitations which include: learning how to phrase questions in a way that opens up further dialogue and reflection, dealing with the unexpected answers one may receive, dealing with the consequences of one’s own actions (especially their unexamined beliefs and assumptions), dealing with sensitive issues, and dealing with the transcription process. In addition, Mason cautions researchers that “the interview method is heavily dependent on people’s capacities to verbalize, interact, conceptualize, and remember” (p. 64). Despite these very real and potentially limiting factors of conducting qualitative interviews, I assert that this method was essential to this study. Every method of data generation or collection has disadvantages and advantages. For the purpose of this study, the qualitative interview was the main source of data generation in addition to health assessments, blogging, and data collection through logs. In order to be reflexive in these interviews, it was essential that I thoroughly examined my thoughts, beliefs and attitudes regarding the active workstation.

**Intellectual Orientation Towards the Problem**

Entering into this study, I have established a sense of the problem as well as an intellectual orientation for solving the problem. I engage with this research wearing the lens that believes in the health benefits of physical activity; particularly for sedentary adults. I also look at the following case with a paradigm shifting away from moderate to vigorous exercise being the only viable option for increasing one’s health benefits; and am leaning toward a mentality that focuses on ‘active living,’ or building activity into every aspect of one’s day. I also examine the situation as an issue that is broader than individual choice, but is highly affected by the built environment in which one lives and therefore it is the built environment that must change to enable individual behavior change. The choice of using a qualitative case study reflects my desire to better understand the perceptions and beliefs of a new active workstation user.

Several life experiences have led me to this way of thinking starting with a history of teaching Physical Education and Health to students ranging from Pre-K to 8th grade. It was within this setting that I tried to help students see that physical activity is an uphill battle in today’s society, and that many other sedentary activities (i.e. video games, computers, and
television) as well as opportunities (i.e. walking instead of driving) are constantly competing for one’s time. Another invaluable experience was living outside of the United States in a developing country for a year. It was within this context that I realized that “structured exercise” is an anomaly to most of the world that do not have the liberty to take the time and energy to intentionally exercise. Instead, physical activity is naturally built into the way that they live. As a result, I have also intentionally built activity back into my day. It is with these lenses that I see the active workstation as an opportunity to fight the uphill battle of Western culture’s sedentary systems in such a way that also naturally builds movement back into one’s day without needing to spend an hour at the gym. I did not ignore this aspect of who I am, and I practiced reflexivity as a researcher as a result.

**Paradigm/Worldview.** A paradigm is, “a basic set of beliefs that guide action” (Guba, 1990, p.17). The paradigm in which I examined this study is Social Constructivism which is described as, “relying as much as possible on the participants’ views of the situation” (Creswell, 2007, p. 20). With this paradigm, I assert that as people develop understandings and meanings of their world that are subjective to their perceptions and experiences and thus each person will have a different perception of what reality is. With this paradigm, I also understand that my own background and history will shape my interpretations, so I had to “position myself” accordingly by acknowledging my own values, beliefs and attitudes (Creswell, 2007).

**Research Approach.** In order to generate new knowledge and be able to interpret and find meaning within this knowledge, this study used the case study research approach. Creswell (2007) describes a case study as, “a qualitative approach in which the investigator explores a bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection, involving multiple sources of information and reports a case description and case-based themes” (p.73). There are three different types of case studies: intrinsic, instrumental, or collective case studies (Creswell, 2007). This study will utilize the intrinsic case study, defined as, “the idea that the case itself is of interest; the researcher is focused on teasing out what can be learned about that particular case” (Schram, 2006, p.107). He goes on to say, “The value of the case study lies in facilitating appreciation of the uniqueness, complexity, and contextual embeddedness of individual events and phenomena” (Schram, 2006, p. 107). This study utilized the case study method because the question being explored was found within a
bounded system and there was a need to learn more about how implementing an active workstation into the workplace was experienced by a new user.

**Procedures**

In this section, I will describe the procedures I used to conduct this study. First, I will describe the sampling methods that I used to find my case study participants. Then I will explain the way in which data was generated. Finally, I will discuss potential ethical issues that I considered for this study.

**Sampling.** As a case study, this study thoroughly examined the experience of a new active workstation user at work. The goal of this study was to better understand what it is that these new users enjoy, what they found as barriers or conflicts to using the active workstation, and what incentives and challenges they experienced and perceived along the way. With this in mind, I used purposeful sampling which Creswell (2007) defines as, “the inquirer selects individuals and sites for study because they can purposefully inform an understanding of the research problem and central phenomenon in the study” (p. 125). The criterion I have for choosing participants includes: working in a low physical activity occupation, and are either very physically active (participating in moderate to vigorous activity 3 or more times a week) or very sedentary (engages in no structured physical activity). The exclusion criterion included: anyone who is uncomfortable using a treadmill at speeds of 1-2 mph; anyone who requires assistive devices to walk or maintain balance; anyone whose physician has told him/her not to walk at all, or not to walk on a treadmill, or perform vigorous exercise, anyone who weighs more than 350 pounds (a treadmill limit), anyone who knows or suspects they have a balance disorder, and anyone with Diabetes Mellitus may only participate with prior approval from their physician.

**Data Generation.** One participant was identified and agreed to participate through an initial introduction of the active workstation and a trial use of one week. This participant identified as being regularly physical active. Upon signing the informed consent form (See Appendix A), the participant wore an accelerometer for: two weeks prior to walking, during their first two weeks of walking, and after using the active workstation for four months. The purpose of wearing the accelerometer was to measure any change of activity that the active workstation has on both their work time and their leisure time.

The participant also began the study with a series of physiological assessments including: blood lipids test, body composition, blood pressure, resting V02, sub-maximum V02, flexibility,
cognitive test, and a typing test. These assessments were given a second time, approximately four months after she began walking. While the focus of this study is on the participants’ experiences and perceptions of using an active workstation at work, these assessments provided supplemental data for data triangulation. Data triangulation is, “using multiple data sources in a single research study,” (Johnson, 1999, p. 164). This aided in interpreting the information generated with the participants. For example, if the participant perceived that their typing speed increased from when they began walking to the end of data collection, this can be verified by measuring their actual typing speeds before they began walking and at the end of data generation.

However, the main source of data generation was through the previously discussed qualitative interview. The interviews took place in the participant’s office on a weekly basis and lasted approximately ten to twenty minutes. The interviews were semi-structured with open-ended questions, as the participant guided the conversation and I as the researcher followed their lead and asked for clarification. The interviews were audio recorded, transcribed verbatim and then emailed to the participant to ensure accuracy. In addition to the recorded conversations, conversations with the participant that were not recorded will also contributed to my understanding of the participants, as it would be impossible to disregard these conversations. I also kept ‘field notes,’ of my experiences with the participant. Particularly, after each interview, I made note of what I observed and how I interpreted what they were saying.

A final way that data generation occurred is through blogging. The participant had access to their own personal blog and could write any thoughts about their experience on this blog. The goal behind this was to ‘capture’ the experience in the moment that it was happening. They had access to this blog while they worked on the active workstation and they could blog as they are walked.

**Ethical Issues.** The interviews that were conducted lead to topics of discussion that were potentially sensitive in nature. The active workstation addressed issues such as: physical fitness, medical problems, and overall health and well-being. In order to preserve confidentiality, the participant was assigned a pseudonym. For the purpose of this study, the participant’s name is Beth.
Data Analysis

This section describes analysis of the data generated. Ulin, Robinson, and Tolley (2005) outline the five main interrelated steps of analysis as: reading, coding, displaying, reducing, and interpreting. Using these steps, I and two other readers went back and forth between reading and coding to identify themes and assign data to these themes.

Reading the Data. The first step in data analysis was reading and listening to the transcribed interviews a minimum of three times. As I read through them, I began to informally make note of any themes that are emerging, particularly any themes that were unexpected. I then followed up on these themes in subsequent interviews. I also began to identify patterns that I noticed within the interviews such as, “possible relationships between themes, contradictory responses, or gaps in understanding” (Ulin et al., 2005, p. 146).

Coding and Displaying. Once familiar with the transcripts, I began to code the themes. Shank (2006) describes coding as, “an act of selective attention. When we code, we mark those things in our data that we need to revisit” (p. 147). I made note of any information that appeared to have meaning. Anything that answered these questions was coded: How do new users describe their experience using an active workstation? What do they enjoy? What stops them from walking? How does walking impact their work? How does walking impact their relationships with co-workers? How does using the active workstation make them feel? I will begin by using inductive labeling which is described by Shank (2006) as, “the process of moving from the specific to the general” (p. 149). As I became more familiar with the patterns and emerging themes, I was able to be more consistent with my labeling. At this point, I extracted the information that was similar in theme and built new documents containing all the similarly themed ideas.

Reducing and Interpreting. Ulin et al. (2005) describe data reduction as, “the process of distilling the information to make visible the most essential concepts and relationships” (p. 160). With all my data collected, I established central themes and sub themes that emerged. Ulin et al. (2005) describes this process as separating the essential from the nonessential. The final step of analysis was interpretation which is defined as, “the act of identifying and explaining the data’s core meaning” (Ulin et al., 2005, p. 162). In order to ensure the validity of my interpretation, I used researcher triangulation. In addition to myself interpreting the data and coding for themes, I had two additional readers who followed the established protocol on their
own. When all three readers completed coding and establishing themes, we discussed our findings. As the researcher, it was imperative that I was not the only one interpreting the data as a way to eliminate researcher bias.

Practical Implications

The purpose of this study is to understand the particular experiences a new active workstation uses through her perceptions and feelings toward her experience. The goal of this study therefore, is not to take the information learned from this specific phenomenon and generalize it to any new user. However, the information generated from this study is a stepping stone towards shedding light on this unexplored phenomenon. It is my hope that the knowledge generated by this very focused study will contribute to a larger body of knowledge that has yet to be developed. Ultimately, I desire that the knowledge gained from this and other studies will influence the protocols for successful implementation of active workstations into new office settings by better understanding what barriers and benefits are experienced on an individual level.
Chapter Four: Manuscript

Running Head: ACTIVE WORKSTATION CASE STUDY

A NEW USER’S PERCEPTIONS AND EXPERIENCES OF THE ACTIVE WORKSTATION AT WORK: A CASE STUDY

Manuscript Type: Original Research

Keywords: built environment, low intensity physical activity, sedentary workplace, active workstation

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ABSTRACT

Background: Levels of physical activity at work are dramatically decreasing as jobs and technology change. The active workstation is a potential solution to incorporating more physical activity into the office setting, but little is understood about the perceived experience of active workstation use. Purpose: This case study explored the perceptions and experiences of a new active workstation user at work. Methods: Using purposeful sampling, a participant with a sedentary occupation was selected. The participant began using an active workstation at a self-selected speed and distance during the workday. Weekly interviews were conducted for three months, transcribed, and subject to inductive coding, analysis and interpretation using researcher triangulation. Findings: The main benefit from active workstation use was knowing that she walked at work. The main barrier she experienced was a lack of perceived physical and mental benefits. Active workstation use also required a negotiation of external influences and the logistics of walking while working. Conclusions: If there are few experienced benefits, active workstation users may struggle to stay motivated to walk and work. Further research is needed to better understand the barriers and benefits that hinder or facilitate active workstation use.

Keywords: built environment, low-intensity physical activity, sedentary workplace, active workstation
Introduction

In the United States, 24% of the adult population is sedentary and only 26.2% of the adult population meets the recommended levels of physical activity (PA) (30 minutes of moderate to vigorous physical activity most days of the week).\textsuperscript{1-2} Between 1988 and 2008, the prevalence of overweight (having a BMI greater than 25) has increased from 55.9% to 68%.\textsuperscript{3-4} Excess weight is also associated with an increased risk of high blood pressure, Type 2 Diabetes Mellitus, gallbladder disease, osteoarthritis, and heart disease.\textsuperscript{5} Moreover, PA alone may not be enough to combat the detrimental effects of sedentary living.\textsuperscript{6}

In an effort to address sedentary living, James Levine proposes focusing less on structured exercise as the solution to increasing energy expenditure and reducing sedentary living and instead building more “non-exercise activity thermogenesis” or NEAT into the day.\textsuperscript{7} In recent years the CDC and ACSM has changed their position when it comes to PA for health benefits stating, “Physical activity can be accumulated through the day in shorter bouts of 10 minute durations,” as opposed to its original position of accumulating 30 minutes or more of moderate intensity PA on most days of the week.\textsuperscript{8-9} The CDC and ACSM’s transition of moving away from longer stretches of exercise to shorter and more naturally occurring opportunities for exercise supports the emphasis on increasing one’s NEAT energy expenditure.

The exercise movement that swept the nation in the 1970’s left many to believe that “more is better,” and it must be of a certain intensity to be effective.\textsuperscript{10} However, a reevaluation is warranted. With 70% of Americans not achieving the recommended 30 minutes of moderate to vigorous activity on five or more days of the week and with obesity and chronic diseases occurring at epidemic proportions, the “more is better” mentality is not working.\textsuperscript{11} While moderate to vigorous activity still provides many health benefits, and is essential for increasing levels of physical fitness, there is emerging evidence that increasing the amount of low intensity PA can have similar health benefits.\textsuperscript{10} Introducing low intensity PA back into sedentary work environments may be a valuable step toward reversing the trend of inactivity.

The problem of inactivity is relatively new, and many attribute it to the agricultural, industrial, and technological revolutions that have transpired in the last 150 years, transforming the way in which Western nations work and play. The advancement of technology has caused a shift away from reliance on manual labor resulting in a decrease in physical activity in all aspects of life.\textsuperscript{12-13} This is evident in the workforce, where most people spend at least eight hours of
their waking day. In 2000, 58.2 million people (42.6% of the working population) were employed in low-activity occupations, compared to 16 million in 1950 and 33.7 million in 1970. The built environment of work, more specifically the typical design of the office setting: a desk, chair, and computer are key players in the steady decrease of PA, as the use of computers and technology is at an all time high. With new evidence demonstrating the detrimental effects of sitting for long periods, there is a need for change in the way people work.

Two potential solutions to increasing activity in the work place are common. The first are wellness programs that promote physical activity at work through exercise classes, health coaching, gym memberships and much more. While these programs have demonstrated a decrease in absenteeism and increased job satisfaction, they do not address the issue of the sedentary work itself. The second potential solution is through an ecological approach that looks holistically at the work environment and strives for way to increase PA during working hours. The ecological approach examines the individual, the social environment, the physical environment, and the policies that affect a population’s ability to be physically active. By exploring the problem of increasing PA levels at work through this lens, the complexities interwoven in the issue become apparent: the built environment that promotes or prohibits PA, the policies of the office, the social expectations of what a productive worker looks like, and more. However, by breaking down these constructs and moving forward with innovative ideas, it may be possible to transform the office into a place where PA while working is part of the culture of work.

One component of the ecological model is the physical environment, also known as the built environment, in which one works. The built environment is defined as, “encompassing aspects of a person’s surroundings which are human-made or modified, as compared with naturally occurring aspects of the environment.” From driving a vehicle instead of walking to work, to taking the elevator instead of using the stairs, these creative man-made laborsaving devices have successfully replaced the dwindling opportunities for movement with technology. While low-activity occupations are unlikely to disappear, ideas about the way these occupations look and operate are under inspection, with alternatives arising that may enable the transformation of office design. One such design provides an alternative to the office chair, one of the largest barriers to movement in the office setting, by replacing it with a treadmill.
In 2007, James Levine and his coworkers designed an active workstation in response to the idea that non-exercise activity thermogenesis is the most plausible way to increase energy expenditure. His hypothesis was that the active workstation would be a way to enhance weight loss in obese office workers.\textsuperscript{14} The goal of active workstation use is to increase PA and reduce sedentary time throughout one’s day which will increase energy expenditure, more specifically energy from NEAT. The active workstation consists of a motorized treadmill and a height adjustable desk, with the intention that one could sit and work, or raise the desk up and walk on the treadmill and work, with speeds ranging from 0.5 km/h to 3.2 km/h.\textsuperscript{14}

Existing research has examined the cognitive abilities and motor skills required to perform work as well as the physiological effects of using an active workstation.\textsuperscript{14,19-23} Levine and Cox both found an increase in energy expenditure when using an active workstation in contrast to sitting.\textsuperscript{14,19} Other research has demonstrated that there is a slight decrement in work performance tasks such as typing, mouse tasks, and math scores when using the active workstation, but argue that this decrement would not significantly impact their ability to work.\textsuperscript{20-23} In addition, Cox found no significant difference in speech between sitting, standing, and walking, suggesting that walking while working and successfully talking to another employee or on the phone is highly plausible.\textsuperscript{19} Finally, in a mixed methods study, Straker examined work productivity as well as perceptions of productivity and found that there was a slight decrement in work performance, but the \textit{perceived} decrement was consistently more than the actual.\textsuperscript{22} While the previously mentioned studies examined the potential health benefits of walking at work as well as the potential effects of work performance, the implementation of the active workstation into an actual office setting is limited, creating significant gaps in the research of the active workstation’s effectiveness.

No research has examined the experiences and perceptions of office workers who use the active workstation in the workplace setting, therefore this case study used qualitative methods to take an in-depth look at the impact of the active workstation, as a possible alternative to sedentary work. This was done through an examination of the in-depth experiences and perceptions of the participant as they implement the active workstation into their office environment, changing the way their low-activity occupation is performed. Therefore, the purpose of this study was to better understand what it is that facilitates or hinders using the active workstation at work from the experience and perspective of a new user.
Methods and Procedures

Recruitment and Design

The study design was a qualitative case study designed to thoroughly examine the experience of a new active workstation user at work. Using purposeful sampling, an employee was identified who described her work as sedentary. The criterion for choosing a participant included working in a sedentary occupation with extensive computer use. The participant exclusion criterion included: being uncomfortable using a treadmill at speeds of 1-2 mph; requiring assistive devices to walk or maintain balance; being instructed by a physician to not to walk at all, not to walk on a treadmill, or perform vigorous exercise; weighing more than 350 pounds (a treadmill limit); having a balance disorder; and those with Diabetes Mellitus required prior approval from their physician.

Case Study Participant

Beth* (*pseudonym) is a 34-year-old woman who works as a professor at a Midwestern university. She identifies as white and is married with two young children and she regularly engages in vigorous physical activity by running three or more times a week. Beth is a very fit individual with a BMI of 22.5 and a V02 max of 42.4 ml/kg/min, which puts her in the top 85th percentile of fitness (maximal aerobic power) for her age and gender.25 Beth’s job requires her to sit for hours at a time working at her computer.

Active workstation Implementation

Prior to using the active workstation, Beth participated in a trial period of walking and working for one week to ensure interest in continuing to use it at work. After the initial interview, an active workstation was placed in Beth’s office and she was instructed to walk at a self-selected speed and length of time each day, with the recommendation of walking either two hours a day at one mile an hour, or one hour a day at two miles an hour.14 Semi-structured interviews were conducted on a weekly basis until saturation. Saturation occurred when Beth described her active workstation experience as a normal part of her workday, approximately eleven weeks after she began walking at work.

Interviews and Analyses

The key form of data generation occurred through weekly interviews that took place in the Beth’s office on a weekly basis, lasted approximately ten to twenty minutes, and were semi-structured with open-ended questions. Informed consent was obtained from the participant, and
the university’s institutional review board approved the study protocol. Beth was interviewed before walking while working to gain an understanding of her perceptions of the active workstation before she began the study. Social Constructivism was the lens in which the knowledge was generated and bracketing and reflexivity were practiced by the primary researcher.24

The interviews were audio recorded and transcribed. The transcribed interview was emailed to Beth to ensure accuracy. Observations of each interview were also recorded in field notes to remind the researcher of the non-verbal occurrences within the interview. Data was analyzed using inductive analysis based on the work of Ulin, Robinson, and Tolley.26 The process included reading, coding, displaying, reducing, and interpreting. The first step in data analysis was reading and listening to the transcribed interviews a minimum of three times. Anything that answered the following questions was coded: How does she describe her experience using an active workstation? What does she enjoy? What stops her from walking? How does walking affect her work? How does walking affect her relationships with co-workers? How does using the active workstation make her feel? Emerging themes were recorded and addressed in subsequent interviews. Once all the data was collected, central and sub themes were established.

To ensure validity, the collected data was coded, reduced and interpreted by three different people using researcher triangulation. The three researchers consisted of: 1) the primary investigator, 2) a graduate student with qualitative research experience who did not know Beth, and 3) an undergraduate student with qualitative research experience who knew Beth. The findings were then shared with Beth using participant feedback, who verified their validity.

Findings

Prior to beginning the study Beth saw the active workstation as, “an opportunity to keep moving because it frustrates me that I spend multiple hours in a row just sitting here and doing my work, not that my work bugs me, it’s the sitting still” (Interview 1). Her attitude toward physical activity is very positive, “So my attitude about physical activity and exercise in general is that, if you can do it, if you physically are able, it’s good for you stress management wise, it’s good for you emotionally, it’s good for you physically, and I’ve always just made an effort to do it.” (Interview 1). When asked if she had any hopes for the active workstation, she said she was
hoping to lose three pounds, improve her cognitive abilities in the afternoon, and increase her productivity after adjusting to using the active workstation. Potential roadblocks that she foresaw included: clothing choices, her competitive side kicking in, how people will perceive her differently and its impact on her professionalism, and sweating. She expressed excitement for getting to try something that is innovative.

Qualitative analyses within the categories of benefits and barriers were identified, in addition to two key themes of (a) negotiation of active workstation use and (b) negotiation of external influences. Themes, sub themes, and their associated experiences are summarized in Table 1.

**Benefits**

Beth experienced a key benefit from the active workstation. She enjoyed the opportunity to be more active throughout the day. “It makes me feel better in that I feel like I’m being active even on days where I couldn’t run, and that I’m not just sitting here” (Interview 10). In the same interview, she goes on to say, “I like the idea that I have the option, because prior to having one in my office, there was no option unless I tried to pack my whole day in before 4:00 and then go to the gym…it has removed some barrier of increasing some physical activity” (Interview 10). Her experience of benefits was more of a psychological benefit of knowing that she walked and the feeling of accomplishment that walking provided, not necessarily the experience of walking itself.

**Barriers**

Beth experienced several barriers in using the active workstation as a new user. The main barrier she experienced was a lack of benefits from using the active workstation. Several times throughout the interviews she commented on not perceiving any physical benefits from walking. At one point she asked, “It’s not impacting my risk factors, it’s not impacting my weight, it’s not impacting my cognitive functioning, so for someone like me, what is the gain for doing this?” (Interview 3). She perceived the activity was too low to make a difference in how she felt and this directly affected her experiences walking. As a result, Beth’s attitude toward the active workstation focused on “pushing through” walking, “I made a decision that I was going to push through, kind of like when things get rough for me, I just say, ‘Well, what do I have to do?’ And I kind of made up my mind of how I’m going to get through it” (Interview 4). Her
perceptions of receiving little benefit from walking influenced her experiences of walking. Beth also encountered other barriers that will be discussed in the latter two themes.

**Negotiation of External Influences**

Throughout the interviews, it was apparent that use of the active workstation changed the way Beth viewed her work and she perceived that it also changed how others viewed her as well. She spent quite a bit of time discussing how she negotiated these interactions and how they affected her experiences. Four sub themes within external influences are professionalism, novelty, “dispelling the myth,” and compliance.

**Professionalism.** Using the active workstation challenged the way Beth viewed professionalism in several ways. The original location of the active workstation made Beth feel inaccessible to her students and co-workers. When she was on the active workstation, her back was to the door and she was unable to meet casually with anyone without stopping and getting off the active workstation. After a few weeks, this situation was remedied by moving the active workstation so that she could see the door while she walked. This was at the sacrifice of losing desk space in her office.

Another experience she had to negotiate regarding professionalism was determining when it was appropriate to continue walking versus when she needed to sit while meeting with people. For example, she felt comfortable walking with some drop-in meetings from students, whereas she experienced dissonance with walking and meeting with her supervisor. Beth experienced a power differential between herself and others when walking on the treadmill, because she was spatially in a position of power over those who sat. In terms of meeting with her supervisor, she perceived her supervisor was uncomfortable with this power differential. Beth explains, “So what I’m noticing is—because of the height differential, if you are going to talk to someone and walk, they undoubtedly feel more comfortable standing next to you” (Interview 10). Beth also felt that using the active workstation while meeting with others can be very distracting for them. She explains, “For some people, it’s really distracting because you’re moving, and when you have a normal conversation with someone, you’re not moving, so it’s just odd to pop in on somebody and not feel like you have their full attention, whereas the walking obviously has to take part of my attention” (Interview 7).

Using the active workstation meant Beth had to think differently about her attire and the issue of sweating at work. “I still worry, that when I do start to sweat, I’m smelling…it’s not like
I’m pouring out sweat like I ran, but even a little under your arms is going to make you feel self-conscious” (Interview 11). Beth changed the way she dressed when she began using the active workstation and asked herself, “Am I going to be perceived differently now that I am making more relaxed clothing choices than I would standard?” (Interview 3). For example, Beth did not wear any skirts when she began walking. By changing her style of dress so that walking and working was more comfortable, Beth wondered if this affected how others perceived her professionalism.

**Novelty.** Novelty was another negotiation of external influences that Beth encountered as she began walking. The active workstation assaults the classic vision of what it looks like to work productively in an office setting. Instead of focusing on work while sitting, the active workstation adds a new element that intrigued many, consequently causing many interruptions for Beth. Many people stopped by her office to learn about the active workstation. She describes their experience as, “Everybody that is a virgin to seeing one of these things always say, ‘oh, I really want one,’ except for the few people that have given a negative reaction…From the vast majority of people they are like, ‘That is a great idea, I would want one of those’” (Interview 10). Interactions like these left Beth feeling positive about her experience. However, after time she felt the novelty wear off and she perceived that her walking while working was affecting others. This influenced her own experience, “Yeah, it dampens [my experience] a little bit. But it’s not just fighting my own internal struggle or my motivation for doing it, it is also realizing how much I am impacting my immediate environment” (Interview 7).

One interaction in particular with a student who gave a negative non-verbal reaction to Beth walking caused her to feel self-conscious about walking, “Is it me or is it the fact that I’m just walking?…She didn’t say anything negative but her overall demeanor and her facial expressions expressed that she could not believe what I was doing” (Interview 5). It was interactions like this and comments from others that caused Beth to feel uncomfortable at times with walking and as a result, the novelty of using an active workstation began to diminish.

**Dispelling the Myth.** Another external influence that Beth encountered from using the active workstation is what she called, “dispelling the myth.” Because the active workstation has a treadmill, she experienced many questions from others, particularly women, regarding exercise and weight loss. Along the lines with the novelty wearing off, Beth describes, “No the coolness factor has definitely worn off, I have to explain all the time that it’s not a workout, which always
seems to disappoint people” (Interview 4). In addition to others seeing this as a way to lose weight, Beth also perceives the active workstation in this way, “I definitely, 100% think that women tend to see this as some kind of weight loss device. I have my tendencies to believe that as well…treadmills are equated with weight loss, and I don’t think that association will ever stop” (Interview 7). Beth is surprised by others’ reactions to the active workstation in her office, because she perceives they are committed to healthy living, and yet it is even a struggle for them to embrace this new way of working. “I think it is a new concept and I think this department should be most familiar or least surprised by it, but I still think it’s so outside of the norm and there’s no one else in the department doing it” (Interview 7). Using an active workstation means that Beth must educate those around her about the purpose of walking while working, how it is different from ‘exercise,’ with the goal being to reduce sedentary time.

**Compliance.** The weekly interviews also influenced in Beth’s experience of the active workstation. Beth desired to be a compliant participant and she felt accountable and often times guilty about her active workstation use. “I want to be compliant, I’m rule oriented, you tell me I have to do a certain amount per day—it was really hard the last two days to not be able to do that” (Interview 5). She struggled when she was not able to use the active workstation, especially if she knew she had walked a lot throughout the day to other places on campus. She struggled knowing that she was not being sedentary, but that it was not counting towards the study.

Beth’s experience on the active workstation was highly influenced by external sources. From positive reactions from co-workers, to a negative response from a student, to meeting with a researcher each week for an interview, all these interactions with others influenced her experience with the active workstation. She struggled when her professionalism felt compromised, when the novelty wore off, and when she had to constantly inform others about what the active workstation is and what it does.

**Negotiation of Active Workstation Use**

Using the active workstation meant Beth had to change the way in which she worked. These changes affected how she worked, what tasks she worked on, her physical state, and how she felt about work. Therefore, the four sub themes of negotiation of active workstation use are: physical logistics, task choice, physical impact on her body, and psychological factors.
**Physical Logistics.** Beth’s transitioning from sitting to walking while working created many logistical challenges. Technology was the largest challenge to overcome to make it feasible to move from sitting to walking. For Beth, she began by using her laptop on the active workstation and her desktop at her desk. This limited what she could do at either working station. Eventually, she was able to configure an additional monitor, keyboard, and mouse for her desktop and have them on the active workstation via a wireless connection, but this often led to a poor signal and was often more of a barrier than a solution. Another challenge was the active workstation has a timer on it to keep track of how long one walks, but when stopped, the timer clears. This was a frustration as Beth was keeping track of her time for the study.

Other physical or mechanical logistics that Beth encountered were: a squeaky treadmill that interrupted her concentration and caused her to worry about distracting others in the office; she perceived that the active workstation warmed up her office considerably and she began using a fan to try to cool off; and the excessive noise of the active workstation, fan, and squeaking treadmill combined. She explains, “I don’t like what’s called white noise, it really annoys me. And so the treadmill already makes noise and so when it was squeaking it was making even more noise, so then the fan adding that, I just find I have to have my headphones in to block all that out” (Interview 7). Some physical logistics with typing that she noticed when she worked included: struggling to use multiple key functions the first few times while walking and working and tapping too lightly on the keys so that the laptop does not register it.

**Task Choice.** In deciding what work tasks she would do on the active workstation, she began by writing while walking. This included tasks such as writing manuscripts, grants, etc. She would walk at speeds of 1.5 mph to 2.0 mph, and typically would walk between two to four hours a day. Some tasks that she could not do on the active workstation included printing, using the phone, and working with files that were on her desktop. “Email checking, writing, and organizing all happen on the active workstation, and if I have to do something that would require printing, using my phone, or shifting things around between computers, I have to sit for that” (Interview 3). Beth used to leave her office to write and when she began writing on the active workstation, she struggled with the increased distractions, “I do miss sneaking away. I do, because it felt like that was my time, even when I’m here when I’m walking…if someone knocks on the door I still have to stop an answer it. I don’t think it affects the quality of the work, but I definitely think the increased number of interruptions that I experience now” (Interview 3).
By working on the active workstation, Beth became much more aware of sitting in the evenings when she was working, “When I’m working at home it makes me feel guilty that I’m sitting there working instead of walking, in some respect. It makes me acutely aware of the amount of time I spend just sitting there” (Interview 6). Overall, she feels comfortable doing most tasks while using the active workstation, “It’s not limited by the type of task, it’s really limited by the type of programs I have on my computer. Anything I can do on a computer I don’t think I have a reason why I couldn’t do it here” (Interview 6). One problem she ran into with some tasks was the impact that they had on her body, specifically in the form of headaches.

**Physical Impact on Body.** Beth experienced few physical benefits from walking at work, sometimes she felt more alert after walking, but it also made her more tired. Beth experienced a series of bad headaches while she walked at work. Although she does not blame the active workstation for these headaches, she does believe that it may have contributed to them. “I honestly think there’s something to the effect of walking, the stress, the staring at a computer screen all together combined that give me a headache” (Interview 11). She further describes her experience, “I felt like I got pressure behind my eyes and that it hurt to look beyond the focus of the computer screen…kind of that concentrated task, looking at the screen while walking” (Interview 10). As a result, Beth transitioned away from intense reading and writing activities to focusing on less intensive activities such as checking her email on the active workstation.

As mentioned before, she felt better knowing that she walked and did something healthy for her body, but rarely did she feel the benefits physically. Using the active workstation raised her awareness of the physical state of her body, “I am acutely aware of how it’s impacting my tiredness level, my hunger level, my weight fluctuations, and my sweat” (Interview 3). Other physical impacts on her body included wrists rubbing when she walked for long periods of time, and feeling bottom heavy. “I feel bottom heavy…I feel like my pants are tighter now. Which is just a little frustrating” (Interview 7). All of these physical affects combined also contributed to the psychological factors that influenced Beth’s experience.

**Psychological Factors.** Imperative to Beth’s experience of the active workstation were the psychological factors that drove her perceptions. Beth believes that using the active workstation changes the way she balances her life, “Because everything is an equation and everything you add, something else has to go, and so I’m thinking in my head, ‘Okay, if I add this into the day then what’s going?’” (Interview 10). In addition to this, guilt plays a large role in
Beth’s experience. “My experience has been fairly good. I do find that it is a little added guilt to have it here. And the added guilt is that I should be able to make more time to work—I thought I sat at my desk more than I guess I really do, so it’s been interesting to track how little time I spend in my office” (Interview 2). Part of her experience includes the desire to lose weight by walking and working, and the raised awareness of her weight impacts her experiences, “It makes me acutely aware of how much I weigh, so it makes me keep in the back of my mind that I want to keep—make sure that I make it a priority. So, it’s another motivator, it’s another added level of guilt” (Interview 2). The guilt from wanting to maximize her efforts and the desire to maintain balance in her life affect her experience of the active workstation.

Many factors affected Beth’s negotiation of active workstation use. From the logistical aspects such as the desk height or the temperature of the room, to psychological factors such as feeling guilty when she was not walking, to deciding what tasks she would work on while walking and at what speed and for how long, all of these factors have shaped her experience of the active workstation.

Discussion

The purpose of this study was to better understand what hinders and facilitates active workstation usage from the perspective of a new user. The study is exploratory in nature due to little previous research on the topic. After thorough analysis of the data, it appears that the active workstation had far more barriers than benefits for Beth. Negotiating an entirely new way to work created unanticipated problems for Beth that affected her experience of the active workstation. Beth spoke to the fact that she felt few benefits, and when comparing her baseline and four month health assessments, one can see that her health remained steady. (See Table 2). Despite the dramatic increase in daily activity via the active workstation, Beth did not perceive a significant increase in the benefits she was hoping for, specifically weight loss and improved alertness.

Beth’s lack of perceived benefits may be attributed to the fact that she is already participating regularly in moderate to vigorous activity and therefore may not receive the same level of benefit of adding low intensity physical activity into her day in the same way as a sedentary person might. In addition to a lack of benefits, Beth participated in this study at a time of very high stress in her career. It was difficult to separate her experiences with the active workstation from the stress of her job. Particularly when the active workstation became very
integrated into her working day, “It’s gotten to the point that it’s just like my chair, well that’s where I do my work” (Interview 11).

This study focuses on a new way of thinking about how one does work. Similar to that of other offices, the culture Beth is currently working in has never seen such a drastic innovation of how one works before. This transformation of the way work is done really causes one to take a second glance and ask questions. Beth was daily inundated with comments from coworkers and students that reminded her that walking at work is an anomaly, and she was different. These comments began as a source of novelty and excitement, but began to wear on her after awhile. Other’s questions about the purpose of the active workstation and why she was using it continually reminded her that other’s perceived it as a weight loss device, and despite being a healthy and physical active person, she often saw it that way to. The active workstation is a tool for preventing sedentary occupations from negatively affecting those who are employed in them. There needs to be a shift away from seeing active workstations solely as a weight loss device and more towards providing opportunities for movement in a sedentary occupation. If Beth used the active workstation in a culture that focused less on weight as a symbol of health, and focused more on being physically active as a measure, then she may have had a more positive experience.

Limitations. This study is limited to one person’s perceptions and experiences. Although this information cannot be generalized to other people or populations, it is still a valuable contribution to the body of knowledge about experiences with the active workstation. Because of this limitation, future research will need to investigate the experiences of many different people using an active workstation at work to gain a broader perspective of what hinders and facilitates the experience. Ongoing studies with more participants would provide valuable knowledge, particularly to adherence to active workstation use at work.

Conclusion

This qualitative case study explored the experiences and perceptions of a new active workstation user at work. Weekly interviews were conducted, transcribed and interpreted, revealing that this particular participant found the biggest barrier to be a lack of benefits from walking and working, and the main benefit being the idea of knowing that she was doing something healthy for her body, even though she did not experience many physical benefits. In addition to barriers and benefits, two other themes of the participant’s experience included: negotiation of external influences and the negotiation of active workstation use. The participant
of this case study exercised regularly and was at the 85th percentile of fitness for her age and it is possible that her experiences with low intensity physical activity at work did not produce the same levels of physical benefits as running, which may partially explain the imbalance in barriers. Further research examining other people’s perceptions and experiences of the active workstation is needed to better understand the behaviors conducive to active workstation usage at work.

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References


Table 1 Summary of Beth’s active workstation Perceptions and Experiences as a New User

<table>
<thead>
<tr>
<th>Themes and Subthemes</th>
<th>Perceptions and Experiences</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Benefits</strong></td>
<td></td>
</tr>
<tr>
<td>Knowing she walked for health</td>
<td>She felt better <em>knowing</em> that she walked, and felt a sense of accomplishment by walking and working</td>
</tr>
<tr>
<td><strong>Barriers</strong></td>
<td></td>
</tr>
<tr>
<td>Lack of Benefits</td>
<td>Perceived few tangible or experienced benefits to motivate her to continue walking. Experienced barriers that hindered walking such as: sweat, perceptions of others, guilt, etc.</td>
</tr>
<tr>
<td><strong>Negotiation of External Influences</strong></td>
<td></td>
</tr>
<tr>
<td>Professionalism</td>
<td>Changed her wardrobe to walk at work, had to negotiate walking and maintaining a level of professionalism, self-conscious about appearance</td>
</tr>
<tr>
<td>Novelty</td>
<td>Others were jealous and eager to try walking and working, as time went on, novelty wore off</td>
</tr>
<tr>
<td>“Dispelling the Myth”</td>
<td>Treadmill = exercise; had to dispel the myth to others that she was ‘exercising’</td>
</tr>
<tr>
<td>Compliance</td>
<td>Desired to be a good participant and this made her feel guilty when she could not walk</td>
</tr>
<tr>
<td><strong>Negotiation of active workstation Use</strong></td>
<td></td>
</tr>
<tr>
<td>Physical logistics</td>
<td>Technology, workstation noise, warmth of the room, no pause function/time clears, all affected her experience</td>
</tr>
<tr>
<td>Task choice</td>
<td>Began by writing and reading on Workstation, moved to emailing only, limited by programs on the computer but felt capable of doing anything on the Workstation, walked a minimum of 1.5 mph and most often at 2.0 mph, walked for 2-4 hours each day.</td>
</tr>
<tr>
<td>Physical impact on body</td>
<td>Few benefits, felt tired, increased hunger, increased headaches and sweat, perceived a change in body shape.</td>
</tr>
<tr>
<td>Psychological factors</td>
<td>Felt guilty not walking, desired to maximize her efforts, decided to ‘push through’ and keep walking.</td>
</tr>
</tbody>
</table>
Table 2. Comparison of baseline and four-month follow-up
Health assessments

<table>
<thead>
<tr>
<th>Health Assessment</th>
<th>Baseline</th>
<th>4 month</th>
<th>Difference</th>
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<tbody>
<tr>
<td>Waist (in.)</td>
<td>28.5</td>
<td>30.5</td>
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<tr>
<td>Blood pressure</td>
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<td>121/73</td>
<td></td>
</tr>
<tr>
<td>Blood pressure</td>
<td>116/82</td>
<td>121/73</td>
<td>+5</td>
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<tr>
<td>Weight (kg)</td>
<td>60.7</td>
<td>61.7</td>
<td>+1.0</td>
</tr>
<tr>
<td>Body Fat (%)</td>
<td>23.7</td>
<td>23.7</td>
<td>0</td>
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<tr>
<td>Fat Weight (kg)</td>
<td>14.4</td>
<td>14.6</td>
<td>+0.2</td>
</tr>
<tr>
<td>Lean Weight (kg)</td>
<td>46.3</td>
<td>47.1</td>
<td>+0.8</td>
</tr>
<tr>
<td>Total Cholesterol (mg/dL)</td>
<td>190</td>
<td>161</td>
<td>-29</td>
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<tr>
<td>HDL (mg/dL)</td>
<td>67</td>
<td>44</td>
<td>-23</td>
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<tr>
<td>TRG (mg/dL)</td>
<td>179</td>
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<tr>
<td>LDL (mg/dL)</td>
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<td>+17</td>
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<tr>
<td>GLU (mg/dL)</td>
<td>97</td>
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Bibliography


Cox, R.H. Metabolic Cost and Speech Quality While Using an active workstation. *JPAH*. In Press.


Pate, R., Pratt, M., Blair, S., Haskell, W., Macera, C., et al. (1995). Physical activity and public health: A recommendation from the Centers for Disease Control and Prevention and the


APPENDIX A: Informed Consent Form

Informed Consent Form

Title of Research Project: Walk and work: case study series

Principal Investigator: Ronald H. Cox, PhD

Provided that you are over the age of 18, you are invited to participate in a research study that will investigate physical activity patterns of subjects during the workday and in leisure time. Subjects will be randomly assigned to a control group or an experimental group. The experimental group will use the active workstation which consists of a treadmill combined with a height adjustable standing desk. You will be asked screen questions (based on the exclusion criteria outlined below) by the researcher to ensure that it is safe for you to participate in the study. You may not participate in this study if you have any of the conditions noted on the list of exclusion criteria below:

<table>
<thead>
<tr>
<th>Exclusion Criteria</th>
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<tbody>
<tr>
<td>Anyone who is uncomfortable walking on a treadmill at speeds of 1-2 mph.</td>
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<tr>
<td>Anyone who requires assistive devices to walk or maintain balance.</td>
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<tr>
<td>Anyone whose physician has told him/her not to walk at all, or not to walk on a treadmill or perform vigorous exercise.</td>
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<tr>
<td>Weight &gt; 350 pounds (d/t treadmill limit)</td>
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<tr>
<td>Anyone who knows or suspects they have a balance disorder</td>
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<td>Those with Diabetes Mellitus may only participate with prior approval from their personal physician</td>
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If you choose to participate in this study, you will visit room 16 in Phillips Hall for testing on eight occasions over a 12 month period for approximately 1 hour on each occasion. You have two, one-hour sessions about every four months during the year. You will complete the following tests:

Metabolic Assessment and Exercise Readiness

1. Complete the Physical Activity Readiness Questionnaire. This is a brief (7 questions) questionnaire pertaining to your capability to perform physical activity.

2. Following universal precautions, a finger-stick blood sample (20 microliters) will be collected for the purpose of determining HDL cholesterol, LDL cholesterol, total cholesterol, triglycerides, and blood glucose. The blood sample will be analyzed using the Cholestech desktop analyzer according to manufacturer’s recommended protocol. You will be required to fast for 12 hours before these tests. We will schedule this appointment at your convenience to minimize the need to fast beyond 12 hours.
3. **Body composition will be determined using the BodPod (air plethysmography) and a bioelectrical impedance analyzer. For this test, you will stand barefoot on a scale.** For the BodPod test, you will change into attire appropriate for the test. For women this is either a Lycra swimsuit or bike shorts and a jogging bra that you provide. For men this will be a Speedo type swimsuit or bike shorts that you provide. The body composition lab has a private changing room so you will never be in a public area in your testing attire.

4. Body weight and height will be determined using a balance scale with a stadiometer.

5. Resting metabolism will be determined via indirect calorimetry. This is a non-invasive test that requires you rest quietly while breathing into a mouthpiece/face mask connected to a metabolic cart which measures and analyzes expired respiratory gases.

6. Estimated maximal oxygen uptake will be determined via a sub-maximal treadmill test. This test requires you to walk on a treadmill at speeds between 2.8 and 3.7 mph. The grade will be increased progressively from 0% (level) to a maximum of 15%. You will not exercise beyond 85% of your maximal heart rate (for example, a 40 year old subject would work at a heart rate no higher than 153 bpm vs. their predicted maximum of 180 bpm). The test takes approximately 20 minutes to complete. The maximum percent grade will vary by individual and will be determined by your heart rate during the test. This is usually accomplished within three levels. Heart rate is measured and monitored using a Polar Heart Rate Monitor, which consists of a chest strap worn by you and monitor affixed to the treadmill.

7. Blood pressure will be determined with an electronic blood pressure meter. In this procedure, familiar to all who have been to a physician’s office, a cuff will be placed around your arm and inflated to a pressure about 30mmHg higher than the anticipated blood pressure. As the pressure of the cuff is released the results of your systolic and diastolic blood pressure will appear.

8. Your waist will be measured using a tape measure.

**Questionnaires**

*To assess the effects of participation in the active workstation program on study participants’ psychological health and well-being, a set of self-report questionnaires will be administered to each participant four times across a 12 month-period (once at baseline, and then again at four-month intervals).*

All questionnaires will be administered in a packet form at baseline and again at four-month intervals until the conclusion of the study. You will be given a copy of the survey packet by a research assistant (or a faculty co-investigator) along with a sealed envelope. You will complete the survey packet in a confidential manner (i.e., without anyone else seeing the form). Once the packet is completed, you will insert the completed survey in the envelope, seal it up, and write the last four digits of your Social Security Number across the seal. The research assistant (or faculty co-investigator) will return the sealed envelope to Dr. Horn (Dr. Horn does not have the key to codes/names). It is anticipated that you can complete the entire questionnaire packet in 15-20 minutes. All questionnaire data will be held in complete confidence, and completed surveys will be stored in a locked cabinet in a Miami University faculty member’s office. No one other than members of the research team will see the completed surveys.

**Activity Assessment**
We will also determine baseline activity levels by collecting/analyzing data from an accelerometer that you wear on your waistband for 2 weeks prior to beginning use of the active workstation in the office. The accelerometer is similar to a pedometer, but is smaller (about 1 inch x 1 inch x 0.5in). This device capture information about movement in three planes—vertical, horizontal, and lateral. If you are in the experimental groups, after 2 weeks, you will begin using the active workstation and will continue to wear them accelerometer for an additional 2 weeks. It is important that you wear the accelerometer anytime you are not sleeping, bathing, or swimming.

*You will be given a log to record the time you put the accelerometer on each day and the time you take the accelerometer off each day. You will also record any physical activity in which you participate (walking, gardening, etc.) and the time you start and stop the activity. Logs will be collected by a research assistant. To ensure compliance, email reminders will be sent to each participant by a research assistant each week.*

**active workstation Implementation/Activity**

Once baseline data are collected, you will begin using the active workstation in your workspace if you are assigned to the experimental group. If you are in the control group, you may not use the active workstation.

The active workstation is an active workstation with a treadmill integrated into a height adjustable desk. You will use this active workstation to walk-and-work for a portion of your workday. For this case study, the active workstation will be installed in your workspace at Miami University for 1 year. The active workstation does not replace your usual desk and you will decide when to use the active desk, but we do ask that you accumulate a minimum of 2 hours per day of active workstation use. However, if you are using the desk for less than 1 hour a day for one week, we will remove the active workstation and make it available for another participant.

If you find the active workstation to be unsuitable for your work, notify Ron Cox (coxr@muohio.edu or 529-4435) and the desk will be removed.

The investigator/research assistant will teach your how to adjust the active workstation for proper ergonomic form while working. The active workstation has an odometer that records the amount of time the treadmill is in use, as well as the distance walked. The research assistant(s) will come to your office each week to collect this information and reset the odometer.

If you are in the experimental group, the investigator/research assistant will teach you how to adjust the active workstation for proper ergonomic form while working. You will record the time you spend using the active workstation on a calendar provided by the investigator. The research assistant(s) will come to your office each week to collect this information and discuss any problems you are having with the active workstation. There is a small possibility that you could stumble or fall while walking-and-working, just as this might happen while walking at any other time. You will be walking at speeds between 0.8-1.5 mph, which is rather slow compared to the walking we do every day. For comparison, walking at a speed of 2 mph is a leisurely pace and is considered low intensity physical activity. Walking at 3-4 mph is considered moderate intensity physical activity and would be considered sufficient to constitute exercise is done for a sufficient length of time. There is also a possibility that you will experience delayed onset muscle soreness from walking. Muscle soreness of this type does not require medical intervention and usually resolves within 4 days.
If you sustain a minor injury during testing or while using the active workstation in your office, you should consult your personal physician. In the event you do not have a personal physician, we will provide you with the address and phone number of the urgent care clinic at McCullough-Hyde hospital.

McCullough-Hyde Hospital, 110 N. Poplar Street, Oxford, OH, 513-523-2111

In the event that a severe injury occurs in the lab, we will call 911 to obtain medical assistance for you.

You are strongly encouraged to make the research staff aware of any discomfort or concerns you experience during the testing sessions or while you are using the active workstation in your office. Be aware that should a physical injury result from the research procedures, financial compensation is not available and medical treatment is not provided free of charge.

We encourage your cooperation throughout the testing sessions and during the time the active workstation is in your workspace. However, your participation is voluntary and you are free to refuse to participate and/or withdraw from the study at any time without being penalized or affecting your relations with Miami University in any way. Any information obtained in connection with this study that can be identified with you will remain confidential and will be disclosed only with your permission. In any written reports, publications or presentations, no participant will be identified by name.

If you are a participant in the experimental group or the control group, you will receive a $10 Kroger gift card for each testing session in the Phillips Hall laboratory. In addition, you will receive a $10 Kroger gift card for each week you wear the accelerometer.

By signing this document, I acknowledge the following:

- I, ________________________________, hereby agree to participate as a volunteer research subject in the scientific investigation described above, which is an authorized part of the education and research program of Miami University under the supervision of Ronald H. Cox, PhD.
- The investigation and my part in the investigation has been defined and fully explained to me and I understand the explanation. A copy of procedures of this investigation has been provided to me and has been discussed in detail with me.
- I am above the legally required 18 years of age necessary to participate in this study
- I understand I can refuse to answer questions during the interview or refuse to participate in any interviews
- I have been given the opportunity to ask questions and all such questions and inquiries have been answered to my satisfaction.
- I understand that in the even of physical injury resulting from the research procedure, financial compensation is not available and medical treatment is not provided free of charge.
- I further understand that I am free to stop my participation at any time during the study.
- I have reviewed the inclusion and exclusion criteria with the investigator and have no condition which precludes exercise.
- I have answered the PAR-Q items honestly

If you have questions or concerns about the study, please contact Ron Cox at 513-529-4435 or coxrh@muohio.edu, Mandy Zylstra at zylstraj@muohio.edu. If you have general questions about your rights as a research participant, you may also contact Miami’s Office for the Advancement of Research and Scholarship at 513-529-3600 or humansubjects@muohio.edu.
<table>
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<tr>
<th>Date</th>
<th>Participant’s Signature</th>
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Participant’s Name Printed

I, the undersigned have defined and fully explained the investigation to the above participant.

<table>
<thead>
<tr>
<th>Date</th>
<th>Investigator’s signature or that of official representative</th>
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</table>
Title of Research Project: Walk and work: case study series

Principal Investigator: Ronald H Cox, PhD

The following is an addendum to the original walk and work: case study series informed consent form.

If you choose to participate in this study, you will visit room 16 in Phillips Hall for testing on eight occasions over a twelve month period for approximately 1 hour on each occasion. You will have two, one-hour sessions about every four months during the year. You will complete the following tests:

9. Cognitive Test
   ● Stroop Color and Word Test (SCWT) (Stoelting, Wood Dale, IL):
     ○ The cognitive dimension tapped by Stroop is associated with cognitive flexibility, resistance to interference from outside stimuli, creativity and psychopathology—all of which influence the individual's ability to cope with cognitive stress, and process complex output.
     ○ SCWT activates an automatic verbal interference by requiring the participant to override the reading response in favor of color naming. This test has been found to be a reliable and valid measure to identify differences in selective attention related to interference. This test consists of three sections. Each section has 100 items presented in five columns of 20 items each. Section one consists of the words red, green, and blue presented randomly and printed in black ink. Participants will verbalize as many of these words as possible in 45 seconds. Section two contains blocks of four Xs printed in red, green, or blue ink and participants verbally identified the color of the print of as many items as possible in 45 seconds. Section three contains color words printed in an incongruent color—for instance the word red printed in blue or green ink. The participant’s task is to verbally identify the color in which the word is printed rather than reading the word and to complete as many items as possible in 45 seconds.
     ○ This test will be conducted while standing AND walking at 1.5 mph on the active workstation.

10. Typing Test
   ● Mavis Beacon Teaches Typing (V. 20)
     ○ The software displays adjusted words/minutes at the end of the test and this is the score that will be recorded
     ○ Participants will take the Intermediate Speed Typing test while standing AND walking at 1.5 mph.

active workstation Implementation/Activity

When you begin to use the active workstation, you will begin to blog daily about your experiences. In this blog, you will write about any barriers or facilitators to walking, as well as any information that you feel is important for research (i.e., what tasks you had difficulty working on, how did walking making you feel: while walking, after walking? etc.) The blog will be on Blackboard and only you, Ron Cox (principal investigator) and Mandy Zylstra (research assistant) will have access to this blog.

Interviews
Also, the research assistant will visit you once a week for a short interview that will be audio recorded and then transcribed. You will be allowed and encouraged to read the transcriptions to ensure their accuracy. The transcription will be coded to ensure confidentiality. Upon being transcribed, the recording will be deleted and the transcribed interview will be kept in a locked file cabinet of a faculty member’s office.

Several participants will be asked to participate in a focus group interview regarding their active workstation experiences. The interview will be recorded and then transcribed. You will be allowed and encouraged to read the transcriptions to ensure their accuracy. The transcription will be coded to ensure confidentiality. Upon being transcribed, the recording will be deleted and the transcribed interview will be kept in a locked file cabinet of a faculty member’s office.

By signing this document, I acknowledge the following:

I, ____________________________, have reviewed the addendum and agree to participate as a volunteer research subject in the scientific investigation described above, which is an authorized part of the education and research program of Miami University under the supervision of Ronald H. Cox, PhD.

If you have questions or concern about the study, please contact Ron Cox at 513-529-4435 or coxrh@muohio.edu, or Mandy Zylstra at zylstraj@muohio.edu.

______________________________
Date

_______________
Participant’s Name Printed

I, the undersigned have defined and fully explained the addendum to the above participant.

______________________________
Date

Investigator’s signature or that of official representative